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Anything You Can Do, AI Can't Do Better: An Analysis of Conception as a Requirement For Patent Inventorship And A Rationale For Excluding AI Inventors

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ANYTHING YOU CAN DO, AI CAN'T DO BETTER: AN ANALYSIS OF CONCEPTION AS A REQUIREMENT FOR PATENT INVENTORSHIP AND A RATIONALE FOR EXCLUDING AI INVENTORS

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I. INTRODUCTION

"You're unbelievably naïve," said Ultron to Vision.[2]
"Well, I *was* born yesterday," responded Vision.[3]

Intended as a snarky comeback, Vision's response in the movie *Avengers: Age of Ultron* highlights a fundamental difference between artificial intelligence ("AI") processing and the functioning of the human mind. As Ultron aptly put it (irony aside), AI *are* simply naïve. Despite the trend of anthropomorphizing AI in science fiction, modern AI remain fundamentally different from human beings.

AI technologies emerged in the early 1950s, and Alan Turing asked his famous question, "Can machines think?"[4] Only a few years later, in 1956, a presentation at the Dartmouth Summer Research Project on Artificial Intelligence ("DSRPAI") coined the term "artificial intelligence" and introduced what is considered to be one of the first AI programs.[5] The first successful AI program was likely either Arthur Samuel's checkers-playing program[6] or Allen Newell, Herbert Simon, and Cliff Shaw's automated reasoning program, called Logic Theorist.[7]

Initially, development of AI was restricted by computer storage limitations, and AI development stagnated for a period of decades.[8] Then, in the 1980s, new algorithmic techniques

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[2] AVENGERS: AGE OF ULTRON (Marvel Studios & Walt Disney Pictures 2015).

[3] *Id*.

[4] A. M. Turing, *Computing Machinery and Intelligence*, 49 MIND 433, 433 (1950). Turing proposed the "imitation game" in his paper contemplating whether or not machines could think.

[5] Rockwell Anyoha, *The History of Artificial Intelligence*, HARV. U. SITN BLOG: SPECIAL EDITION ON ARTIFICIAL INTELLIGENCE (Aug. 28, 2017), http://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/.

[6] *See* Arthur L. Samuel, *Some Studies in Machine Learning Using the Game of Checkers*, 3 IBM J. OF RES. & DEV. 210 (1959).

[7] *See* Leo Gugerty, *Newell and Simon's Logic Theorist: Historical Background and Impact on Cognitive Modeling*, 50 PROC. OF THE HUM. FACTORS AND ERGONOMICS SOC'Y ANN. MEETING 880 (2006).

[8] *See* Anyoha, *supra* note 5.

sparked a resurgence in AI.[9] Among these techniques were "deep learning" and "expert systems."[10] In 1997, IBM's Deep Blue defeated world champion Garry Kasparov in a chess match[11]—an enormous leap from the very first chess-playing AI only fifty years earlier. Recent rapid growth in both computer processing power and data storage and acquisition has led to the current AI boom of the Digital Age.[12]

AI have become ubiquitous in many industries. We encounter numerous implementations of AI in our daily lives—from friendly, voice-activated personal assistants like Siri and Alexa, to Facebook's powerful facial recognition and targeted advertisements.[13] AI is also used widely in the technology, banking, and marketing industries.[14] These AI are exceptionally useful for the limited tasks that they are programmed to accomplish.

For example, Facebook has used an AI tool called DeepFace to learn to recognize people in photos that users upload.[15] Facebook claimed the application's most advanced image recognition tool was as successful as humans, or even slightly more so, at recognizing the same people in different images.[16] Another potentially more troubling example comes from the French company, Cloem, which has developed algorithms based on patent law best practices and brute force techniques to compile patent claim permutations generated from a set of keywords and a

[9] *See id*.

[10] *See id*.

[11] William Saletan, *Chess Bump: The Triumphant Teamwork of Humans and Computers*, SLATE (May 11, 2007), https://slate.com/technology/2007/05/the-triumphant-teamwork-of-humans-and-computers.html.

[12] *See* WORLD INTELLECTUAL PROPERTY ORGANIZATION, WIPO TECHNOLOGY TRENDS: ARTIFICIAL INTELLIGENCE (2019).

[13] *See* Karen Hao, *What is Machine Learning?*, MIT TECH. REV. (Nov. 17, 2018), https://www.technologyreview.com/2018/11/17/103781/what-is-machine-learning-we-drew-you-another-flowchart/.

[14] *See* Anyoha, *supra* note 5.

[15] Yaniv Taigman, Ming Yang, & Marc' Aurelio Ranzato, DEEPFACE: CLOSING THE GAP TO HUMAN-LEVEL PERFORMANCE IN FACE VERIFICATION (2014).

[16] *See id*.

seed patent claim by altering the word-choice and making other grammatical variations.[17] Even more recently, IBM's "Miss Debater" AI debated live against debate champion Harish Natarajan.[18] Miss Debater crafted its case on the topic of subsidizing preschools by scanning billions of existing sentences from a document library and strategically aggregating the sentences into a surprisingly coherent argument.[19]

At the structural level, modern AI techniques are generally focused within the subset of machine learning algorithms, including neural networks and deep learning.[20] Machine learning algorithms discern patterns from data, and deep learning techniques amplify this effect by utilizing multiple layers of computational nodes to sift through data and find patterns.[21] Machine learning techniques can be further categorized into three subcategories: supervised learning, unsupervised learning, and reinforcement learning, with supervised learning being the most prevalent technique.[22] Another system of classifying AI that is used more generally by those in technological fields refers to Artificial Narrow Intelligence ("ANI"), Artificial General Intelligence ("AGI"), and Artificial Superintelligence ("ASI").[23] All existing AI currently fall into the category of ANI—no existing AI (not even the most complex deep learning algorithm) is capable of learning, perceiving, understanding, and functioning on the level of humans.[24]

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[17] CLOEM, https://www.cloem.com/flat/technology/ (last visited April 16, 2020). The beta system touts that users can "play with infinity in a few steps."

[18] Sigal Samuel, *An AI System Competed Against a Human Debate Champion. Here's What Happened. Here's what happened*, VOX (Feb. 12, 2019) https://www.vox.com/future-perfect/2019/2/12/18222392/artificial-intelligence-debate-ibm-san-francisco.

[19] *See id.*

[20] *See* Hao, *supra* note 13.

[21] *See id.*

[22] *See id.*

[23] Naveen Joshi, *7 Types of Artificial Intelligence*, FORBES (Jun. 19, 2019), https://www.forbes.com/sites/cognitiveworld/2019/06/19/7-types-of-artificial-intelligence/#5660adfa233e.

[24] *Id.*

The increasing prevalence of AI in so many industries raises real concerns about the legal implications of AI. Intellectual property law, and particularly patent law, is one field in which these concerns have been raised. In fact, AI is already a familiar topic to many patent attorneys, and the World Intellectual Property Organization ("WIPO") estimated that nearly 340,000 AI-related patent applications have been filed as of 2019.[25] Coinciding with the increasing prevalence of AI, the United States Patent and Trademark Office ("USPTO") also recently published a request for comments on the intersection between intellectual property rights and AI.[26]

On April 27, 2020 the UPSTO published a long-awaited decision declining to extend patent inventorship to an AI, based on the statutory plain meaning and case law defining the requirements for proper inventorship.[27] Prior to the April USPTO decision, one commentator criticized that the U.S. had not yet addressed the question of whether or not AI could be recognized as an inventor on a patent, despite the likely use of AI in the development of numerous currently granted patents.[28] Given the likelihood that AI were already widely used in the development of patented inventions, the validity of AI inventorship was a question that desperately needed resolution, and the USPTO got it exactly right in answering with a resounding "no."

The act of invention under U.S. patent law has traditionally required both "conception" and "reduction to practice" as a means of identifying the proper inventor of the patented invention.[29] As AI become more powerful, it is unclear whether or not AI could eventually be deemed to have

[25] WORLD INTELLECTUAL PROPERTY ORGANIZATION, *supra* note 12.

[26] U.S. Patent & Trademark Office, PTO-C-2019-0029, *Request for Comments of Patenting Artificial Intelligence Inventions* (Aug. 27, 2019).

[27] U.S. Patent Application No. US16/524,350 (filed July 29, 2019) (Decision on Petition Apr. 27, 2020).

[28] Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1083 (2016) ("[M]achines have been autonomously generating patentable results for at least twenty years").

[29] MPEP § 2138 (9th ed. 2018).

"conceived" of an inventive idea. However, our understanding of the functioning of the human brain has also changed significantly due to technological advances and has revealed stark differences between human and AI processing, so the legal definition of "conception" as it relates to patent inventorship should reflect that understanding.

This paper argues that the "conception" element of patent inventorship is necessarily a human neurological process and it is vital to the functioning of the U.S. patent system because of the underlying policy of incentivizing inventiveness. Thus, AI processing, regardless of relative efficiency compared to humans, cannot amount to "conception," as defined by U.S. patent law, so AI cannot and should not be recognized as inventors under U.S. patent law. As such, this paper provides a deeper rationale to support the USPTO decision denying inventorship recognition for an AI. This paper does *not* intend to determine whether or not AI could be granted legal personhood; decide if AI should have any other roles in the U.S. patent system; or elaborate on AI as patentable subject matter. These questions will require close analysis of the applicable sections of the U.S. patent laws and relevant case law, and, ultimately, it will likely fall to Congress to address whether or not AI will ever be recognized through legal personhood. Rather, this paper posits that the patent law requirement that an inventor must have conceived of the claimed subject matter in a patent application is connected to the incentivization scheme of the U.S. patent system and, therefore, inherently a human quality.

This paper is divided into four parts. The introduction is Part I. Part II provides an overview of patent inventorship and the definition of "conception" as a requirement for inventorship. Part III illustrates the rationale for excluding AI from being recognized as inventors under the conception requirement with an example case, analogy to other limitations on intellectual property rights for non-human entities, and an overview of human cognitive neuroscience compared to the

characteristics of modern AI. Part III also recognizes problems that might arise under this analysis and provides a possible avenue for resolution. In conclusion, this paper summarizes the modern requirement of "conception" for proper inventorship as an inherently human mental activity, which excludes AI.

II. PATENT INVENTORSHIP: WHO IS AN INVENTOR AND WHAT IS CONCEPTION?

A. Intellectual Property Clause of the Constitution

Article I, section 8, clause 8 of the Constitution (the "Intellectual Property Clause") grants to 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."[30] Thus, Congress has the sole discretion to create a patent system, and Congress has delegated the power to issue patents to the USPTO. However, it remains a constitutional requirement that the patent system is tied to inventors. Therefore, the terms used in the Intellectual Property Clause itself, including "inventor," are subject to constitutional interpretation, and it is important to consider the original understanding of these terms in defining patent rights.

B. Constitutional Definition of "Inventor"

The Intellectual Property Clause is "unique in that it is the only one of the Enumerated Powers where the drafters mandated 'a specific mode of accomplishing the particular authority granted,'" so the specific reference to "inventors" and their "discoveries" is significant.[31] In an

[30] U.S. Const. art. I, § 8, cl. 8.

[31] Brief of Appellants at 46, MadStad Eng'g, Inc. v. U.S. Patent & Trademark Office, 756 F.3d 1366 (Fed. Cir. 2014) (No. 2013-1511), 2013 WL 5536452 (quoting Figueroa v. United States, 66 Fed. Cl. 139, 149 (2005), *aff'd*, 466 F.3d 1023 (Fed. Cir. 2006)).

effort to ascertain the meaning of constitutional terms, legal scholars have looked to contemporary sources, such as Samuel Johnson's dictionary.[32] There, "inventor" is defined as "[o]ne who produces something new; a deviser of something not known before."[33] Mirroring the verbs "devise" and "produce" in this definition indicates that the "produc[tion of] something new" must stem from the mind of the inventor, so an inventor is someone who thinks of and thereafter creates novel subject matter. This is the person whom Congress has the discretion to recognize with the patent exclusive rights.[34]

C. A Patent Must List the Proper Inventor

Under the U.S. patent laws, patent rights vest initially in the inventor.[35] Specifically, § 101 of the Patent Act states: "*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 . . . .*"[36] The plain language of § 101, in accordance with the Intellectual Property Clause of the Constitution, makes it clear that only an inventor may obtain a patent; therefore, inventorship is inherently a condition for patentability.[37]

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[32] SAMUEL JOHNSON, A DICTIONARY OF THE ENGLISH LANGUAGE (6th ed. 1785).

[33] *Id.*

[34] *See* U.S. Const. art. I, § 8, cl. 8. The patent exclusive rights referred to in the Intellectual Property Clause of the Constitution are often shorthanded as a "monopoly."

[35] *Id. See, e.g.,* Agawam Woolen Co. v. Jordan, 74 U.S. 583, 602 (1868) ("He is the inventor and is entitled to the patent who first brought the machine to perfection and made it capable of useful operation. . . . No one is entitled to a patent for that which he did not invent unless he can show a legal title to the same from the inventor or by operation of law . . . ."); 41 ANNALS OF CONG. 934 (1824)("[T]he right of the inventor [is] the fruit of his mind—it belongs to him more than any other property—he does not inherit it—he takes it by no man's gift—it peculiarly belongs to him, and he ought to be protected in the enjoyment of it.").

[36] 35 U.S.C. § 101 (2012) (emphasis added).

[37] *See id.*; *see also* U.S. Const. art. I, § 8, cl. 8.

Prior to enactment of the Leahy-Smith America Invents Act of 2011 ("AIA")[38], 35 U.S.C. § 102(f) set forth an explicit inventorship requirement for priority in the "first-to-invent" patent system: "A person shall be entitled to a patent unless he did not himself invent the subject matter sought to be patented."[39] Although this explicit inventorship requirement was eliminated with the AIA and the shift to a "first-inventor-to-file" system, a patent will still be determined to be invalid if an actual inventor is not named.[40] The Manual of Patent Examining Procedure ("MPEP") published by the USPTO defines rejections based on both § 101 and § 115 for incorrect inventorship of applications filed on or after September 16, 2012.[41] To date, neither the Supreme Court nor the Federal Circuit has addressed the constitutionality of the "first-inventor-to-file" system[42], though one commentator suggests that the new rules for priority are not inconsistent with the framers' views on the purpose of the U.S. patent system.[43] Regardless of any decision on priority, it remains a constitutional requirement that patents are granted to inventors.[44]

The proper inventor for a patent can either be a single human (sole inventorship) or multiple humans (joint inventorship).[45] "Inventor" is defined as "the individual or, if a joint invention, the

[38] Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in scattered sections of 35 U.S.C.).

[39] 35 U.S.C. § 102(f) (amended 2011).

[40] *See* 35 U.S.C. § 115(a) (2012); *see also* U.S. Const. art. I, § 8, cl. 8. It is also notable that if inventorship were no longer important under the AIA, it would not have made sense to refer to the system as "first-*inventor*-to-file."

[41] MPEP § 2137.01 (9th ed. 2018); *id*. at § 2157 ("Although the AIA eliminated pre-AIA 35 U.S.C. 102(f), the patent laws still require the naming of the actual inventor or joint inventors of the claimed subject matter.")

[42] *See* MadStad Eng'g, Inc. v. U.S. Patent & Trademark Office, No. 8:12-cv-1589-T-23MAP, 2013 WL 3155280 (M.D. Fla. May 8, 2013), *aff'd*, 756 F.3d 1366 (Fed. Cir. 2014), *cert. denied*, 153 S.Ct. 1398 (U.S. Feb. 23, 2015) (No. 14-366) (affirming dismissal for lack of standing but declining to reach the question of constitutionality of the "first-inventor-to-file" system).

[43] *See generally* Alexander J. Kasner, *The Original Meaning of Constitutional Inventors: Resolving the Unanswered Question of the Madstad Litigation*, 68 STAN. L. REV. ONLINE 24 (2015).

[44] *See* U.S. Const. art. I, § 8, cl. 8.

[45] DONALD CHISUM, 3A CHISUM ON PATENTS § 10.04 (2020).

individuals collectively who invented or discovered the subject matter of the invention."[46] Defining "an inventor" so broadly as "an individual" seems to leave open the question of whether or not AI could be an inventor. However, although many statutes define "person" to include abstract entities such as corporations and societies, in addition to individual people[47], that is not the case with the term "individual" as used in the patent statutes because corporations cannot be inventors.[48] Additionally, the act of invention for purposes of U.S. patent law has developed to require two related elements, conception and reduction to practice, the first of which excludes AI.

D. Conception

i. A Mental Act

Conception is the mental formulation by the inventor of a complete inventive idea.[49] Donald Chisum describes that the modern concept of "conception" developed from two decisions by the Commissioner of Patents Leggett in 1871.[50] In the first of these cases, *Edison v. Foote & Randall*, the Commissioner relied on the idea of conception to decide an interference over the invention of an adapted telegraph printing lever.[51] There, Edison relied upon the date he successfully constructed the instrument as the date of invention, but Foote and Randall relied upon an earlier date corresponding to a sketch made by Foote, which experts testified they could have

[46] 35 U.S.C. § 100(f) (2012).

[47] 1 U.S.C. § 1 (2018) ("[T]he words "person" and "whoever" include corporations, companies, associations, firms, partnerships, societies, and joint stock companies, as well as individuals . . . .").

[48] *See, e.g.*, MBO Laboratories, Inc. v. Becton, Dickinson & Co., 602 F.3d 1306, 1310 n.1 (Fed. Cir. 2010); New Idea Farm. Equip. Corp. v. Sperry Corp., 916 F.2d 1561, 1566 n.4 (Fed. Cir. 1990).

[49] CHISUM, *supra* note 45 at § 10.04.

[50] *Id*. at § 10.04(1)(a).

[51] *Id*. (citing Edison v. Foote, 1871 C.D. 80 (Comm'r Pat. 1871)).

translated into a working model.[52] The Commissioner awarded priority to Foote and Randall and stated that "[i]nvention is not the work of the hands, but *of the brain*. The man that first conceived the complete idea by representing it on paper, or by clear and undisputed oral explanation, is the first inventor . . . ."[53] *Edison v. Foote & Randall* therefore distinguished conception as a mental act, rather than a physical act.

In *Cameron & Everett v. Brick*, the Commissioner further defined the mental act of conception between two extremes: construction of a working model and "the idea struck out—the brilliant thought obtained—the great improvement in embryo."[54] The Commissioner struck a balance between these extremes and defined conception as the point in time "when the 'embryo' has taken some *definite form in mind* and seeks deliverance, and when this is evidenced by such description or illustration as to demonstrate its completeness."[55] Though decided in the context of priority of invention, these early decisions by the Patent Office consistently recognized the mental element of conception as superior to the physical element of constructing the invention.[56]

In *Smith v. Nichols*, the U.S. Supreme Court solidified the importance of conception over any physical act of creation.[57] In the opinion, Justice Swayne declared that "A patentable invention *is a mental result.* It must be new and shown to be of practical utility. Everything within the domain

[52] *Id.*

[53] *Id*. (quoting Edison v. Foote, 1871 C.D. 80, 81 (Comm'r Pat. 1871)) (emphasis added).

[54] *Id*. (quoting Cameron v. Brick, 1871 C.D. 89, 90 (Comm'r Pat. 1871)).

[55] *Id*. (quoting Cameron v. Brick, 1871 C.D. 89, 90 (Comm'r Pat. 1871)) (emphasis added).

[56] *See also* Reckendorfer v. Faber, 92 U.S. 347, 356–57 (1875) ("Mechanical skill is one thing: invention is a different thing. Perfection of workmanship, however much it may increase the convenience, extend the use, or diminish expense, is not patentable. The distinction between mechanical skill, with its conveniences and advantages and inventive genius, is recognized in all the cases.").

[57] *See* Smith v. Nichols, 88 U.S. 112 (1874).

of the conception belongs to him who conceived it. The machine, process, or product is but its material reflex and embodiment."[58]

In 1897, the Court of Appeals of the District of Columbia decided the leading case *Mergenthaler v. Scudder*.[59] There, Mergenthaler relied upon constructive reduction to practice at the time of filing his patent applications as the date of invention in an interference proceeding, and Scudder attempted to establish prior invention of the same linotype machine with earlier evidence of conception. The *Mergenthaler* court reversed in favor of Mergenthaler and refined the definition of conception in relation to completeness:

> The conception of the invention consists in the complete performance of *the mental part of the inventive act.* All that remains to be accomplished, in order to perfect the act or instrument, belongs to the department of construction, not invention. It is therefore *the formation, in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is thereafter to be applied in practice*, that constitutes an available conception, within the meaning of the patent law.[60]

The *Mergenthaler* definition of conception has been widely adopted by the courts, and the Court of Appeals for the Federal Circuit has used this definition of conception since its establishment in 1982.[61]

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[58] *Id*. at 118 (emphasis added).

[59] Mergenthaler v. Scudder, 11 App. D.C. 264 (D.C. Cir. 1897).

[60] *Id*. at 276 (citing W. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 375 (1890)) (first emphasis added).

[61] CHISUM, *supra* note 45 at § 10.04(1)(c). *See, e.g.*, Sewall v. Walters, 21 F.3d 411, 415 (Fed. Cir.1994) ("Conception is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation."); Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir.1986) ("Conception is 'the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.'") (first citing W. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 532 (1890), then citing Coleman v. Dines, 754 F.2d 353, 359 (Fed. Cir.1985)).

Additionally, because the date of conception could dominate over the date of reduction to practice if the inventor continued to work with reasonable diligence after conception[62], the mental act of conception is the most important characteristic of invention, not the physical act of reduction to practice. In fact, actual reduction to practice was never required for a valid patent application[63], which leaves only the mental act of conception as an absolute requirement to define the inventive act.

Although most cases on conception predate the AIA, and often concerned determining a precise date of invention, those cases remain important because they define the act of invention, which remains a constitutional requirement. By focusing on the act of conception, with reduction to practice being of secondary consideration, patent law has long highlighted the mental aspects of inventive activity.

When these early cases were decided and conception was defined as a mental act, that mental act almost certainly only referred to human mental processes. It would not have been necessary at the time to define "mental act" any further because the idea of machines with human-like intelligence was only barely conceivable, even in science fiction. The earliest example of AI in fiction may be Samuel Butler's *Erewhon*, published in 1872, which explores Butler's premise that machines might develop consciousness.[64] However, this premise was presented in a satirical

[62] Mergenthaler, 11 App. D.C. at 276 ("'He who first conceives and gives expression to the idea of an invention in such clear and intelligible manner that a person skilled in the business could construct the thing, is entitled to a patent, provided he uses reasonable diligence in perfecting it.'") (quoting McCormick Harvesting Mach. Co. v. Minneapolis Harvester Works, 42 F. 152, 157 (C.C.D. Minn. 1890)).

[63] MPEP § 2138.05 (9th ed. 2018). Reduction to practice could be either actual or constructive, and the simple filing of the patent application was sufficient to establish both conception and constructive reduction to practice of the subject matter claimed in the application. *Id*. The inventor did not need to show evidence of actual reduction to practice when relying on the content of the patent application. *Id*. *See also* Hyatt v. Boone, 146 F.3d 1348, 1352 (Fed. Cir. 1998).

[64] SAMUEL BUTLER, EREWHON (1872).

view of Victorian society and certainly not widely viewed as realistic. AI was not technologically realized until the mid-twentieth century.[65]

ii. Connecting Conception to Inventorship: Burroughs Wellcome Co. v. Barr Laboratories, Inc.

Despite its basis in cases related to priority of invention, the meaning of "conception" is also closely linked to other issues, including inventorship. Determining priority of invention based on the date of conception is the corollary of determining the proper inventor based on who conceived of the invention. Furthermore, conception is described as "the touchstone of inventorship."[66]

In the leading case *Burroughs Wellcome Co. v. Barr Laboratories, Inc.*, the Federal Circuit decided an issue of proper joint inventorship based on conception.[67] There, Barr Laboratories ("Barr") sought FDA approval to manufacture and market a generic version of the drug 3'-azidothymidine ("AZT") by filing an Abbreviated New Drug Application ("ANDA").[68] Burroughs Wellcome ("Burroughs") commenced a patent infringement suit against Barr after it was notified of the ANDA.[69] Barr conceded that its AZT product would infringe Burroughs' patents; however, Barr filed a counterclaim under 35 U.S.C. § 256 (1988) seeking to correct inventorship of Burroughs' patents to add two NIH employees as coinventors—Barr had obtained a license to manufacture and sell AZT from the government, which would be the owner of the NIH

[65] *See supra* notes 4-7 and accompanying text.

[66] Sewall v. Walters, 21 F.3d 411, 415 (Fed.Cir.1994) ("Conception is the touchstone of inventorship, the completion of the mental part of invention.").

[67] *See* Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223 (Fed. Cir. 1994).

[68] *Id*. at 1226.

[69] *Id*.

coinventors' interests in Burroughs' patents.[70] Barr argued that the invention was not conceived in a sufficiently complete form until Burroughs received the results from tests conducted by the NIH.[71]

A panel of the Federal Circuit held that the inventors listed by Burroughs successfully claimed conception prior to the purported NIH coinventors for five of Burroughs' patents because their conception was corroborated by a draft patent application dated prior to any of the experiments conducted by the NIH.[72] The panel clarified that "[The] document is not itself a conception, for *conception occurs in the inventors' minds*, not on paper. The draft simply corroborates the claim that they had formulated a definite and permanent idea of the inventions by the time it was prepared."[73] Furthermore, the purported NIH coinventors merely participated in the normal course of clinical trials for the drug.[74] The panel held that the NIH employees were not joint inventors of Burroughs' inventions.[75] Thus, the *Burroughs* court looked to evidence of conception to determine whether or not individuals could be properly joined as coinventors, in addition to determining priority of invention.

The Federal Circuit addressed conception in terms of patent inventorship again in 2003 in *Board of Education v. American Bioscience, Inc.*[76] In the *Board of Education v. American Bioscience, Inc.* case, a panel of the Federal Circuit applied the definition of conception in the

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[70] *Id.*

[71] *Id*. at 1227.

[72] *Id*. at 1230.

[73] *Id*. (emphasis added).

[74] *Id.*

[75] *Id*. at 1231.

[76] 333 F.3d 1330 (Fed. Cir. 2003). *See also* Eli Lilly & Co. v. Aradigm Corp., 376 F.3d 1352 (Fed. Cir. 2004) (considering circumstantial evidence of conception to determine if a scientist was a co-inventor); Nartron Corp. v. Schukra U.S.A., Inc., 558 F.3d 1352 (Fed. Cir. 2009) (holding that an individual who explained the state of the art did not conceive of the invention and was not a co-inventor).

context of chemical inventions to determine whether or not an individual contributed to the conception of the patented compound and could be recognized as an inventor.[77] The panel held that an individual could not be properly recognized as a joint inventor of a chemical compound simply for "having in mind specific portions of a claimed compound" rather than the final compound "with all its components."[78]

A proper inventor is the human who has conceived of the invention. Because of the significant connection between conception and inventorship[79], conception case law will remain relevant for patent applications governed by the AIA "first-inventor-to-file" priority system.[80] The Federal Circuit has not yet addressed the question of inventorship for a patent filed under the AIA, but because the proper inventor must still be listed on every patent application[81], it is highly likely that proper inventorship (and joint inventorship) will still be determined based on conception.

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[77] *See* Bd. of Educ. v. Am. Bioscience, Inc., 333 F.3d 1330 (Fed. Cir. 2003).

[78] *Id*. at 1340.

[79] The mental act requirement of conception was also tenuously associated with the "Flash of Genius" doctrine, which was applied by the Federal Circuit for over a decade until it was abolished in 1952. *See* 35 U.S.C. § 103 (2012). This doctrine addressed the patentability of an invention and was formalized by the Supreme Court in 1941. *See* Cuno Engineering Corp. v. Automatic Devices Corp., 314 U.S. 84 (1941). In *Cuno*, the Supreme Court held that a patentable invention "must reveal the flash of creative genius not merely the skill of the calling." *Id*. at 91. The Flash of Genius doctrine tied patentability to the specific nature of the patentee-inventor's mental process. *See, e.g.*, *The "Flash of Genius" Standard of Patentable Invention*, 13 FORDHAM L. REV. 84, 87 (1944) ("the standard of patentable invention represented by [the Flash of Genius doctrine] is apparently based upon the nature of the mental processes of the patentee-inventor by which he achieved the advancement in the art claimed in his patent, rather than solely upon the objective nature of the advancement itself."). Ultimately, the Flash of Genius doctrine proved to be a vague and unworkable standard and the doctrine was statutorily overruled by § 103 of the Patent Act. 35 U.S.C. § 103 (2012). *See also* Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 15 (1966) ("It also seems apparent that Congress intended by the last sentence of s 103 to abolish the test it believed this Court announced in the controversial phrase 'flash of creative genius,' used in *Cuno Engineering* . . . ."). One commentator argues that it logically follows from this legislative history that "patentability of computational inventions should be based on the inventiveness of a computer's output" rather than the requirement of any particular mental act. Abbott, *supra* note 28 at 1111. This view, however, goes a significant step further than the abolishment of the Flash of Genius doctrine. The Flash of Genius doctrine may have been an unworkable test for connecting patentability of an invention to a *specific* mental process, but there is no evidence to suggest that the "mental act" aspect of conception generally was also unworkable or unnecessary. The courts continue to apply the requirement of "conception" in cases relating to priority and inventorship.

[80] *See* CHISUM, *supra* note 45 at § 10.04.

[81] *See* 35 U.S.C. § 115(a) (2012); *see also* U.S. Const. art. I, § 8, cl. 8.

This leaves the critical inquiry of whether or not AI can satisfy the conception requirement and be listed as inventors on patent applications. As the subsequent discussion will demonstrate, it is clear that AI *cannot* satisfy the conception requirement.

iii. Policy of Incentivizing Inventors' Ingenuity

The policy considerations that are vital to the existence of the U.S. patent system serve as further evidence that conception is the critical element of the act of invention and, therefore, proper patent inventorship. The framers of the Constitution largely took the position that the patent system should function as an economic trade between inventors and the public.[82] Thomas Jefferson is viewed as one of the foundational architects of the U.S. patent system, and he was of the opinion that "patents were meant as '*encouragement to men to pursue ideas*, which may produce utility.'"[83] Moreover, numerous legal scholars have recognized this view of the policy underlying the U.S. patent system as more persuasive than other property rights justifications.[84]

It is unlikely that AI could ever be incentivized in the way that human inventors are incentivized (e.g., monetarily or with industry recognition and stature) and issuing patents that are not incentive-driven could lead to vast over-privatization of inventions.[85] More is certainly not always better, particularly when the means to achieving more is to flout decades of

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[82] *See generally* Kasner, *supra* note 43.

[83] *Id*. at 29 (quoting Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), *in* 13 THE WRITINGS OF THOMAS JEFFERSON 326, 335 (Andrew A. Lipscomb & Albert Ellery Bergh eds., 1903)) (emphasis added).

[84] *See e.g.*, Shlomit Yanisky Ravid & Xiaoqiong Liu, *When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era*, 39 Cardozo L. Rev. 2217, 2239 (2018) ("To effectively incentivize innovations, patent law provides rewards, which should be high enough to promote innovation . . . .").

[85] Numerous commentators have raised the concern that the U.S. patent system might already function to stifle rather than promote inventiveness because of the vast number of patents with uncertain enforceability. *See, e.g.*, Oskar Liivak, *Overclaiming Is Criminal*, 49 ARIZ. ST. L.J. 1417, 1417 (2017) (citing Mark A. Lemley & Mark P. McKenna, *Scope*, 57 WM. & MARY L. REV. 2197, 2285 (2016)).

inventorship precedent and sound policy. In the words of Thomas Jefferson himself, it is man's "ideas" which are to be encouraged.[86] As will be addressed in greater detail below, modern AI do not conceive of "ideas," so to speak, and cannot be incentivized to conceive of ideas, thus, participation by AI in the U.S. patent system would not comport with the primary policy goals of the system itself.

III. AI CANNOT SATISFY THE CONCEPTION REQUIREMENT OF PATENT INVENTORSHIP

A. DABUS: An Example Case

So far, there have not been many patents filed listing an AI inventor, but one highly publicized example provides an illustration of how the issue will be treated in both the United States and European patent systems. Dr. Stephen L. Thaler developed an AI called "Device for Autonomous Bootstrapping of Unified Sentience" ("DABUS") and filed patent applications on two inventions allegedly created autonomously by DABUS.[87] The two patent applications, one for a fractal food container and one for an attention-attracting beacon (the "DABUS applications"), each listed DABUS as the sole inventor.[88] Dr. Thaler included himself as the legal representative for DABUS and the assignee of the DABUS applications.[89] The DABUS applications were filed with the USPTO and multiple international patent offices, including the European Patent Office ("EPO") and the United Kingdom Intellectual Property Office ("UKIPO").[90] The USPTO as well

[86] Kasner, *supra* note 43 at 29 (quoting Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), *in* 13 THE WRITINGS OF THOMAS JEFFERSON 326, 335 (Andrew A. Lipscomb & Albert Ellery Bergh eds., 1903)).

[87] Austin J. Kim & Matthew Horton, *USPTO Confirms Inventorship as Limited to Natural Human Beings*, FOLEY & LARDNER LLP: PRIVACY, CYBERSECURITY, & TECH. L. PERSP. BLOG (Apr. 30, 2020), https://www.foley.com/en/insights/publications/2020/04/uspto-confirms-inventorship-limited-human-beings.

[88] *Id.*

[89] *Id.*

[90] *Id.*

as both the EPO and UKIPO all refused the DABUS applications on the grounds that an AI cannot be an inventor.[91]

On April 27, 2020 the USPTO published its decision on the DABUS applications in response to a petition to vacate a Notice to File Missing Parts of Nonprovisional Application (the "Notice").[92] The issued Notice indicated that the DABUS applications did not identify the inventor.[93] The USPTO denied the petition and refused to recognize DABUS as an inventor based on the plain language of the patent statutes and Federal Circuit "conception" precedent requiring a patent inventor be a natural person.[94]

By late November of 2019, the EPO had similarly declined to extend inventorship to DABUS after oral proceedings for the European counterparts of the DABUS applications.[95] There, the EPO denied inventorship recognition to DABUS by recognizing the European patent system's scheme of moral rights of inventors and summarizing that the inventor designated on a patent application must be a human being, not a machine.[96] The UKIPO took a very similar approach in its December 2019 decision.[97] The moral rights scheme is somewhat different from some of the

[91] *Id.*

[92] U.S. Patent Application No. US16/524,350 (filed July 29, 2019) (Dec. Comm'r Pat. Apr. 27, 2020) (petition denied).

[93] *Id.*

[94] *Id.* at 5-7 (first citing Univ. of Utah v. Max-Planck-Gesellschaft Zur Forderung Der Wissenschaften E.V., 734 F.3d 1315, 1323 (Fed. Cir. 2013), then citing Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237, 1248 (Fed. Cir. 1993)). The USPTO explained in its decision that "[w]hile these Federal Circuit decisions are in the context of states and corporations, respectively, the discussion of conception as being a 'formation in the mind of the inventor' and a 'mental act' is equally applicable to machines and indicated that conception—the touchstone of inventorship—must be performed by a natural person." *Id.* The USPTO also decided that none of the policy considerations raised by the petitioner outweighed the plain language of the statues as interpreted by the courts. *Id.*

[95] Eur. Patent Application No. EP18275163 (filed Oct. 17, 2018) (decision Jan. 27, 2020) (finalizing outcome of oral proceedings conducted on Nov. 25, 2019).

[96] *Id.*

[97] *See* U.K. Intellectual Property Office, BL O/741/19, *Patent Decision for GB1816909.4 & GB1818161.0* (Dec. 4, 2019).

economically motivated policies that dictate recognition of inventors in the U.S. patent system; however, counsel for Dr. Thaler argued that AI would continue to invent even without incentivization.[98] This logic sounds like an admission that "inventing" is an automatic, pre-programmed process for DABUS—it does not sound like conceiving of an inventive idea. Despite Dr. Thaler's optimistic view of DABUS, DABUS is still limited by the training inputs it receives and the underlying architecture of its software and hardware, just like any other AI.

B. Analogous Limitations of IP Rights for Other Non-Human Entities

i. Corporations Cannot Be Inventors

As further evidence of the view that inventorship requires human conception, consider the jurisprudence on the issue of whether non-human entities can be inventors. For example, corporations are barred from being recognized as inventors on patent applications, and, instead, corporations participate in the patent system as assignees.[99] Instead, corporations participate in the patent system as assignees.

Part of the reasoning for excluding corporations from inventorship recognition is the idea that a corporation cannot conceive of an invention because a corporation has no collective consciousness to perform the required mental act. For example, in *z4 Technologies, Inc. v. Microsoft Corp.*, accused infringer Microsoft alleged, inter alia, in support of its defense of prior invention, that it "*corporately* both *conceived* and reduced to practice."[100] A panel of the Federal

[98] Eur. Patent Application No. EP18275163, *supra* note 95 (counsel for Dr. Thaler argued in written submission in preparation to/during oral proceedings that "AI systems will continue to develop technology that is clever and will do so irrespective of whether or not Patent Offices decide to grant patents on the inventions they conceive.")..

[99] *See, e.g.*, MBO Laboratories, Inc. v. Becton, Dickinson & Co., 602 F.3d 1306, 1309 n.1 (Fed. Cir. 2010) ("Individuals, not corporations, create inventions."); New Idea Farm. Equip. Corp. v. Sperry Corp., 916 F.2d 1561, 1566 n.4 (Fed. Cir. 1990) ("[P]eople conceive, not companies . . . .").

[100] z4 Technologies, Inc. v. Microsoft Corp., 507 F.3d 1340, 1354 (Fed. Cir. 2007) (emphasis added).

Circuit noted that "[t]he district court expressed reservations concerning the propriety of asserting corporate conception, but it expressly declined to decide this issue . . . . Because we agree that this instruction was not relevant, we need not and do not address the merits of Microsoft's claims regarding corporate conception."[101] As such, the Federal Circuit indicated in dicta a concern about recognizing non-human inventorship or inventorship arising from alternatives to conception in an individual human mind.[102]

Further, the example of barring corporations illustrates a connection to the underlying social goals of the U.S. patent system. Commentators describe that initial patent rights vest in human inventors rather than abstract entities like corporations as a way of incentivizing human ingenuity separately and in exchange for the economic benefit of the invention.[103] The link between conception and the economic reward of patenting is critical to the patentability inquiry. However, corporations have no ingenuity to incentivize. In the same manner, AI processing cannot be simply substituted for human ingenuity as doing so would break the connection between the initial node of ingenuity and the ultimate economic benefit that is conferred by the patent system. It is insufficient to argue that AI might be able to produce inventions entirely without incentivization because the U.S. patent system presumes that inventive ingenuity must be incentivized in order to occur.[104]

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[101] *Id.*

[102] *Id*. *See also* Univ. of Utah v. Max-Planck-Gesellschaft Zur Forderung Der Wissenschaften E.V., 734 F.3d 1315, 1323 (Fed. Cir. 2013) (holding that States also cannot be inventors because "[t]o perform [the required] mental act, inventors must be natural persons and cannot be corporations or sovereigns. And because States cannot be inventors, it follows that inventorship is not a core sovereign interest of the States.")

[103] *See* Daryl Lim, *AI & IP: Innovation & Creativity in an Age of Accelerated Change*, 52 AKRON L. REV. 813, 858-59 (2018).

[104] *See supra* notes 82-84 and accompanying text.

ii. Animals as Other Non-Human Entities and Comparison to Copyright Law

Further bolstering the foregoing analysis is how the U.S. Copyright Office treats non-human authors. Though copyright law is distinct from patent law in many ways, each of these systems arises from the same clause of the Constitution[105], and it can be useful to analogize between the two intellectual property systems at a broad level.

Under U.S. copyright law, an author is the creator of a work of original expression.[106] Eligible works of authorship can include literary works, musical works, architectural works, and photographs, among others.[107] In the notorious case, *Naruto v. Slater*, a six-year-old, "highly intelligent," crested macaque named Naruto picked up David John Slater's camera and took multiple "selfies."[108] The complaint in *Naruto* alleged that a book published containing the "selfies" violated Naruto's copyright.[109] The court disagreed and held that it would be an "extraordinary step" unsupported by the Copyright Act to extend copyright authorship to a non-human.[110]

The *Naruto* case indicates that the courts are leery of giving legal recognition to non-human forms of consciousness without explicit legislative intent. On the topic of other forms of consciousness, Charles Darwin described the difference between the minds of man and animals as "one of degree and not of kind."[111] In contrast, AI is different in both degree and kind: in degree,

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[105] *See* U.S. Const. art. I, § 8, cl. 8.

[106] *See* Burrows-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 57-58 (1884) ("An author in that sense is he to whom anything owes its origin; originator; maker; one who completes a work of science or literature.") (internal citation omitted).

[107] 17 U.S.C. § 102 (2012). *See* Burrows-Giles, 111 U.S. at 58.

[108] Naruto v. Slater, No. 15-cv-04324-WHO, 2016 U.S. Dist. LEXIS 11041, at *1-3 (N.D. Cal. Jan. 28, 2016), *aff'd* 88 F.3d 418 (9th Cir. 2018).

[109] *Id*.

[110] *Id*. at *8-10.

[111] 1 CHARLES DARWIN, THE DESCENT OF MAN AND SELECTION IN RELATION TO SEX 105 (1st ed. 1871).

the processing ability of AI may be greater than that of humans in limited situations, but, in kind, AI lacks grounding in common sense and thousands of years of evolution. The courts should follow *Naruto* and refrain from sneaking AI into the patent system under the standard of conception when the patent system has always presupposed that inventions develop from a human mental act.

The U.S. Copyright Office has taken a comparatively more proactive stance on preventing the intrusion of AI into the protection for creative works. Well before the April 2020 USPTO decision to not recognize AI as inventors, copyright law expressly excluded automatically generated works that are produced without input from a human author.[112] As such, the recent USPTO decision is consistent with copyright law in that it reasserts a bright-line rule barring non-human inventorship.

C. Scientific Perspectives

i. Uniqueness of the Human Mind

While neuroscience may generally be an unfamiliar topic in the courts, Justice Breyer has long advocated for legal decisions to be more rigorously informed by scientific developments because "[s]cientific issues permeate the law."[113] Cognitive neuroscience is notoriously one of the more opaque fields within the broad category of human biology, and we are far from having a complete understanding of the human brain, but modern neuroscience techniques still highlight

[112] Lim, *supra* note 103 at 836-37 (quoting U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 313.2 (3d ed. 2017)) ("The U.S. Copyright Office . . . determined that it will register only those works 'created by a human being,' while excluding 'works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author.'").

[113] Stephen Breyer, *Science in the Courtroom*, 16 (4) ISSUES IN SCIENCE AND TECHNOLOGY (2000), https://issues.org/breyer/. Justice Breyer eloquently pointed out in his article that "[a] judge is not a scientist, and a courtroom is not a scientific laboratory. But the law must seek decisions that fall within the boundaries of scientifically sound knowledge." *Id.*

just how truly unique the functioning of the human brain really is, particularly in comparison to AI.

Human brains contain something on the order of 100 billion neurons—the cells that form the building blocks of the human nervous system. A biological neuron typically consists of a cell nucleus, which receives input from other neurons at input terminals called dendrites, and an axon which transmits chemical signals from the cell nucleus as outputs across synapses to other neurons. However, the range in brain sizes throughout the animal kingdom suggests that the uniqueness of the human brain is found in something more than just the sheer number of its component parts.[114]

Despite a significant lack of clarity in the field of cognitive neuroscience, neuroimaging studies—particularly functional magnetic resonance imaging ("fMRI") techniques—have begun to uncover the neural processes that give rise to human creativity and innovation.[115] A recent study used fMRI techniques to identify and model a brain network associated with human creative activities, which indicated that there may be a specific neuronal connectivity profile that characterizes human creativity.[116]

One aspect of the human nervous system that is quite different from artificial neural networks is that our nervous system responds to both internal and external (to the body) stimuli.[117] Though artificial neural networks contain similar component parts to biological neurons, artificial

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[114] Alan Jasanoff, *The cerebral mystique*, AEON (May 8, 2018), https://aeon.co/essays/we-are-more-than-our-brains-on-neuroscience-and-being-human. *See also* INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES, FROM MOLECULES TO MINDS CHALLENGES FOR THE 21ST CENTURY WORKSHOP SUMMARY 11 (2008) ("[T]he brain is significantly more than the sum of its parts . . . ."). *Contra* Ravid, *supra* note 84 at 2225-29 (identifying eight crucial features of AI systems and suggesting that AI systems that include all of these features are comparable to humans).

[115] Roger E. Beaty et al., *Robust prediction of individual creative ability from brain functional connectivity*, 115 (5) PNAS 1087, 1087 (Jan. 30, 2018). fMRI techniques allow researchers to visualize and examine coordinated patterns of neural activity while humans perform particular tasks.

[116] *Id*.

[117] Jasanoff, *supra* note 114 (referring to reciprocal brain-body interaction pathways such as the hypothalamic-pituitary-adrenal ("HPA") axis and the physiological influence of intestinal microbes).

neural networks simply do not replicate this sort of dynamic complexity. In fact, due to their relative simplicity, artificial neural networks are typically used in neuroscientific research models to learn more about the human brain and its specific pathways but not to replicate it.[118]

From an evolutionary perspective, it has been suggested that the uniqueness of human cognitive abilities emerged as a set of social skills under cooperative and prosocial evolutionary motivations.[119] Phylogenetic comparisons to our closest biological relatives indicate that specific social pressures probably triggered the evolution of human cognition.[120] Other species may have some similar cognitive traits, but human cognition on the whole is unparalleled.[121]

Thus, faithfully replicating human cognition would likely require finding a means of accurately reproducing the social conditions under which our species evolved. Without this understanding, any artificial model of human cognition is just guessing and checking with little hope of actually replicating. The law should not tolerate the bald assertion that AI could potentially replicate human cognition because it is unsubstantiated by the weight of cognitive neuroscience and evolutionary anthropology.

ii. Characteristics of Modern AI

It is easy to think of AI as conscious beings, and the trend of anthropomorphizing AI in fiction has been around for over a century, but allowing those anthropomorphic characterizations to spill over into our understanding of modern AI technologies is misleading at best and generally

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[118] INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES, FROM MOLECULES TO MINDS CHALLENGES FOR THE 21ST CENTURY WORKSHOP SUMMARY 11-13 (2008).

[119] Evan L. MacLean, *Unraveling the evolution of uniquely human cognition*, 113 (23) PNAS 6348, 6352 (June 7, 2016).

[120] *Id*. at 6349-52 (comparing cognitive traits of bonobos and chimpanzees).

[121] *Id*. at 6352.

just incorrect. Somewhat unfortunately, this trend has only been exacerbated by the explosive popularity of "neural networks" as a machine learning technique. The name originated from the biological organization of neurons and synapses[122], though no neural network is anywhere near a faithful replication of the human brain. Furthermore, because the neuroscience of human creativity is far from fully understood, it can be easy to assume that AI are more similar to humans than is true in reality. David Watson of the Alan Turing Institute opines that "[b]y anthropomorphizing a statistical model, we implicitly grant it a degree of agency that not only overstates its true abilities, but robs us of our own autonomy."[123]

Watson is particularly critical of neural networks for three main reasons: (1) they are easy to fool; (2) they are extremely data inefficient; and (3) they are "myopic" or, in other words, near-sighted.[124] These deficiencies are all noted with respect to human cognition. Artificial neural networks only "learn" by assessing an outcome and modifying the system's "weights" so that the weights are gradually shifted in the direction that increases performance of the specified tasks.[125] Other experts hypothesized that "the alleged myopia problem is just a byproduct of the requirement that [neural networks] select a label from a constrained choice set."[126] But this illustrates exactly

[122] *See* Elizabeth Fernandez, *AI is Not Similar to Human Intelligence. Thinking So Could be Dangerous*, FORBES (Nov. 10, 2019), https://www.forbes.com/sites/fernandezelizabeth/2019/11/30/ai-is-not-similar-to-human-intelligence-thinking-so-could-be-dangerous/#7295a6b46c22.

[123] David Watson, *The Rhetoric and Reality of Anthropomorphism in Artificial Intelligence*, 29 MINDS & MACHINES 417, 434 (2019).

[124] *See id*. at 422-24. Watson suggests alternative algorithmic techniques may have other similarities to human cognitions, but he concludes that "the rhetoric of anthropomorphism can do more harm than good when it comes to conceptualizing the important ethical challenges posed by emerging [AI] technologies." *Id*. at 418.

[125] Madeline Schiappa & Ethan Rudd, *Man vs machine: comparing artificial and biological neural networks*, SOPHOS NEWS (Sep. 21, 2017), https://news.sophos.com/en-us/2017/09/21/man-vs-machine-comparing-artificial-and-biological-neural-networks/.

[126] Watson, *supra* note 123 at 424.

the reason that AI processing is not equivalent to human cognition. AI are limited by their inputs and the tasks they are programmed to accomplish.

In other words, AI are constrained by the inputs from developers, or at least by the biases imparted by the developer into the code that constitutes the AI. Because of the inherent biases in AI code, the creation of AI is different from the genetic transmission of traits from one human to her offspring—it is not a wholly objective process, and an AI would to some degree always reflect the choices of the developer who programmed it.[127] Humans, by contrast, are the products of thousands of years of evolution. AI are the immediate product of the individual developers who wrote their code.

Admittedly, a mere biological requirement for intelligence would be a poor test because, theoretically, computers could be created from organic materials and, in fact, the preliminary components of such a biological computer have already been created.[128] However, Abbot agrees that "[i]n the event that policymakers decide computers should not be inventors, a rule explicitly *barring nonhuman inventorship* would be a better way to achieve that result."[129] A bright-line rule distinguishing human inventorship from non-human (including AI) activities is the most durable approach. This approach prevents the courts from having to wade through opaque factual determinations of whether or not a particular AI's algorithmic architecture constitutes a sufficiently equivalent "mind" on a case by case basis.

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[127] *See* Amir H. Khoury, *Intellectual Property Rights for "Hubots": On the Legal Implications of Human-Like Robots As Innovators and Creators*, 35 CARDOZO ARTS & ENT. L.J. 635, 648 (2017) ("[E]ven if a certain Hubot is deemed to have full awareness and a "life" of its own, it still remains a machine—its seeming humanity is only a reflection of our own humanity and human emotions."). Khoury imagines "Hubots" as the combination of autonomous intelligence and human form. *Id*. at 640.

[128] Abbott, *supra* note 28 at 1111 (citing Sebastian Anthony, *Stanford Creates Biological Transistors, the Final Step Towards Computers Inside Living Cells*, EXTREMETECH (Mar. 29, 2013), http://www.extremetech.com/extreme/152074-stanford-creates-biological-transistors-the-final-step-towards-computers-inside-living-cells [https://perma.cc/ENX4-WZKA]).

[129] *Id*. (emphasis added).

D. Possible Consequence of Excluding AI from Patent Inventorship

Although excluding AI from patent inventorship is consistent with conception case law and the technological realities of modern AI, one possible consequence of excluding AI from inventorship recognition under the conception rationale can be termed the "no inventor scenario." For some and possibly most modern AI, the individual or individuals who developed the AI's programming can probably be recognized as the inventors of any subject matter produced through functioning of the AI—so long as the developers can meet the *Mergenthaler* standard of conception (i.e., the formation in their minds of a definite and permanent idea of the complete and operative invention). However, the concern is that, as AI become more complex—for example with the implementation of deep learning—developers may never know precisely what an AI's algorithms are doing to reach a particular result, and the result might be subject matter far removed from anything the developers ever contemplated, so such developers would not be able to meet the *Mergenthaler* conception standard. If the AI cannot be listed as the inventor on a patent application for that subject matter, and the developers cannot be listed either, then there is no proper inventor.[130]

Some commentators suggest that this scenario indicates that the patent system should only be narrowly concerned with the result of invention, not the human mental act that has traditionally taken place, in order to adequately encourage AI development.[131] This illustrates the tension

[130] This scenario may have even resulted as a side-effect of the UKIPO decision on the DABUS applications—the UKIPO chose to concede that DABUS was the creator of the inventions, but still refused to recognize DABUS as the inventor because DABUS was not a human, so it implied that there was no proper inventor at all. *See* U.K. Intellectual Property Office, BL O/741/19, *Patent Decision for GB1816909.4 and GB1818161.0* (Dec. 4, 2019).

[131] *See, e.g.*, Abbot *supra* note 28 at 1079 ("Treating nonhumans as inventors would incentivize the creation of intellectual property by encouraging the development of creative computers."). Interestingly, Abbott's article does not consider the alternative that developers of AI might be chilled if the AI rather than the developer were to be recognized as the proper inventor.

caused by significant industry movement toward broad implementations of AI. However, this result is not inconsistent with the conception framework of inventorship upon which the courts have relied since the nineteenth century and the policy of incentivizing human ingenuity that the framers cemented as the cornerstone of the U.S. patent system. Because AI are non-human by definition, and therefore AI can neither "conceive" of subject matter nor be incentivized to do so, AI are never proper inventors and any subject matter derived wholly from AI processing is unpatentable.

The courts could potentially resolve this issue by carving out an exception to the *Mergenthaler* standard of conception for developers of AI, such that the developer of an AI is always the default inventor of any subject matter created by the AI, regardless of whether or not the developer has a definite and permanent idea of the complete and operative invention, but such a decision would be inconsistent with decades of inventorship precedent. An unprecedented exception like this could lead to a slippery slope of arguments *ad absurdum* regarding the inventorship status of inventors' progeny or even their acquaintances—if an AI's output is its developer's invention in spite of conception case law to the contrary, then what about subject matter created by the developer's biological children, and what about the subject matter created by the students the developer taught? A better solution would be to allow Congress to address the issue directly by statute. Congress can decide if AI are important enough for social progress that a unique exception in patent law should be made. Until then, only humans can be listed as inventors on patents.

IV. RECOMMENDED OUTCOME

Conception is the foundational requirement for invention in the U.S. patent system. Furthermore, conception is the earliest discernable nexus between the act of invention and the economic benefits conferred by the patent system. Sooner or later, a case challenging joint inventorship on a patent governed by the AIA will make it to the Federal Circuit. The Federal Circuit should explicitly adopt the conception standard articulated in *Mergenthaler* as the requirement for proper inventorship for patent cases originating under the AIA.

In doing so, AI should be excluded from being recognized as inventors on patent applications because modern AI processing is distinct from the human mental act of conception. Furthermore, AI processing breaks down the requisite nexus between human ingenuity and the economic benefits that are granted to patent holders. In order to prevent a complete breakdown of the legal framework of patent inventorship, inventorship must be limited to humans. If we ever find ourselves in a world where an AI can supersede its programming and autonomously request to be listed as an inventor, we have far more pressing problems to worry about.

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