

Winter 2022

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Mimi S. Afshar

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Recommended Citation

Mimi S. Afshar, *Artificial Intelligence and Inventorship – Does the Patent Inventor Have to be Human?*, 13 HASTINGS SCI. & TECH. L.J. 55 (2022).

Available at: https://repository.uchastings.edu/hastings_science_technology_law_journal/vol13/iss1/5

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Artificial Intelligence and Inventorship – Does the Patent Inventor Have to be Human?

MIMI S. AFSHAR*

TABLE OF CONTENTS

I.	Introduction	56
II.	What is AI?.....	57
III.	When Innovation Invents—What are AI’s Patentable Inventions? .	58
IV.	Status of AI in Australia, China, Europe, South Africa, and the U.S. Regarding Inventorship	59
V.	Criteria for Inventorship in the U.S.....	62
VI.	The Case for AI Inventorship	63
	A. U.S. Requires Identifying the Inventor(s)	63
	B. Denying AI Inventorship Rights Will Hinder Innovation and Defeat the Patent Clause	63
	C. PHOSITA and AI Are Simply Two Sides of the Same Coin....	65
	D. AI Solves the “Inventorship” Headache During Prosecution ...	66
VII.	Ramifications of AI Inventorship.....	66
VIII.	Time to Amend Patent Laws to Accommodate AI as the Inventor..	68
	A. Proposal to Amend Patent Laws to Recognize AI as the Inventor	69
	B. Eliminate Listing the Inventor Requirement.....	70
	C. Amend 35 U.S.C. § 101	70
	D. Policymakers Need to Take Action.....	70
IX.	Conclusion: AI should be Recognized as a Legitimate Inventor	71

* Mimi Afshar is a US patent attorney, the director of the Intellectual Property Law Clinic, and clinical assistant professor at NCCU School of Law.

I. Introduction

Artificial intelligence (“AI”) is ubiquitous; our smartphones help us navigate around town, virtual digital assistants such as Alexa and Siri respond to our questions, and social media channels such as Facebook, Instagram, and Twitter help us remain connected. Furthermore, financial institutions, pharmaceutical companies, and insurance companies all utilize AI to their advantage and to obtain leverage over their competitors. In particular, in the case of the *COVID-19* pandemic, the role of AI has never been so crucial.¹ AI continues to be at the forefront of technological development. Similar to coping with changes brought by the Industrial Revolution, legislatures need to embrace AI and be mindful of the challenges and effects that AI has on different laws, in particular patent laws.

Artificial Intelligence is directly related to innovation, the protection of which in turn is partly governed by patent laws. This innovation leads to questions regarding the ramifications on patent inventorship in the AI arena. One key question is whether an AI system or device can be considered an “inventor” of a patent application. The United States Patent and Trademark Office (“USPTO”) has provided its answer by clearly rejecting AI as an “inventor,” since AI cannot meet certain statutory definitions for an inventor or the relevant tests for determining inventorship.² Importantly, the Patent Act does not expressly limit inventorship rights to humans, but it does suggest that each inventor must have a name and be an “individual.”³

In exploring this exciting territory, one should consider what types of patent law policies will help promote innovation and the progress of science, consistent with the United States (“U.S.”) Constitution.⁴

To address these issues, this article focuses on AI and patent laws — mainly, on whether AI should be considered an “inventor” under relevant U.S. and foreign patent statutes. Specifically, I submit that AI can qualify as an inventor and allowing AI to be listed as an inventor would incentivize innovation. Furthermore, statutory recognition of AI as an inventor would

1. See, e.g., Michael Chui and Matthias Evers, *COVID 19 and the Bio Revolution*, *McKinsey Global Institute - Project Syndicate* (June 10, 2020) <https://www.project-syndicate.org/commentary/covid-19-biological-innovation-ai-gene-editing-by-michael-chui-and-matthias-evers-2020-06?barrier=accesspaylog> (“Advances in biological sciences have been gathering pace since the human genome was mapped – a 13-year process completed in 2003. ... [T]he resulting bio-revolution has been driven by rapid progress in computing, automation, and artificial intelligence (AI).”).

2. *Decision on Petition In re Application of Application No. 16/524,350*, Dec. Comm’r Pat. 4-8 (Feb. 17, 2020), [available at https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf](https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf).

3. 35 U.S.C. § 100(f).

4. See U.S. Const. art. I, § 8, cl. 8; this clause is also sometimes referred to as the “Patent Clause” or the “Copyright Clause.”

encourage investment in developing inventive AI systems, as the corresponding human inventors will be assured they can patent the results.⁵

II. What is AI?

Generally, defining AI is difficult; One reason for this is because a clear definition for “intelligence” is lacking. Nevertheless, artificial intelligence refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with the human mind, such as learning and problem solving. In the 1950s, the fathers of the field, Marvin Minsky and John McCarthy, described AI as any task performed by a program or machine that, if a human carried out the same activity, a human would have to apply intelligence to accomplish the task.⁶

John McCarthy coined the term “Artificial Intelligence,” and he defined AI as “the science and engineering of making intelligent machines, especially intelligent computer programs.”⁷ Here, I focus on the definitions relevant to patents because of the question of AI regarding inventorship. Matthew Scherer’s definition of AI is most suitable: “[m]achines that are capable of performing tasks that, if performed by a human, would be said to require intelligence.”⁸ Indeed, this machine-borne intelligence perceives data from the outside world and decides which activities to engage in to maximize its probability of success in achieving its ultimate goal.⁹ Thus, AI has already successfully created inventions that humans are likely capable of creating, but the AI-generated inventions occur with greater efficiency. Further, as AI evolves, it becomes invaluable for solving specific problems and will improve human skills such as accuracy, speed, and capacity to process vast amounts of data.

5. See Angela Chen, *Can 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/>.

6. See Nick Heath, *What is AI? Everything you need to know about Artificial Intelligence*, ZD NET (Feb. 12, 2018), <https://www.zdnet.com/article/what-is-ai-everything-you-need-to-know-about-artificial-intelligence/>.

7. See John McCarthy, *What is Artificial Intelligence?*, 2-3 (Nov. 12, 2007), <http://jmc.stanford.edu/articles/whatisai/whatisai.pdf>.

8. See Matthew U. Scherer, *Regulating Artificial Intelligent Systems: Risks, Challenges, Competencies, and Strategies*, 29 HARV. J.L. & TECH. 353, 362 (2016) (describing AI systems as an integral part of life and calling for new regulations).

9. See Dr. Shlomi Yanisky Ravid & Xiaoqiong (Jackie) Liu, *When Artificial Intelligence Systems Produce Inventions: An Alternative Model For Patent Law At The 3A Era*, 39 CARDOZO L. REV. 2215, 2226 (2018).

III. When Innovation Invents—What are AI’s Patentable Inventions?

The Creativity Machine (CM) and Watson are early examples of computer inventors, but others also exist.¹⁰ CM is a computational paradigm that “came the closest yet to emulating the fundamental neurobiological mechanisms responsible for idea formation.”¹¹ The Creativity Machine generates novel ideas through the use of artificial neural networks, whereby collections of on/off switches automatically connect themselves to form software without human intervention.¹² In contrast, IBM’s Watson computer system “generates millions of ideas out of the quintillions of possibilities, and then predicts which ones are best.”¹³ This feature distinguishes Watson as a different AI platform from CM because Watson utilizes a more conventional architecture of logical deduction combined with access to massive databases containing accumulated human knowledge and expertise.¹⁴ Although Watson is not modeled after the human brain, it is nonetheless capable of generating novel, nonobvious, and useful ideas.¹⁵

More recently, inventions have also been created by “DABUS AI.” DABUS (Device Autonomously Bootstrapping Uniform Sensibility) is an AI system created by Dr. Stephen Thaler, a known pioneer in the area of AI. Thaler reported that AI ‘DABUS’ goes far beyond the usual machine on-off patterns of neural structures.¹⁶ DABUS “invented” an improved beverage container designed for safer handling and transportation and a neural flame device used in search-and-rescue missions. Both inventions were created without any human intervention.¹⁷

10. See Daniel Riester et al., *Thrombin Inhibitors Identified by Computer-Assisted Multiparameter Design*, 102 PROC. NAT’L ACAD. SCI. USA 8597, 8597–8602 (2005).

11. *What Is the Ultimate Idea?*, IMAGINATION ENGINES INC., <https://perma.cc/P877-F33B> (last visited July 8, 2021).

12. See Stephen L. Thaler, *Synaptic Perturbation and Consciousness*, 6 INT’L J. MACH. CONSCIOUSNESS 75, 75-107 (2014).

13. See *Whats Next in AI is fluid intelligence*, IBM, <http://www.research.ibm.com/cognitive-computing/computational-creativity.shtml#fbid=kwG0oXrjBHY> (last visited July 8, 2021).

14. See Adam Lally, *IBM Watson: Beyond Jeopardy with Adam Lally*, Association for Computing Machinery (June 13, 2013) available at <https://acct-learning.acm.org/techtalks/ibm>.

15. See Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C.L. REV. 1079, 1080 (2016).

16. See Ryan Abbott, *The Artificial Inventor behind this project*, ARTIFICIAL INVENTORS, <http://artificialinventor.com/dabus/> (last visited July 9, 2021).

17. See Richard Johnson, *Inventive AI: can machines innovate?*, BRITE INNOVATION REV., https://brite.nridigital.com/brite_autumn19/artificial_intelligence_invention_intellectual_property (last visited July 8, 2021).

IV. Status of AI in Australia, China, Europe, South Africa, and the U.S. Regarding Inventorship

While an AI system may create an invention that meets the statutory requirements for patentable subject matter, the question remains whether AI can be considered an inventor and whether it can be granted patent rights.

Australia is a key example of a country in which AI can be recognized as an inventor, at least from a procedural standpoint. The Federal Court of Australia addressed the issue of whether a patent application identifying an AI system as the inventor is a valid submission under the Australia Patents Act. The case arose as an appeal, in which Dr. Thaler's patent application that listed DABUS as the inventor was initially rejected by the Australia Patent Office. The Deputy Commissioner of Patents had held the original patent application had lapsed for failure to properly provide the name of the inventor¹⁸, since the Patents Act is "inconsistent with an [AI] machine being treated as an inventor."¹⁹

The Federal Court of Australia reversed the Patent Office decision, holding that an artificial system or device can qualify as an inventor under the Australian Patents Act.²⁰ In supporting his reasons for allowing AI as an inventor under current Australian patent laws, Justice Beach initially posed a fundamental yet profound query: "We are both created and create. Why cannot our own inventions create?"²¹ Also, Justice Beach provided a distinction between ownership of a patent versus who can be an inventor, which are separate issues that he asserted the Deputy Commissioner had confounded.²²

One answer to this question is Justice Beach's observation that "it is consistent with the [Australian Patents] Act to construe the term 'inventor' in a manner that promotes technological innovation and the publication and dissemination of such innovation by rewarding it, irrespective of whether the innovation is made by a human or not."²³

Importantly, the Federal Court decision is relatively narrow, noting that a non-human inventor cannot be an applicant for a patent nor a grantee of a patent. Further, Thaler's patent application did not undergo any prosecution and was not granted as a result of the Federal Court decision; rather, the application has been returned to the Australian patent office for further

18. *Thaler v Comm'r. of Patents*, [2021] FCA 879 (30 July 2021) 17-18 (Austl.), available at <https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/single/2021/2021fca0879>.

19. *Id.* At para. 3.

20. *Id.* At para. 41.

21. *Id.* At para. 15.

22. *Id.* At para. 12.

23. *Id.* At para. 124.

processing in view of the decision. Accordingly, if the DABUS Application progresses to allowance in Australia, the issues of who is the proper applicant and/or who is the grantee will need to be resolved prior to issuance.

As another example, Rule 13 of Chinese Patent Law Implementing Regulations regards an “inventor” or “designer” as “any person who has made creative contributions to the substantive features of an invention-creation.”²⁴ Further, the Chinese Examination Guidelines explain that the “inventor” shall be an individual, and an organization or company is not qualified to be “inventor.”²⁵

In the United Kingdom (UK), a recent (Sep. 2020) High Court of Justice decision²⁶ concerning DABUS as an inventor is also instructive. In this case, Stephen Thaler filed two UK patent applications under his own name but listed DABUS as the inventor. Justice Smith provided that the definition of “inventor” is the “person who is the actual deviser of the invention,”²⁷ and “[b]ecause DABUS is a thing, it cannot even hold property, let alone transfer it.”²⁸ Thus, “Dr. Thaler was a person but not the inventor; and DABUS was the inventor but not a person.”²⁹

However, Justice Smith also provided that “...nothing in this analysis should be taken to suggest that DABUS is not itself capable of an inventive concept. ... DABUS is not, and cannot be, an inventor ..., simply because DABUS is not a person.”³⁰ Clearly, Justice Smith appears to at least superficially support AI as being an inventor (similar to Justice Beach’s analysis under the Australia Patents Act), but the present UK statutes do not extend to recognizing AI as an inventor.

Overall, this decision highlights that, in the UK, the Patents Act of 1977 does not allow recognition of AI as an inventor, but the court recognized that the legislature is the more appropriate body to address the issue.³¹

As another comparative example, Rule 19(1) of the Implementing Regulations of the European Patent Convention (EPC) does not require that the inventor is a human and serves only as the purpose of properly

24. Chinese Patent Law Implementing Regulations, Ch. 1 – Rule 13, <https://www.ccpit-patent.com.cn/node/1132/1131> (last visited July 6, 2021).

25. Chinese Examination Guidelines, part I, Chapter 1, Section 4.1.2: Formality Examination of Invention Patent Application (2010), *available at* <http://www.cnipa.gov.cn/docs/20191018163512108738.pdf>.

26. *Thaler v The Comptroller-Gen. Of Pat. 's, Designs and Trade Marks* (2020) EWHC 2412 (Pat.) (U.K.), *available at* <https://www.bailii.org/ew/cases/EWHC/Patents/2020/2412.html>.

27. *Id.* At para. 19.

28. *Id.* At para. 22.

29. *Id.* At para. 18.

30. *Id.* At para. 21.

31. *Id.* At para. 10.

identifying the inventor, including requiring a “family name.”³² An inventor named in a **European patent** presumably must **be a natural person**.³³ In late 2019, the European Patent Office (EPO) rejected AI ‘DABUS’ as the inventor of the two patent applications filed for the two inventions allegedly created by DABUS AI³⁴, paralleling the same rejections by the UK patent office.

Finally, in the US, Thaler had similarly filed a patent application listing DABUS as the inventor.³⁵ The USPTO issued a series of Notices “requiring the inventor to be identified by his or her legal name.”³⁶ Thaler responded that “inventorship should not be limited to natural persons, and, therefore, the naming of DABUS as the inventor ... is proper.”³⁷

The Decision held that the patent statutes preclude a broad interpretation of “inventor” to cover machines.³⁸ The USPTO cited the language of 35 U.S.C. § 101, noting the reference to “**Whoever** invents or discovers ...” (with “whoever” meaning a natural person), along with 35 U.S.C. § 115(b) citing “himself” or “herself” as to the individual who is believed to be the original inventor, and 35 U.S.C. § 115(h) providing that “[a]ny **person** making a statement...”³⁹ Moreover, the USPTO cited the Federal Circuit’s proclamation that “only natural persons can be ‘inventors.’”⁴⁰

Accordingly, China, the EPO, and the UK all currently require a “person” as the inventor for any patent filings, which is similar to current U.S. requirements.

However, in stark contrast to countries which do not recognize any non-person inventor, South Africa has recently granted a patent that recognizes

32. Rule 19: Designation of the Inventor, European Patent Convention (2020), *available at* <https://www.epo.org/law-practice/legal-texts/html/epc/2016/e/r19.html> (“The request for grant of a European patent shall contain the designation of the inventor. However, if the applicant is not the inventor or is not the sole inventor, the designation shall be filed in a separate document. The designation shall state the family name, given names and full address of the inventor, contain the statement referred to in Article 81 and bear the signature of the applicant or his representative.”).

33. *See* Rule 19: Designation of the Inventor, European Patent Convention (2020); Article 81: Designation of the Inventor, European Patent Convention (2020).

34. *See* EP Application No. 18,275,163 (filed Oct. 17, 2018); EP Application No. 18,275,174 (filed Oct. 17, 2018).

35. U.S. Patent Application No. 16/524,350 (filed July 29, 2019), *available at* https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf.

36. *Id.* at 6.

37. *Id.* at 4 (internal citations omitted).

38. *Id.*

39. *Id.* (emphasis added).

40. *Beech Aircraft Corp. v. EDO Corp.*, 990 F.2d 1237, 1248 (Fed. Cir. 1993).

an AI entity (i.e., DABUS) as the inventor.⁴¹ While this granted patent ostensibly acknowledges the inventive contributions of AI, the South African Patent Office (CIPC⁴²) does not conduct any formal patent examination.⁴³ Accordingly, the now-published patent may be subject to any challenge based on lack of novelty or inventive step⁴⁴, and whether there is any challenge to inventorship remains to be seen.

Thus, Australia presents a more compelling case supporting recognition of AI as an inventor, since it has been ruled upon by an Appellate court, whereas the South Africa patent has yet to be challenged or litigated.

V. Criteria for Inventorship in the U.S.

Inventorship in the U.S. is governed by 35 U.S.C. § 101, which provides: “[w]hoever invents or discovers any new and useful process, machine, manufacture or composition of matters, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”⁴⁵ Thus, an inventor is referred to as someone “who” invents, and “who” is typically understood as referring to a person and not a thing.

The statute also describes joint inventors as the “two or more persons” who conceived of the invention.⁴⁶ According to the U.S. Supreme Court’s *Chakrabarty* decision, “anything under the sun which is made by man is patentable subject matter.”⁴⁷ An inventor is one who “conceives” of an invention, and conception requires a “definite and permanent idea of the complete and operative invention.”⁴⁸

Further, under U.S. Patent Law, the term “inventor” is defined as an “individual” or “individuals” who invented or discovered the subject matter of the invention.⁴⁹ This language has existed since the 1952 legislation that established the basic structure of modern patent law.⁵⁰ The “individual”

41. See CIPC Intell. Prop. Online, *Sulfide Ore Flotation Collector, Application Thereof and Sulfide Ore Flotation Method*, 54 PAT. J. 255, 255 (2021).

42. Companies and Intellectual Property Commission, *What is a Patent*, <http://www.cipc.co.za/index.php/trade-marks-patents-designs-copyright/patents/>.

43. See Ed Conlon, *DABUS: South Africa issues first-ever patent with AI inventor*, MANAGING IP (July 29, 2021), <https://www.managingip.com/article/b1sx9mh1m35rd9/dabus-south-africa-issues-first-ever-patent-with-ai-inventor>.

44. *Id.*

45. 35 U.S.C. § 101.

46. 35 U.S.C. § 116(a).

47. *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

48. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986).

49. 35 U.S.C. 100(f).

50. Pub. L. No. 82-593, 66 Stat. 792 (1952); see also Gregory Dolin, *Dubious Patent Reform*, 56 B.C. L. REV. 881, 889 (2015) (discussing aims of 1952 Patent Act).

requirement likely was included to reflect the constitutional language that specifically gives “inventors” the right to their discoveries as opposed to other legal entities that might assert ownership rights.⁵¹ Such language may have been included to ensure patent rights were vested in individual inventors than to corporate entities where ownership was in dispute. Thus, AI may not have been in the legislators’ collective minds in 1952.

VI. The Case for AI Inventorship

A. U.S. Requires Identifying the Inventor(s)

So why should one be concerned about AI and inventorship? The answer is driven by patent laws. A patent applicant is required to identify and provide an oath and declaration from the inventor(s) showing that he/she is the true inventor.⁵² The USPTO will issue a “Notice to File Missing Parts” if the application does not identify each inventor by his or her legal name (as noted above for the Thaler U.S. application). Furthermore, failure to include an inventor can result in a patent being invalid or unenforceable.⁵³ But what happens when the inventor is not a “natural” person (i.e., AI, so it cannot be listed as an inventor), or the person submitting the patent application (i.e., the creator of AI) does not satisfy the inventorship requirement as discussed above? A simple answer is that no patent application can be filed.

B. Denying AI Inventorship Rights Will Hinder Innovation and Defeat the Patent Clause

Intellectual property rights find their roots in the Patent Clause of the U.S. Constitution, which grants Congress the power “[t]o promote the progress of science and useful arts, by securing for limited times to *authors and inventors* the exclusive right to their respective writings and discoveries.”⁵⁴ Patent rights foster economic incentives and promote innovation. From an economic perspective, patents deal with new knowledge, as embodied in an innovative product/process, and they also

51. In the words of the United States Court of Appeals for the Federal Circuit: “people conceive, not companies.” *New Idea Farm Equip. Corp. v. Sperry Corp.*, 916 F.2d 1561, 1566 (Fed. Cir. 1990).

52. 37 C.F.R. § 1.63 (2021).

53. See, e.g., *Advanced Magnetic Closures, Inc. v. Rome Fastener Corp.*, 607 F.3d 817, 829 (Fed. Cir. 2010).

54. US Const. art. I, § 8, cl. 8 grants Congress the enumerated power “[t]o promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.”

confer limited exclusivity (monopoly) rights to the inventor.⁵⁵ Furthermore, patents can serve to promote new discoveries, thereby working toward “promotion of science and useful arts.”⁵⁶ “By endowing discoverers with property rights over the fruits of their efforts, patents affect the incentive to innovate and are likely to increase the flow of innovations.”⁵⁷

A fundamental goal of the patent system is to encourage the dissemination of technical knowledge through the patent disclosure requirement.⁵⁸ The patent system achieves this goal through a quid pro quo: in exchange for the right to exclude, the inventor must fully disclose the technical details of the invention to make and use the invention without undue experimentation.⁵⁹ By providing an incentive for disclosure (quid pro quo), patents help disseminate scientific and technical information, allowing other inventors to avoid duplicating existing inventions (potentially avoiding wasteful innovation efforts), thus facilitating development of further inventions that build on existing patents by “improving” or possibly designing around a patent.⁶⁰

This reasoning is not limited to a U.S. centric view of patents. Importantly, Justice Beach (of the Australia Federal Court, noted previously) cautions that taking a narrow view of the “inventor” concept “would inhibit innovation not just in the field of computer science, but in all other scientific fields that may benefit from the output of an artificial intelligence system.”⁶¹

Obviously, denying AI inventorship rights will hinder innovation and defeat the Patent Clause because the creator of the AI would not be able to file a patent application, even though the subject invention may satisfy other requirements of patentability (i.e., novelty and nonobviousness). The ripple

55. Corrine Langinier & GianCarlo Moschini, *The Economics of Patents: An Overview*, at 2 (Iowa State Univ., CARD Working Paper, No. 02-WP 293, 2002), <https://www.card.iastate.edu/products/publications/pdf/02wp293.pdf>.

56. Federal Trade Commission, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy* (2003), <https://www.ftc.gov/sites/default/files/documents/reports/promote-innovation-proper-balance-competition-and-patent-law-and-policy/innovationrpt.pdf>.

57. LANGINIER & MOSCHINI, *supra* note 55, at 3.

58. Sean B. Seymore, *Symposium: The Disclosure Function of the Patent System*, 69 VANDERBILT L. REV. 1455 (2016) (quoting *Brenner v. Manson*, 383 U.S. 519, 533 (1966)).

59. *Id.*

60. In exchange for providing their technical knowhow and knowledge, a patentee is granted a twenty-year period of protection in which they have exclusive rights to make, use, and/or sell their invention. Patents issued by the U.S. Patent and Trademark Office confer upon the patent holder the right to exclude others from making, using or selling the invention throughout the United States, as well as the right to prevent others from importing the invention into the United States; see 35 U.S.C. § 271.

61. *Thaler v. Comm’r of Patents*, para. 56, p. 12 [2021] FCA 879 (July 30, 2021), available at <https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/single/2021/2021fca0879>.

effect of not acknowledging inventorship to AI could prevent companies from investing in AI technologies and prevent breakthroughs in important areas such as drug discovery. Therefore, although AI (as an “artificial” entity) would not be motivated to invent by the prospect of being acknowledged as the inventor, the person who creates the AI would be motivated via such AI inventorship to develop creative machines.

C. PHOSITA and AI Are Simply Two Sides of the Same Coin

“Whenever there is a failure to find some person in real life who can objectively assess the facts of a given situation, law does not hesitate to create and define fictitious persons.”⁶² One such fictitious person is a “person having ordinary skill in the art” (also known as PHOSITA).⁶³ The PHOSITA standard is applied by a patent examiner in analyzing the novelty and nonobviousness of the subject patent application, or applied by a judge or jury in reviewing the claims of an issued patent that is the subject of litigation. Importantly, PHOSITA is a “hypothetical person who is presumed to be aware of all the pertinent prior art,”⁶⁴ and applies that awareness in scrutinizing patentability of the patent claims in view of the prior art.

Accordingly, various patent validity and infringement questions are decided in accordance with the PHOSITA standard.⁶⁵ For example, under 35 U.S.C. § 103(a), an invention must be nonobvious to one of ordinary skill in the art to be granted a patent. So, the question is: if the law accepts a hypothetical person to assess and ultimately render such important decisions on patentability as nonobviousness, why should AI not be considered an inventor?

Justice Beach raised a similar issue in his Federal Court of Australia opinion discussed above, in which he described the Australian Patents Act as referring to a “hypothetical construct of ‘a person skilled in the relevant art in the light of the common general knowledge’ at the relevant date.”⁶⁶ He astutely noted that the relevant section of the Act does not “focus[] on the thought processes of an actual human, let alone the subjective thought processes of a human inventor.”⁶⁷ Further, Justice Beach notes that the concept of evaluating “inventive step” in the patent context does not concern

62. Naina & Jasmeet Gulati, *Knowledge/Skill Standards of a “Person Skilled in Art”: A Concern Less Visited*, 17 J. MARSHALL REV. INTELL. PROP. L. REV. 588, 589 (2018).

63. See Jonathan J. Darrow, *The Neglected Dimension of Patent Law’s PHOSITA Standard*, 23 HARV. J. L. & TECH. 227, 233 (2009).

64. *Standard Oil Co. v. American Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985).

65. See Joseph P. Meara, Notes and Comments, *Just Who Is the Person Having Ordinary Skill in the Art? Patent Law’s Mysterious Personage*, 77 WASH. L. REV. 267 (2002).

66. *Thaler v Commissioner of Patents*, para. 140, p. 28 [2021] FCA 879 (July 30, 2021).

67. *Id.*

the inventor's mental processes, and whether a human or machine produces an inventive step is irrelevant to the statutory inquiry (at least in Australia).⁶⁸

Clearly, PHOSITA and AI are both not "persons," and are arguably two sides of the same coin. Also, various patent offices outside the US apply a similar theoretical person standard for evaluating inventive steps (which is akin to a nonobviousness assessment). Thus, a critical question arises: why does the USPTO (and ex-U.S. patent offices) implement a fictitious person standard to determine whether an invention is nonobvious, and/or whether the claims of an invention are definite, but it does not allow AI that has autonomously created an invention to be considered the inventor?

D. AI Solves the "Inventorship" Headache During Prosecution

As mentioned above, an applicant who applies for a patent in the U.S. must list each and every inventor in his or her patent application.⁶⁹ Sometimes, the inventor information needs to be updated. For example, during prosecution of the subject application, one or more claims could be cancelled and, if a joint inventor only contributed to those cancelled claims, that inventor's name would need to be removed from the application.⁷⁰

However, if AI is the only inventor in a patent application, no cause would exist to update inventorship during prosecution of the application. In case of an error or any change in the scope of claims during such prosecution, the AI would still be appropriately listed as the inventor.

VII. Ramifications of AI Inventorship

The prospect of AI as the inventor also raises interesting questions about the concept of PHOSITA. As mentioned above, PHOSITA is a legal fiction and is important in determining whether a patent is obvious and thus invalid.⁷¹ Because the level of skill of a PHOSITA depends on the technology at issue, resolving the level of ordinary skill in the pertinent art is a key step in the obviousness inquiry.⁷² Accordingly, how can one define a person as having ordinary skill in the art in order to evaluate the patentability of an invention? Is PHOSITA a "person of ordinary creativity" or an "automaton"?⁷³ If AI is PHOSITA, does that render all inventions obvious?

68. *Id.* at para. 142 and 144.

69. 37 C.F.R. § 1.41(a) (2021) ("An application must include, or be amended to include, the name of the inventor for any invention claimed in the application.").

70. 37 C.F.R. § 1.45(c) (2021).

71. *See* 35 U.S.C. § 103.

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

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

Any potential infringement by AI must also be considered. However, existing laws and precedent appear to rule out AI as an infringer.⁷⁴ If a real person becomes the owner of an AI invention, however, that person should bear responsibility for infringement. “Whoever without authority makes, offers to sell, or sells any patented invention” commits infringement.⁷⁵ Under current patent laws, an infringer may be one who actively induces the direct infringement of a patent.⁷⁶ Based on the Federal Circuit’s interpretation, this definition means the alleged inducer must have knowingly aided another’s direct infringement of a patent.⁷⁷ The unanswered question, then, is when AI operates autonomously, does the AI owner become the direct infringer? This question is difficult, for example, when AI learns from data within the public domain or from a variety of publicly accessible sources. How does a company developing an autonomous vehicle or robot, or even software that can run anywhere across a network, safeguard against infringement?⁷⁸

Scholars suggest measures that might be implemented to reduce uncertainty, such as forbidding certain kinds of AI systems, requiring chips to identify the source of the owner, or even self-defense technology solutions against counterfeiting and copying.⁷⁹ While reinventing alternative tools to prevent AI systems from copying other works or using protective data, one might consider solutions outside of the legal realm, such as “technology traffic lights” indicating sites that forbid intellectual property protected materials or “stop signs” for forbidden zones.⁸⁰ Thus, AI creators have obviously advanced technology to prevent AI from potential infringement.

In any case, current intellectual property laws are ill-equipped for such new and challenging issues. Some academics argue that patents result in

74. Christopher Batiste-Boykin, *In re Google Inc.: ECPA, Consent, and the Ordinary Course of Business in an Automated World*, 20 INTELL. PROP. L. BULL. 21, 22–26 (2015).

75. 35 U.S.C. § 271(a) (2012).

76. 35 U.S.C. § 271(b) (2012).

77. *Akamai Technologies, Inc. v. Limelight Networks, Inc.*, 797 F.3d 1020, 1023 (Fed. Cir. 2015).

78. See Jason D. Lohr, *Managing Patent Rights in the Age of Artificial Intelligence*, LEGALTECH NEWS (Aug. 18, 2016), <https://www.law.com/legaltechnews/almID/1202765385194/Managing-Patent-Rights-In-The-Age-Of-Artificial-Intelligence/> (“Much of the AI in use today is referred to as ‘soft’ AI, where the AI uses computational intelligence to analyze relevant data and attempt to solve a specific problem.”).

79. See Zoe Carpou, *Robots, Pirates, and the Rise of the Automated Takedown Regime: Using the DMCA to Fight Piracy and Protect End-Users*, 39 COLUM. J.L. & ARTS 551, 556 (2016) (using ISPs to fight the phenomena).

80. Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 18–25 (2014) (regulation should create safeguards to restrain the activity of automated artificial intelligent scoring systems to avoid biased scoring).

significant social costs by establishing monopolies.⁸¹ Some state patents also can stifle entry with new ventures by creating barriers to subsequent research.⁸² Judge Posner has even argued that patents may not be needed to incentivize research and development in the software industry.⁸³ In terms of AI software systems, the innovation is often relatively inexpensive, incremental, produced without patent incentives, protected by other forms of intellectual property, and associated with a significant first mover advantage.⁸⁴ Likewise, patents may not incentivize inventors in a university setting because such inventors' motivation to innovate may simply be a desire to publish for academic advancement only.

Regardless of these concerns, granting AI inventorship is a desirable outcome. As previously discussed, the incentive and motivation associated with ownership of AI that "invents" will provide for individuals and entities to build creative inventions, and it is likely to result in a net increase in the number of patentable inventions produced.

VIII. Time to Amend Patent Laws to Accommodate AI as the Inventor

One reason laws change is due to the progressive nature of technology. As technology is constantly developing, laws should change and adapt to remain relevant and purposeful. Patent laws continue to change, and inevitably, patent laws must be amended to accommodate AI.

The Patent Act of 1952 strengthened the US patent system. The drafters broadened Section 101 by adding "process" as a subject matter eligibility requirement.⁸⁵ The drafters also included Section 103, which replaced the subjective and heightened "flash of creative genius" patentability standard with a more objective standard, which is based on how a person of ordinary

81. See Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 314–15 (2013) (discussing the deadweight loss of monopoly).

82. See Lisa Larrimore Ouellette, *Access to Bio-Knowledge: From Gene Patents to Biomedical Materials*, 2010 STAN. TECH. L. REV. 48, 3 at n.1 (considering effects of patents on entry to the bio-medical products market).

83. See William M. Landes & Richard A. Posner, *The Economic Structure of Intellectual Property Law*, HARV. UNIV. PRESS, 312–13 (2003).

84. *Id.*; see also Eric Goldman, *The Problems with Software Patents*, FORBES (Nov. 28, 2012), <http://www.forbes.com/sites/ericgoldman/2012/11/28/the-problems-with-software-patents/#234ba3d66545> (discussing in a three-part series why patents may be unnecessary for software, challenges to fixing the problems, and exploring possible fixes).

85. 5 U.S.C. § 101 (Revision Notes and Legislative Notes).

skill in the art would analyze the claimed subject matter in view of the prior art.⁸⁶

Historically, the scope of patentable subject matter under 35 U.S.C. Section 101 has been significantly modified. Prior to 1980, living things were generally not considered as patentable subject matter. However, the U.S. Supreme Court ruling in *Chakrabarty*⁸⁷ changed this concept: “a live, human-made organism was patentable subject matter under §101.”⁸⁸ Accordingly, the Supreme Court had no difficulty in allowing such revolutionary inventions to be patentable. It would be particularly unwise to prohibit AI inventors on the basis of literal interpretation of texts drafted when such inventions were unforeseeable. If AI inventorship is to be prohibited, it should only be on the basis of sound public policy. Clearly, the drafters of the Constitution may not have envisioned that patents could protect subject matter that did not exist at that time patent laws were enacted.

A. Proposal to Amend Patent Laws to Recognize AI as the Inventor

Some inventions do not involve an active conception step but instead arise through accident. For example, patents granted for Teflon[®],⁸⁹ Post-It sticky notes,⁹⁰ the Slinky toy,⁹¹ Silly Putty,⁹² Play-Dough clay,⁹³ and Saccharin⁹⁴ were all created by accident. Because patentability “shall not be negated by the manner in which the invention was made,”⁹⁵ a deliberate conception step (as opposed to recognition) should not be a prerequisite for patent protection. Accordingly, if no mental step of conception is required, the element of “a natural person” is not strictly necessary for a patentable invention. Therefore, precluding the human conception step requirement results in AI satisfying the inventorship requirement.

86. James F. Davis, *Judge Giles S. Rich, His Life and Legacy Revisited*, FINNEGAN, <https://www.finnegan.com/en/insights/articles/patent-law-could-use-another-judge-rich-right-now.html> (last visited July 8, 2021).

87. *Diamond v. Chakrabarty*, 447 U.S. 303 (1980).

88. 35 U.S.C. § 101 (“Inventions Patentable: Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”).

89. U.S. Patent No. 2,230,654 (issued Feb. 4, 1941).

90. U.S. Patent No. 5,194,299 (issued Mar. 16, 1993).

91. U.S. Patent No. 2,415,012 (issued Jan. 28, 1947).

92. U.S. Patent No. 4,371,493 (issued Feb. 1, 1983).

93. U.S. Patent No. 3,167,440 (issued Jan. 26, 1965).

94. U.S. Patent No. 3,773,526 (issued Nov. 20, 1973).

95. *See* 35 U.S.C. § 103.

B. Eliminate Listing the Inventor Requirement

Some scholars have called for the amendment of patent laws to eliminate the statutory requirement of listing the inventor.⁹⁶ However, this proposal would deprive human inventors of the benefit of inventorship because one of the perks for inventing is the moral recognition of the inventor among his or her peers.⁹⁷ While this argument has merit, it may still be plausible to make an exception and eliminate this requirement for those inventions where AI is the only inventor.

C. Amend 35 U.S.C. § 101

I propose amending the term “whoever” in 35 U.S.C. § 101 to “whatever” so AI could be included in the category of inventors. Thus, the statute would be:

~~Whoever~~ Whatever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Alternatively, I propose to maintain the current language of 35 U.S.C. §101 but redefine “whoever” to include “AI, individuals, and corporations.” Either approach would provide sufficient clarity from Congress for AI to be an inventor.

D. Policymakers Need to Take Action

The patent system must recognize the evolution of AI and its implications, especially in the patent regime, and one must be mindful of the technological reality where the bounds of human ingenuity are extended (or even supplanted) by AI. Thus, policymakers should periodically examine these AI evolutionary developments and their potential effects to ensure that the fundamental rationale and justifications for the patent system are being fulfilled. If policymakers turn a blind eye to these issues, patent practitioners will only continue to be inefficiently guided piecemeal considering what courts decide on a case-by-case basis.

Several scholars have called for amending patent laws, and even former USPTO Director Andrei Iancu was open to a change to

96. Vertinsky and T. Rice, *Thinking About Thinking Machines: Implications Of Machine Inventors For Patent Law*, 8 B. U. J. OF SCI. & TECH. L. 574, 576 (2002).

97. See Jeanne C. Fromer, *Expressive Incentive in Intellectual Property*, 98 VA. L. REV. 1745, 1746 (2012) (some scholars reason instead that creators deserve moral rights in their works either by virtue of the labor they expend to create them or because the works are important components of creators’ personhoods (the aspects of creators’ personalities infused into and bound up in their works)).

accommodate AI.⁹⁸ Furthermore, IP5 (i.e., the patent offices of China, EPO, Japan, Korea, and the US), which handles approximately 85% of the world's patent applications, has established a joint Task Force on New Emerging Technologies and Artificial Intelligence.⁹⁹ This task force is “exploring legal, technical, and policy aspects of new technologies and AI, their impact on the patent system and on the operations” of the IP5.¹⁰⁰ It will be interesting to see what guidelines emerge for addressing applications for inventions created by machines.

IX. Conclusion: AI should be Recognized as a Legitimate Inventor

Allowing AI to be an inventor on a U.S. patent application would incentivize innovation, since the value AI is adding would be more clearly recognized. Furthermore, statutory recognition of AI as an inventor would encourage innovators to further develop inventive AI systems, as they will be assured that they can at least apply to patent the results. Finally, policies should be modified to reflect technological advances to incentivize development of inventive AI and to prevent chaos in light of the increasing number of patent applications for inventions created by autonomous AI.

98. See Andrei Iancu, Director, U.S. Patent & Trademark Office, Remarks by Director Iancu at the Artificial Intelligence: Intellectual Property Considerations Event (Jan. 31, 2019), available at <https://www.uspto.gov/about-us/news-updates/remarks-director-iancu-artificial-intelligence-intellectual-property>.

99. fiveIPoffices, *New emerging technologies and artificial intelligence (NET/AI)*, available at https://www.fiveipoffices.org/activities/net_ai (last visited July 5, 2021).

100. *Id.*
