When the Invented Becomes the Inventor: Can, and Should AI Systems be Granted Inventorship Status for Patent Applications?

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Abstract

Artificial Intelligence ("AI") systems have become vastly more sophisticated since the term was first used in the 1950s. Through the advent of machine learning and artificial neural networks, computers utilizing AI technology have become so advanced that a team of attorneys in the United Kingdom claim that their AI machine, DABUS, actually created patentable inventions. The team went so far as to file patent applications with the European Patent Office, the UK Intellectual Property Office, and the US Patent and Trademark Office. All applications named DABUS as the inventor. This sparked a heated debate within academic and legal communities that centered around whether AI can be an inventor, and, if so, what this might mean for the current state of patent law. This paper discusses the purposes of patent law through a brief look at its history, in an effort to highlight why patent law as it stands may no longer be one- size-fits-all. It considers the evolution of AI systems to explain how one might determine that a machine could be "creative" and therefore justifiably named as inventor. It surveys popular opinions and organizes them on a spectrum ranging from those who believe that patent law should stay as it is and that AI cannot be an inventor, to those who, more dramatically, advocate for the abolition of patent protection for AI inventions. This paper suggests that legislators be proactive in traversing this technological minefield rather than reactive, as technology will continue to outpace, and trample, law if left to its own machinations.

Keywords

Artificial Intelligence; Patent Law; Creativity Machine; Emerging Technologies; Inventor; Artificial Inventor; Patent; USPTO; Copyright; Trademark.

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Introduction

In early August 2019, the Artificial Inventor Project, led by an international team of attorneys, filed patent applications for two inventions in both the US and the EU: one for a "fractal container" — the purpose of which is to "improve grip heat transfer in and out of the container" and enable one container to be connected to another — and the other a "neural flame" — a lighted device to be used for search-and-rescue missions[1]. These inventions seem innocuous enough, and likely to meet the novelty, utility, and non-obviousness requirements for patentability[2]. So what in these applications could possibly spark controversy among legal academics and practitioners, and have the business and tech worlds holding their breath? One small, seemingly insignificant detail: in the area where an applicant must list the inventor of the product or process for which the patent is sought, these attorneys listed DABUS[3], a "Creativity Machine," rather than a human inventor[4].

The patent system[5] is built to deal with "inventors" as human beings. Introducing the possibility that a non-human can "create" or author something has either not been contemplated, or sometimes completely refuted, by US law [Kop M., 2019][6]. Now, however, the United States Patent and Trademark Office (USPTO) recognizes the need to address this question. On August 27, 2019, the USPTO promulgated a request for comment in the Federal Register for several questions relating to Artificial Intelligence (AI) and the patent system[7]. Shortly thereafter, what began as a quest to determine how patent law must react to new uses of technology was then expanded to include all of intellectual property law, and the comment period was extended.

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[1] Artificial Inventor Project, *Patent Application*. Available at: http://artificialinventor.com/patent-applications [hereinafter AIP *Patent Applications*] (accessed: 05.02.2020)

[2] See: 35 U.S.C. §§ 101–103 (2019).

[3] DABUS, or Device for the Autonomous Bootstrapping of Unified Sentience.

[4] AIP *Patent Applications*...

[5] For the purposes of this commentary, unless otherwise noted, "patent system" refers to the United States' patent application and granting process pursuant to 35 U.S.C. §§ 101–390 (2019).

[6] *See:, e.g.*, Naruto v. Slater, 888 F.3d 418, 420 (affirming the district court opinion that Naruto, a crested macaque, did not have standing to sue under the Copyright Act for infringement of a "selfie" taken by the primate with defendant's camera because he is an animal).

[7] Notice, US PTO, Request for Comments on Patenting Artificial Intelligence Inventions, 84 FR 44889. Aug. 2019.

There are arguments for and against awarding AI systems the title of "inventor". Within these arguments and opinions lie core policy questions that the USPTO must address, namely whether inventors can only be human. This commentary endeavors to provide a broad overview of some of the more common positions held by industry leaders and academics on the state of patent law in response to these filed applications. Many such policy opinions and positions rely heavily on the history and purpose of the patent system; the same facts and history construed differently depending on said position.

Part I of this paper charts brief histories of both the patent system and AI, and how we arrived at the current policy discussion. What follows in Part II is a rudimentary, and barbarously simplified, description of how AI systems, and in particular DABUS, work, and how they might share characteristics with a human "inventor". Part III then introduces industry opinions about the idea of inventorship. Part IV touches on how similar questions have been asked and answered before by describing how different countries have reacted to the use of AI in copyrighted, or copyrightable, works. This paper then concludes by suggesting that, rather than following the legal precedent of being reactionary, legislators should take strides now to push these important legal developments forward.

1. Histories Repeat

1.1. Patent Pending — a History

Patents, or the precursor of patents as we know them today, were first introduced in the 1400s [Chirambo C., 2019] and were initially distributed on an *ad hoc* basis[8]. The advent of the printing press in the mid-fifteenth century naturally spurred the need for protection of *literary* works, as dissemination became simpler — however, this event simultaneously created an open market for the imitation of inventions as published news became prominent and new inventions were shared on a wider, and more rapid, scale [Bugbee B., 1967: 17]. In response, inventors became savvier: Filippo Brunelleschi, Florentine architect and engineer,

[8] *See: History of Patent Law*. Available at: https://onlinellm.usc.edu/blog/history-of-patent-law/ (accessed: 13.12.2019)

> refuse[d] to make [his] machine available to the public, in order that the fruit of his genius and skill may not be reaped by another without his will and consent; …if he enjoyed some prerogative concerning this, he would open up what he [wa]s hiding, and disclose it to all [Bugbee B., 1967: 17–18].

This was the first "patent" that recognized an inventor's inherent right to his invention, "and the contractual nature, or *quid pro quo*, of patent protection". The preamble to this grant alone was an acknowledgment by the Florentine government of the benefit to the city of Florence, and society, of incentivizing — and thereby stimulating — creativity by its population, and in providing legal protection for the same.

Subsequent to the heavy decline in the granting of monopolies in Florence [Bugbee B., 19–20], Venice was the next to take up the patent mantle. Importantly, the Venetian Senate then passed what is the first-known general patent law, which embodied the basic tenets of Brunelleschi's patent [Bugbee B., 22]. It read:

> We have among us men of great genius, apt to invent and discover ingenious devices … Now, if provision were made for the works and devices discovered by such persons, so that others, who may see them could not build them and take the inventor's honor away, more men would then apply their genius, would discover, and would build devices of great utility and benefit to our commonwealth.

This law mirrors the underlying policy introduced by the Florentine government: we are inventors and discoverers, but if we are to put in effort to invent and discover, this work should be protected from theft, and inventors should be rewarded for innovation.

The Venetian system spilled over to other parts of the world throughout the following centuries [Bugbee B., 25–27, 35–43][9]. It even extended to colonial America, by way of England and its the Statute of Monopolies [Bugbee B., 36–38]; [Hovenkamp H., 2016: 263, 270][10]. An ad hoc monopoly-granting process continued in the United States until finally, upon the writing of the U.S. Constitution, there was a federal mandate of intellectual

[9] Discussing French, German, and Dutch patent practices based on Venetian patent principles and the English Statute of Monopolies).

[10] *Brief History of Patent Law of the United States*. Available at https://ladas.com/education-center/a-brief-history-of-the-patent-law-of-the-united-states-2/ (accessed: 07.05.2014). The Statute of Monopolies was a reaction to the commercial middle class opposing the grants of patent as royal showings of favor, which limited their ability to engage in mechanical and chemical inventiveness with exclusive rights to their innovations.

property protection directed to Congress: "Congress shall have 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…"[11].

What we see throughout the history of inventive development is a consistent belief that human invention requires incentive, and that the way to incentivize is to offer exclusive rights in the manufacture and production of an entity's innovation. However, while the Patent Act frames inventorship and patentability in reference to human creation, there is no threshold of human control or input for the inventive process written into the law[12]. It seems fair to say that these same incentives to create, invent, or discover cannot exist for AI systems. But perhaps it goes further than that: with the need to incentivize human inventors of AI to push their ideas forward. To see how this detached layer of incentivizing human inventors affects the progress of AI development, we will need to similarly follow the advent and history of artificial intelligence.

1.2. They Walk Among Us — From Science Fiction to Science

AI is a complex field, and defining it proves difficult for most scholars and practitioners [Lea G., 2015]. Since AI can comprise innumerable technologies, and combinations of technologies, it is difficult to condense the concept into one singular definition [Marr B., 2018; Pring-Mill D., 2018]. For purposes of this discussion, it will helpful to start with the first recognized uses of the phrase "artificial intelligence".

Though the idea was bandied about for some time, the concept of "thinking machines" was formally introduced by Alan Turing in his paper *Computing Machinery and Intelligence*, which asked: "Can machines think?" [Turing A., 1950: 433]. The now-famous "Turing Test" was created as a way to address this quandary — if a machine can answer questions, fooling a human judge into thinking that it is human, then the program is said to be exhibiting intelligence [Hern A., 2014][13]. The first known use of the phrase "artificial in-

[11] US Constitution, Art. I, § 8, cl. 8.

[12] World Economic Forum. 4th Industrial Revolution. White Paper: Artificial Intelligence Collides with Patent Law. World Economic Forum Writing Organization: Center for the 4th Industrial Revolution. P. 9. Available at: http://www3.weforum.org/docs/WEF_48540_WP_End_of_Innovation_Protecting_Patent_Law.pdf. (accessed: 09.04.2018)

[13] See also: Exec. Office of the President National Science and Technology Council Comm. on Tech. Preparing for the Future of Artificial Intelligence 5 n.4 (2016).

telligence" came in 1956, when John McCarthy called to order the Dartmouth Summer Research Project on Artificial Intelligence, where researchers from disciplines as varied as language simulation and complexity theory were to gather and begin a discourse about what we now call the field of AI.

Following early successes with computer-based, complex problem solving, like IBM's Deep Thought chess-playing machine in the 1980s [Higgins C., 2017]. AI researchers began with an assumption: if an AI could solve a more advanced problem, then it should also be able to solve much simpler ones. This turned out not to be the case [Higgins C., 21][14]. The realization that the human skills that are the most difficult to reverse engineer are the unconscious ones [Rotenberg H., 2013: 108-109] contributed to a marked cooling off period in AI research. Researchers shifted focus from attempting to solve grand, societal problems to resolving narrow challenges for which there are clear measures of success [Dormehl L., 22].

One area to which this focus was applied was the advent of "expert systems". These involved AI systems operating as problem-solving tools alongside human counterparts. Reasoning was not enough to solve real-world problems; it had to be combined with knowledge in order for it be useful. If, for instance, programmers wanted a computer that would be useful in the field of neuroscience, the system would need to be deeply familiar with every facet of the field in the same way that a studied neuroscientist would be. Programmers and developers "suddenly had to become 'knowledge engineers,' capable of taking human experts in a variety of fields and distilling their knowledge into rules a computer could follow. The resulting programs were called 'expert systems'" [Dormehl L., 23–24].

Creating these systems seemed like a stroke of genius — until the process began hitting roadblocks. Counterintuitively, these expert systems would become *less* accurate as more rules were introduced: the more "knowledge rules" that were incorporated into the system, the more undesirable interactions between those rules would crop up. Essentially the rules, when interdependent, would cause the system to break if a contradictory rule was programmed. The process was complex, and cost prohibitive [Dormel L., 27].

But things changed again in 1996, when two students at Stanford University built a "smart web catalogue" [Dormehl L., 28] — a promising algo-

[14] Enter the Moravec Paradox — suddenly it seemed like it was "comparatively easy to make computers exhibit adult-level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility".

rithm that became the boost AI needed in the court of public opinion, and which contributed to the rapid growth of the field. Within a decade, Geoff Hinton introduced the concept of "deep learning [Dormehl L., 49]". Scientists moved away from programmable knowledge as seen in expert systems, and attempted to model the neural pathways of the human brain inside a computer by creating artificial neural networks [Dormehl L.,31]. In other words, these artificial neural networks are the computational approximation of the human brain [Hawkins J., 2004: 18–21][15]. Though neural networks had been the rejected sibling to traditional AI research, suddenly, this became the only way forward [Dormehl L., 29, 49].

1.3. Crossing the Streams

Here is where we arrive at the crux of our discussion: the point at which patent principles and AI overlap and/or intersect. As quoted above, the provision in the Constitution that gives Congress the power to promote science and the useful arts allows for securing to *authors* and *inventors* the exclusive right to their works[16]. It has long been understood that "authors" and "inventors" refer to humans. In early August 2019, a team from the UK University of Surrey decided to test the boundaries of the patent system: the team filed two patent applications in both the USPTO and the European Patent Office (EPO) claiming an AI system called DABUS as the inventor[17]. The filing tabled the question of how would patent offices react to the claim that the invented has become the inventor.

In response, on August 27, 2019, the USPTO sent out a call requesting comments for patenting AI inventions[18]. The request states that the USPTO "is interested in gathering information on patent-related issues regarding artificial intelligence inventions for purposes of evaluating whether further examination guidance is needed to promote the reliability and predictability of patenting artificial intelligence inventions[19]". The request asked questions like: "What are the different ways that a natural person can contribute

[15] How well neural networks can be mapped to mimic the structure of the brain is not necessarily agreed upon by all AI researchers.

[16] US Const. Art. I, § 8, cl. 8.

[17] AIP Patent Applications…

[18] Notice, USPTO, Request for Comments on Patenting Artificial Intelligence Inventions, 84 FR 44889 (Aug. 2019).

[19] Ibid.

to conception of an AI invention and be eligible to be a named inventor?" and "Do current patent laws and regulations regarding inventorship need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention?"[20] Within two months, a second call was made that expanded the request to also include copyright and trademark[21].

2. How Might AI be Considered an Inventor?

While the USPTO asked several questions surrounding AI inventions in its request for comment, the application filing that sparked debate among legal practitioners and business entities centers around one particular question: whether an AI system can be considered an inventor for patent-filing purposes. The team that filed the application supports AI inventorship[22]. A cursory scan of some of the comments the USPTO received evidences that industry leaders oppose it[23]. The trouble with a blanket statement that AI can or cannot be granted inventorship is that there are several different types of AI, all with varying capabilities, all trained in different ways.

2.1. Machine Learning

Before AI can perform any great inventive or creative steps, it must be built, programmed, and trained. The first two steps of this process are wildly

[20] Ibid.

[21] Notice, USPTO, Request for Comments on Intellectual Property Protection for Artificial Intelligence Innovation, Federal Register no 58141 (Oct. 2019). The conversation about patentability for AI-created inventions started almost three decades prior to these requests for comment. As discussed above, AI has been slower to develop into the all-powerful, self-sufficient thinking machine early AI researchers predicted. Asking questions about patentability for AI inventions in the early 2000s may have been simply twenty years ahead of its time. *See, e.g.*, WIPO Worldwide Symposium on the Intellectual Property Aspects of Artificial Intelligence, (Mar. 1991); Vertinsky L., Todd R. *Thinking About Thinking Machines: Implications of Machine Inventors for Patent Law*, 8 Boston University Journal of Science & Technology Law, 2002, pp. 574, 586–87. ("To take a futuristic view, it may one day become necessary to obtain an assignment of invention rights from computer agents, and in the meantime, due diligence over what computer resources are being used, how, and who owns, controls, and has access to the results is warranted").

[22] See: generally: AIP Patent Applications...

[23] See, e.g., Letter from Thomas M. Coughlin, President, IEEE-USA, to Under Secretary of Commerce for Intellectual Property and Director of the US Patent and Trademark Office. Available at: https://ieeeusa.org/wp-content/uploads/2019/10/101619.pdf [hereinafter IEEE Letter] (accessed: 16.10.2019)

outside the scope of this commentary. However, it is relevant to discuss the training process for AI algorithms to better understand why one might make a policy argument in favor of an AI system being awarded inventor or author status. This training can be done through machine learning — "the ability for computers to learn without being programmed" [Wallace L., 2019]. Based on the documentation surrounding DABUS and the type of learning typically used in Creativity Machines, here we focus on two machine learning methods: supervised learning and unsupervised learning.

In supervised machine learning, the goal of training the algorithm is to uncover insights — *i.e.*, recognize patterns or categorize information — from data, by telling the system the desired output[24]. This process typically has three phases: training, validation, and testing. In the training phase, the algorithm is given "inputs" — data from which it can draw its conclusion — and is told the desired output from this set of data [Ashley K., 2017]. Because the algorithm has the input, and correct output, it can "learn" how variables assigned by the trainer relate to the target output; this helps the system to recognize patterns and make predictions based on the given input[25]. The goal is for the machine to be able to make these categorizations correctly with every piece of data, based on its prior "learning". Once a machine or algorithm has "learned" what it must do, in theory the AI can then take over on its own [Nielsen M., 2019].

Unlike supervised machine learning, when conducting unsupervised machine learning, the algorithm is not given a predetermined set of outcomes[26]. Because there is no desired output, the algorithm cannot classify the data inputs; rather, the goal of this type of training is instead to learn more about the data itself [Brownlee J., 2016]. The important difference between this type of machine learning and supervised learning is that, within the zetabytes of information available on the internet, there are an impossible number of unlabeled or incorrectly labeled data sets. In unsupervised learning, no labels are provided to the machine; it simply has input with no explanation [Dormehl L., 50]. This allows the machine to sift through the data for patterns that a human, given the same magnitude of data, could not possibly see.

[24] Supervised Machine Learning, Data Robot. Available at: https://www.datarobot.com/wiki/supervised-machine-learning/ (accessed: 18.12.2019)

[25] Supervised Machine Learning, Data Robot…

[26] See: Unsupervised Machine Learning, Data Robot...

Both of these types of machine learning lead to machines being able to make predictions based on vast amounts of input. As machine learning continually evolves and increases its prediction accuracy, machines become better able to perform tasks that would previously require human input [Agraval A.et al, 2018].

2.2. DABUS, or the "Device for the Autonomous Bootstrapping of Unified Sentience"

Law is reactive, and often slow to be so. As discussed, the idea of an AI invention then inventing things itself is not new, and neither is the discussion about how patent law will have to deal with it when it happens. While inventions have been deemed "creative" before August 2019, intellectual property law — at least in the United States[27] — has not changed with the growth of AI technology. The team that initiated the Artificial Inventor Project[28] seems to have done so to force the hands of patent offices to confront the question of whether AI can be considered an inventor.

According to the attorneys who filed the applications, DABUS is a "Creativity Machine" — "a particular type of connectionist artificial intelligence"[29]. Connectionist AI systems operate through the use of *artificial neural networks*, which are modeled after the way that neurons and synapses are thought to fire in the human brain, and are used to mimic the way humans learn [Dormehl L., 2019]. There are two neural network layers at play in Creativity Machines: the first network, and what this paper will call the "novelty network," is trained using general information from a variety of fields of knowledge, and is made up of a series of smaller neural networks[30]. It is tasked with generating novel ideas in response to disruptions, or "self-perturbations," in the way the smaller neural networks weigh and interpret statistical data from new inputs[31]. A second, overarching network monitors the novelty network for any ideas that are "sufficiently novel compared to the machine's pre-existing knowledge base"[32]. It responds by increasing or

[27] See: Part IV.

[28] Frequently Asked Questions, Artificial Inventor Project/ Available at: http://artificialinventor.com/frequently-asked-questions/ (accessed: 13.12.2019)

[29] AIP Patent Applications...

[30] AIP Patent Applications...

[31] Ibid.

[32] Ibid.

decreasing the perturbations to which the smaller neural networks react when interpreting data, in order to "form and ripen ideas having the most novelty, utility, or value"[33]. Through this "learning" process, one may start to see how by analogy, an AI system may be considered inventive.

The Artificial Inventor Project maintains that DABUS was trained only on general knowledge "in the field"; as its training was likely unsupervised, there would be no expected outcome from its machinations[34]. Its goal was simply to create something novel. From this training, DABUS came up with these inventions independently, and was able — on its own — to designate them as novel[35].

In some cases of invention by an AI system, a human may still be considered the inventor, perhaps because she exhibited inventiveness in creating a program to solve a specific problem, or carefully curated the information provided to the machine, or even identified the machine's output as novel and inventive[36]. The Artificial Inventor Project team argues, however, that no human may be considered the inventor of *these* inventions[37]. DABUS was not created to solve any particular problem, it was not given training data specifically relevant to its creations, and the machine itself identified that the inventions were novel within the scope of prior art of which it was "aware"[38].

These are all arguments made to support the idea that DABUS itself can and should be the only available option to list as the inventor of these innovations: it exhibited the inventiveness required of a human creator, and no human can claim to have had a hand in its processes. But convincing a patent office of these things is no small task. When so much needs to be proved just to show that an AI system is even capable of creative invention without human intervention, it seems like a monumental, and fruitless, effort for the Artificial Inventor Project team to push the need to list DABUS as the inventor of these products. However, the Manual of Patent Examining Procedure ("the Manual")[39], used by all patent examiners when determining

[33] Ibid.

[34] Ibid.

[35] Ibid.

[36] Ibid.

[37] Ibid.

[38] Ibid.

[39] See: generally MPEP (9th ed. Rev. 08.2017, Jan. 2018).

whether or not to approve a patent application, gives some insight as to why the team is driving these test cases forward.

First, patent law requires the naming of an actual inventor, or joint inventors, and the applied-for subject matter[40]. The Artificial Inventor Project asserts that DABUS is the inventor. DABUS's creator, Stephen Thaler, would not be allowed to list himself as inventor because he had no part in the conception of the products for which the group is seeking patent protection[41]. Patent seekers may not simply leave this area of the application blank, because, secondly, if an inventor is not listed, or is listed incorrectly and is not subsequently corrected, the Manual requires that "Office personnel should reject the claims under 35 U.S.C. 101 and 35 U.S.C. 115"[42]. If Thaler were to claim to be the inventor, but a patent office deems that not to be the case, any applications or claims may be rejected on that fact alone, leaving aside the discussion of whether AI can be a "creator". Because the patent system requires the disclosure of how an object is made or a process is completed in order to be patent-eligible[43], once the information is on record, it becomes public knowledge. The risk, particularly for businesses, is that naming the wrong inventor would result in no one receiving a patent [Crouch D., 2018], but with a chance that now the process is public information and the invention can no longer be monetized on the same scale.

Through this official interpretation of the patent-granting system, it makes sense that there are diverging opinions on how the USPTO should deal with AI as inventors.

3. The AI-Space Continuum

How industry leaders and legal practitioners have reacted to these claims seems to fall on a varied spectrum, though many of the ideas and opinions have areas of overlap. While not all responses to the USPTO's request for comment have been published as of this writing, several industry leaders and associations have weighed in, sharing their views of how the patent system should react to patents filed with an AI inventor moving forward.

[40] See: 35 U.S.C. § 115(a) (2019).

[41] AIP Patent Applications, supra note 1

[42] MPEP §§ 706.03(a), 2157 (9th ed. Rev. 08.2017, Jan. 2018).

[43] See: 35 U.S.C. § 112(a) (2019).

3.1. Legal Gymnastics and the "Law of the Horse"[44]

On one end of the spectrum are proponents for leaving the law in its current state. The Institute of Electrical and Electronics Engineers (IEEE)[45] and the American Intellectual Property Law Association (AIPLA) submitted comments to the USPTO for each of its inquiries[46]. When answering the question "Do current patent laws and regulations regarding inventorship need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention?" AIPLA's position is a clear "no."[47] The letter states that the law requires an inventor to be a natural person, and though DABUS is currently a case testing this principle, it is unclear whether this AI system "is truly 'inventive AI.'"[48] Even if inventive AI does exist in the future, AIPLA says, that still does not dictate that AI should be granted automatically the title of inventor; rather, "it will be necessary to consider what types of activities by AI entities would be considered as inventive contributions to the claimed invention"[49].

Similarly, the Intellectual Property Owners Association (IPOA) emphasizes that "inventors" must be natural persons, and notes that "if non-natural entities were afforded inventor status, additional downstream issues would also need to

[44] *Easterbrok F.* (1996). "The best way to learn the law applicable to specialized endeavors is to study general rules. Lots of cases deal with sales of horses; others deal with people kicked by horses; still more deal with the licensing and racing of horses, or with the care veterinarians give to horses, or with prizes at horse shows. Any effort to collect these strands into a course on 'The Law of the Horse' is doomed to be shallow and to miss unifying principles"). By way of analogy, proponents of prohibiting a machine from being named as an inventor may posit that we do not need a law specific to AI and inventorship; rather, the general rule requires a human to be inventor, and we shall find a human to name on the application, even if she does not meet the traditional "inventorship" standard.

[45] See: IEEE Letter… ("AI designers who created an AI's system's specifications, objectives, and input/output architectures, and who "trains" the AI system (or specifies that training) should be named the inventors of any inventive output of the AI system").

[46] See: Letter from Barbara A. Fiacco, President, American Intellectual Property Law Association, to Under Secretary of Commerce for Intellectual Property and Director of the US Patent and Trademark Office. Available at: https://www.aipla.org/docs/default-source/advocacy/documents/aiplacomments_uspto_rfc_patentingai2019nov08.pdf?sfvrsn=b1945306_0 [hereinafter AIPLA Letter] (accessed: 08.11.2019)

[47] Ibid. at 3–4.

[48] Ibid. at 4.

[49] Ibid. at 4. Later responses to USPTO questions seem to clarify AIPLA's position: the consequences of allowing AI to be named inventor would necessarily affect the measure against which one would determine a person having ordinary skill in the art ("PHOSITA") for the purposes of a patent validity analysis. Ibid. at 8.

be addressed"[50]. For instance, a common concern is that a machine cannot fulfill the requirement for an inventor to sign an affidavit affirming that she is the original inventor, and that she understands that a false statement to that effect has legal consequences[51]. In addition, IPOA cites the fact that it would impossible to depose a machine to determine its inventorship status[52].

Interestingly, however, when answering the question "Are there any other issues pertinent to patenting AI inventions that we should examine?" AIPLA recognizes that depending on the type of AI and the way it analyzes data and "learns" from it, the connection between human inventor and AI system may become more tenuous as AI systems become more "intelligent"[53]. We begin to see areas in which relying on the patent system in its current state may cause problems for future AI innovations.

3.2. Change is Inevitable, and the Sooner the Better

While industry associations seem to agree that changing the law to include AI in the definition of inventor is unnecessary and problematic, legal practitioners differ even amongst themselves as to the impact AI will have on the current patent regime in the United States. In an interview with legal practitioners, Law. com asked Kathi Vidal of Winston & Strawn and John Dragseth of Fish & Richardson, whether current laws and regulations regarding inventorship should be revised in light of the DABUS patents [Graham S., 2019]. Where Dragseth is unconcerned because society is not at a place where "an entity or entities other than a natural person [can] contribute to the conception of an AI invention", Vidal looks ahead: in short, "adding AI to the [already divided incentives for the current patent system in other industries] may stretch our 'one-size-fits-all' patent system to its breaking point". She continued by saying that "very rule needs to be rethought when it comes to AI and all the data the AI analyzed to come up with the invention…if we are going to reward AI inventions, we need to make sure the public receives the appropriate *quid pro quo*".

[50] Letter from Henry Hadad, President, Intellectual Property Owners Association, to Under Secretary of Commerce for Intellectual Property and Director of the US Patent and Trademark Office. Available at: https://ipo.org/wp-content/uploads/2019/11/IPO-Comments_Patenting-AI.pdf [hereinafter IPOA letter]. Accessed: 11.11.2019

[51] See: 35 U.S.C. § 115(b)(2) (2019); 37 C.F.R. § 1.63 (2020); MPEP 602.01(a) (9th ed. Rev. 08.2017, Jan. 2018).

[52] IPOA letter, 6.

[53] Ibid. 9.

One way in which scholars propose to reform the patent system is to increase the patentability threshold as it pertains to AI-created inventions. They suggest a recalibration of the definitions for an inventive step, prior art, and non-obviousness, and standardizing, or at least balancing, guidelines regarding who or what may be considered a "person having ordinary skill in the art". [Kop M., 16; Ramalho A., 2018]. For example, a person operating with an AI would likely embody a different definition of "ordinary skill" from someone doing the same research or production without the use of a machine. This would keep the current patent system in place generally, while changing the quintessential questions asked by examiners with regards to AI inventions.

Change to the patent system, it seems in this view, is necessary, whether or not that means a complete overhaul of the legal regime. There are questions and answers that cannot be addressed or even contemplated by the current state of the law. Technology evolves too quickly for whatever adaptations are made in how the current legal system approaches the awarding of patents. Proponents of these changes, however, do not necessarily advocate for excommunicating AI to another legal realm entirely. They merely push for stretching the metaphorical rubber band to capture that which is not currently suited for traditional notions of patent law protection.

3.3. And Now for Something Completely Different

A subset of the academic population believes that if these issues are not resolved satisfactorily *prior to* AI technology becoming fully capable of creative invention, this would then stifle the incentive for the investment in AI research and innovation. The proposed resolution for this group of scholars often involves a complete change to the patent system, or another regime for regulation entirely.

While it is widely agreed that an AI system would not need to be incentivized to invent in the same way the patent system rewards human inventors, the computer scientists, trainers, and machine learning experts behind these technological marvels may still require the incentive to even create the AI that can accomplish those tasks. Ryan Abbott, theoretical front man of the Artificial Inventor Project, asserts that lack of protection will lead to lack of innovation[54]. He states that if "outdated IP laws around the world don't respond

[54] AIP Patent Applications…

quickly to the rise of the inventive machine, the lack of incentive for AI developers could stand in the way of a new era of spectacular human endeavor"[55].

Other scholars take this view a step further, asserting that traditional patent law is outdated — but even if it were to take into account recent technological development, it cannot be applied to AI-inventions [Yanitsky-Ravid S., Xiaoqiong L., 2018: 2215–2231]. These academics go so far as to advocate for abolishing patent protection for AI inventions. They assert that traditional view that a human person must be identified as inventor for AI-generated inventions is an unrealistic threshold: "AI systems can produce a surprisingly large number of inventions, write and submit numerous patent applications, and even evaluate (or monitor) the risk of patent claims". AI systems can be programmed to fulfill necessary patent-eligibility requirements with regard to its inventions; if the law was not intended to cover human inventors alone, it is theoretically possible that AI systems could be entitled to patent rights in their creations.

The state of the technology may call for a completely new regime for protection, one outside of intellectual property law. Diametrically opposed to Judge Easterbrook's discussion of the law of the horse, perhaps the introduction of legislation and regulation specific to AI should come under the purview of an entirely new agency, rather than existing within current frameworks that need be stretched and manipulated to account for the unique effect AI has on just about every aspect of modern life. The logistics of creating such a new regime have not been contemplated in modern literature, likely because each agency touched by AI reacts to developments seemingly within their purview as they appear. A new system would require the development of an agency that would hardly be able to build from models that already exist, and it is possible that agencies would not let go of this type of regulation to another agency quietly.

3.4. International Approaches and Recent Decisions

Other jurisdictions are facing these same questions. Most jurisdictions represented in the IP5[56] specifically restrict inventorship rights to natural

[55] Ibid.

[56] About IP5 co-operation, five IPoffices. Available at: https://www.fiveipoffices.org/about (accessed: 17.01.2020). Members of the IP5 are EPO, Japan Patent Office (JPO), Korean Intellectual Property Office (KIPO), National Intellectual Property Administration of the People's Republic of China (CNIPA), and the USPTO. Ibid.

persons[57]. Europe, however, does not follow this pattern. Article 60(1) of the European Patent Convention (EPC) simply states that "the inventor or his successor in title is entitled to the right to a European Patent"[58]. "The EPC does not define the term 'inventor' or construe inventorship rights as being limited to only natural persons. Thus, Inventive AI may be recognized by the EPO as an inventor"[59].

Despite the wording, or lack thereof, surrounding inventorship in the European Union, the applications naming DABUS as inventor have been denied in both the EPO and the UK Intellectual Property Office (UKIPO; [Nurton, 2020]). The EPO has not fully explained its reasoning, but relying on Article 81 and Rule 19 of the EPC, stated that the applications "do not meet the requirement of the European Patent Convention (EPC) that an inventor designated in the application has to be a human being, not a machine"[60]. As stated above, this requirement is not clear in the wording of the EPC rules and articles applicable to inventorship; this interpretation of those rules may be the first of its kind.

The UKIPO, on the other hand, published a decision that called other facets of the patent application into question: it accepted that DABUS was the creator, but as a machine, it could not legally be considered the inventor [Nurton J., 2020: 112]. Further, the machine cannot have rights in the invention, and therefore could not possibly assign those rights to the designated "owner" of the invention listed in the application. The Hearing Officer also raised a question that will likely spark further debate in the future: "given that an AI machine cannot hold property rights, in what way can it be encouraged to disseminate information about an invention?"

4. Déjà Vu All Over Again

As with many other questions raised by the USPTO, there is a substantial likelihood that, though these applications have been rejected, they have succeeded in their purpose: to begin a conversation that will likely be hap-

[57] AIPLA Letter, at 10.

[58] Convention on the Grant of European Patents (European Patent Convention) Art. 60(1), Oct. 5, 1973, 1065 U.N.T.S. 199.

[59] AIPLA Letter, at 10.

[60] EPO refuses DABUS patent applications designating a machine inventor. Available at: https://www.epo.org/news-issues/news/2019/20191220.html. (accessed: 20.12.2019). The EPO press release also states that a reasoned decision is expected.

pening for years to come. Of course, this is not the first discussion regarding AI-created intellectual property, specifically within copyright law. The EU and the United States both hold that "there can be no copyright [in the case of purely AI Created works] because of *inter alia* the absence of a human author's own intellectual creation as an extension of his personality". This has been the assumption across all intellectual property forms in these jurisdictions.

Contrary to this, however, the United Kingdom implemented a computer-generated works (CGW) regime, which "stretches human authorship towards algorithmic authorship". The rights given to CGW are slightly different than typical copyright protection; for instance, no moral rights are awarded, and the protection term is shortened to 50 years[61]. This seems odd, considering the UK's decision to reject the Artificial Inventor Project's application. In theory, the same type of concerns would be brought forth in both IP regimes: if a machine can be considered an author, there is still a question of whether the machine can assign its ownership rights over to the copyright registration applicant.

It is curious that this concern was considered more of an issue in the patent context. Speculating, one could say there are two reasons for this divergence. First, it is possible that the decision with regards to the DABUS patent applications is an effort by the UKIPO to roll back some of its policies on computer-generated works. Second, the office may have found something so uniquely present in the patent system and inventiveness requirements that the analogy to copyright rulings cannot apply.

If either reason, this shift toward allowing certain of CGW or AI-Generated Works to be attributed to the AI itself in copyright law still has the potential to carry over to the patent side of intellectual property. Because the requirements for invention are more strenuous than the requirements for works of authorship, the speed of AI development can only tell how these offices will approach these questions moving forward.

Conclusion

The law is reactive. As it stands, there is heated debate as to whether AI is in a place to purely be creative or inventive — but regardless, the time seems

[61] Japan follows a similar strategy, with a commercial component: "only AI Generated Works that have a significant economic impact, will be granted protection".

to be coming. The Artificial Inventor Project's goal in submitting applications naming an AI as inventor appears to be an attempt to begin the conversation surrounding these systems, and how the law can and should react to these innovations *before* they exist, knowing this technology is coming.

The dominant view is that, for now, the law should remain as it is. However, regarding the speed with which AI develops, legislators and regulators heeding this advice may be faced sooner than they think with AI that can do what DABUS is purported to have done, with more alacrity and even less human intervention. It may be time for legislation and regulation to attempt to work ahead of technological innovations to continue to provide incentives for the development of these AI systems.

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