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AI and IP: Are Creativity and Inventorship Inherently Human Activities?

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AI AND IP: ARE CREATIVITY AND INVENTORSHIP INHERENTLY HUMAN ACTIVITIES?‡

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ABSTRACT

As artificial intelligence algorithms (AIs) become ever more powerful and sophisticated, they are becoming capable of generating audio and visual works that human audiences might typically regard as "music" or "art." This begs the question, can these AI-created works be granted copyright protection in the U.S.? Should they be granted the same copyright protections as human-created works? If AI-generated works are copyrightable, what are the legal and policy implications? Similarly, AIs can now devise novel and non-obvious solutions to known problems. The first patent applications have been filed in the U.K. and elsewhere, naming an AI as an inventor. Can AIs be "inventors" under U.S. patent laws? This is one of a dozen questions the U.S. Patent and Trademark Office has recently raised for public comment about AI inventions in the U.S. Are we on the cusp of a new era that extends intellectual property protection to computer-created "music," "art," and "inventions"? Or is it more likely that will we conclude that these protections are exclusively available to the products of human creation?

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I. INTRODUCTION

Acts of creation and creativity are generally considered to be among the core of activities that define what it means to be human. Creating art, composing music, and writing literature fall into that category. So, too, does the act of invention—the spark of genius, the proverbial light bulb coming on over the inventor's head.

As artificially intelligent algorithms become ever more powerful and sophisticated, they are increasingly able to mimic these activities—to create audio data that (human) listeners might recognize as music, to create visual data that some might call art, and to prepare written texts that are, at least, coherent. They are also able to solve problems with solutions that nobody else has ever thought of. But are these algorithmically-generated outputs properly considered music, art, literature, and inventions?

Thus framed, this is a debate for the philosophers, the computer scientists, and perhaps the mercantile interests backing both. We will not be able to resolve that debate in this short essay. But there are closely related legal questions that we can address. And while we cannot predict what the law will be, or perhaps what it should be, we can shed light on what the law currently is and how it approaches these questions.

II. ARE AI-CREATED WORKS PROTECTABLE UNDER COPYRIGHT?

As companies are investing more and more into artificial intelligence, and AI-technologies become more sophisticated, the outputs of those AI technologies are looking (and sounding) ever more human-like. Particularly in the area of audio ("music") or visual ("art") outputs, questions have been more frequently raised over whether works created using AI-technologies are protected under current intellectual property laws. If the current IP laws do not provide protection, should they? Would extending protection be more beneficial for innovation and creativity as a whole or would it backfire against the very human artists copyright laws were originally meant to protect? Interpreting—or reinterpreting—existing copyright law to keep pace with the evolution of works becoming more computer-generated is at the center of this debate.

III. AI AND COPYRIGHT

U.S. Copyright law protects "*original* works of *authorship* fixed in any tangible medium."[1] Copyright law does not, however, protect ideas, procedures, principles, or processes.[2] Works must be "original to the author," meaning they are "independently created by the author" and possess "at least some minimal degree of creativity."[3] There seems to be a widespread assumption that authorship has always meant human authorship,[4] although the Constitution and Copyright Act do not explicitly require "authors" to be human.[5] We have not identified any authority in U.S. case law or from the Copyright Office that questions this assumption (though there has been plenty of speculation to this effect in the academic and popular literature).[6] But now that we are in the digital age of computers being capable of generating complex audio or visual works, like a portrait that mimics the style of a famous painter, or music that sounds like your favorite pop artist, it is time to look critically at whether copyright law *should* require human creativity.

IV. THE HUMAN AUTHORSHIP REQUIREMENT

U.S. courts and the Copyright Office have recognized the human authorship requirement for over 200 years. This concept has come up in many contexts, but no court or agency has yet taken the initiative to question its validity and, in fact, each has held on strongly to the notion that "authorship" entails something quintessentially, uniquely, human.

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1 17 U.S.C. § 102 (2019) (emphasis added).

2 *Id.* ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").

3 Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991).

4 Annemarie Bridy, *The Evolution of Authorship: Works Made by Code*, 39 COLUM. J.L. & ARTS 395, 399 (2016).

5 *See* U.S. CONST. art. I, § 8, cl. 8; *see also* 17 U.S.C. § 102 (2019).

6 Shortly after the United States Trademark Office ("USPTO") published in the Federal Register (84 FR 44889) a request for comments on questions concerning patent law as applied to AI inventions, discussed *infra*, the USPTO supplemented that request seeking comments focused on how AI impacts other types of intellectual property, including copyrights, trademarks, and trade secrets. As applied to copyright law, the questions posed seek comments on whether AI-created works should be given copyright protection, how involved must a human be to qualify the work for copyright protection, whether use of training data is fair use, and whether AI protection promotes the goals of copyright law. The USPTO explicitly states that the "questions should not be taken as an indication that the USPTO has taken a position, or is predisposed to any particular views." 84 FR 58141.

This idea of human authorship first appeared in American case law at least as early as 1879, when the Supreme Court pronounced that writings are "founded in the creative powers of the mind" and "the fruits of intellectual labor."[7]

Five years later, when deciding whether copyright law protects photographs, the Supreme Court distinguished between works of mechanical reproduction and works of human ingenuity. Assuming authorship requires human creativity, it held photographs that represent "original intellectual conceptions of the author" are protectable. It noted than an "author," in its constitutional sense, has been construed to mean an "originator," "*he* to whom anything owes its origin."[8] The defendant argued a photograph does not "embody the intellectual conception of its author" but is instead "the mere mechanical reproduction of the physical features or outlines of some object, animate or inanimate, and involves no originality of thought or any novelty in the intellectual operation connected with its visible reproduction in shape of a picture."[9] The Court stated that "[t]his may be true in regard to the ordinary production of a photograph, and, that in such case a copyright is no protection."[10] But the Court did not need to decide that broader question because the particular photograph at issue was "an original work of art, the product of plaintiff's intellectual invention."[11] In reaching this conclusion, the Court noted a set of findings to the effect that the photograph reflected the plaintiff's "own original mental conception, to which he gave visible form" by posing subject of the photograph, "suggesting and evoking the desired expression," selecting and arranging "the costume, draperies, and other various accessories," and "arranging and disposing the light and shade."[12]

In 1965, the Copyright Office received an application for a musical composition created by a Datatron digital computer and rejected it.[13] In its annual report that year, the Copyright Office recognized that "[a]s computer technology develops and becomes more sophisticated, difficult questions of

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7 In re Trade-Mark Cases, 100 U.S. 82, 94 (1879).

8 Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 58–59 (1884) (emphasis added).

9 *Id.* at 59.

10 *Id.*

11 *Id.* at 60.

12 *Id.* (internal quotations omitted).

13 Bridy, *supra* note 4, at 395 ("The rejection, for which the Office didn't offer—and couldn't have offered—any statutory basis, revealed a deep-seated if unspoken assumption that authors are necessarily human.").

authorship are emerging."[14] But the Copyright Office was not concerned with whether a machine could supply the requisite creativity as the 'author,' but with its ability to determine whether, despite the use of machines in the process of creating it, the work was of human authorship.[15]

In a 1973 compendium, the Copyright Office expressly adopted the human authorship requirement, stating that copyrightable works must embody "a certain minimal amount of original creative authorship," the origin of which must be "owe[d] . . . to a human agent."[16] To help delineate the requirement, the compendium provided examples of non-copyrightable works. One example is an applicant who pressurizes liquid petroleum between two bonded plastic sheets to form outlines and contours of patterns cannot claim a copyright in the work because such patterns and shapes do not owe their origin to a human agent. Instead this is merely a novel idea embodied in the work that does not warrant registration. Put another way, it is a novel technique, but it produces random and unpredictable visual patterns not attributable to a human.

This is distinguishable (or is it) from, say, Jackson Pollock, who is known for splattering paint on a horizontal canvas. While it may look as though he "merely stepped back and threw paint at the canvas," some commentators believe that "every movement of the can or brush was done with purpose."[17] Others say his paintings were spontaneous like a lightning bolt, taking only an hour to create.[18] He controlled the color, direction, and location of the paint (i.e., human origin) as opposed to nature creating the randomness of the visual appeal of the work. Perhaps the question becomes closer when an artist pours paint on a canvas on a spinning wheel, allowing the forces of gravity to produce the visual effect, like Damien Hirst's spin paintings.[19]

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14 LIBRARY OF CONGRESS, COPYRIGHT OFFICE, SIXTY-EIGHTH ANNUAL REPORT OF THE REGISTER OF COPYRIGHTS FOR THE FISCAL YEAR ENDING JUNE 30, 1965, at 5 (1966), https://www.copyright.gov/reports/annual/archive/ar-1965.pdf.

15 *Id.* ("The crucial question appears to be whether the 'work' is basically one of human authorship, with the computer merely being an assisting instrument, or whether the traditional elements of authorship in the work (literary, artistic, or musical expression or elements of selection, arrangement, etc.) were actually conceived and executed not by man but by a machine.").

16 *See* U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 2.8.3 (1st ed. 1973).

17 *See 15 Most Famous Jackson Pollock Paintings*, ARTIST EDITORIAL (July 6, 2009), https://www.theartist.me/art/15-famous-jackson-pollock-paintings/.

18 Kelley Marks, *Jackson Pollock Dripped His Way to Modern Art Stardom*, HUBPAGES (Sept. 1, 2017), https://hubpages.com/art/Jackson-Pollock-Dripped-His-Way-to-Modern-Art-Stardom.

19 Damien Hirst, *Spin Paintings*, DAMIEN HIRST (2012), http://www.damienhirst.com/texts1/series/spins.

Since then, the Copyright Office has continued its practice of requiring human authorship. The Compendium II of Copyright Office Practices says in Section 202.02(b):

> Human author: The term "authorship" implies that, for a work to be copyrightable, it must owe its origin to a human being. Materials produced solely by nature, by plants, or by animals are not copyrightable.

Further, the Compendium II goes on to say in Section 503.03(a):

> In order to be entitled to copyright registration, a work must be the product of human authorship. Works produced by mechanical processes or random selection without any contribution by a human author are not registrable. Thus, a linoleum floor covering featuring a multicolored pebble design which was produced by a mechanical process in unrepeatable, random patterns, is not registrable. Similarly, a work owing its form to the forces of nature and lacking human authorship is not registrable; thus, for example, a piece of driftwood even if polished and mounted is not registrable.[20]

Another example of a non-registrable work is a "weaving process that randomly produces irregular shapes in the fabric without any discernible pattern."[21] Because a machine, not a human, was responsible for the resulting lines on the fabric, the work cannot be copyrighted.

Recently, a judge in the Northern District of California interpreted the copyright statute to require that an author had to be human when a copyright claim was brought on behalf of a Celebes crested macaque in the "monkey selfie case."[22] The court's opinion on this point was short and based on two points. First, the court found if Congress wanted animals to have standing to bring a copyright claim it would have said so. Second, based on statutory construction, copyright law's inclusion of terms like "children" and "spouse" imply an author must be human.[23] Following this opinion, the Copyright Office issued a Revised Circular One, to reaffirm that an "original work of

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20 U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 503.03(a) (2d ed. 1998), https://www.copyright.gov/history/comp/compendium-two-1988-chap1600-1900.pdf.

21 U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 313.2 (3d ed. 2017), https://www.copyright.gov/comp3/docs/compendium.pdf.

22 Naruto v. Slater, No. 15-CV-04324-WHO, 2016 WL 362231, at *3 (N.D. Cal. Jan. 28, 2016), *aff'd*, 888 F.3d 418 (9th Cir. 2018).

23 *Id.*

authorship is a work that is independently created by a human author and possesses some minimal degree of creativity."[24]

Based on case law and the current Copyright Office guidelines, it is safe to say that the current interpretation of copyright law requires the author to be human. Put another way, for a work to be copyrightable, it must owe its originality to a human. Any work that does not would go into the public domain. But this begs the question of whether works created using AI are copyrightable. After all, humans are, to some degree, involved in the development of the expression. Does it turn on the role of the AI?

V. APPLICATION UNDER CURRENT LAW

Even if "authorship" requires a human artist, it may still be possible to conclude that AI-generated images are copyrightable because the "originality" that must be contributed by the human is a low threshold. A work satisfies the originality requirement as long as it possesses some "creative spark," no matter how crude, humble, or obvious it might be; originality does not signify novelty.[25] When evaluating whether a fixed expression created using AI-technology is copyrightable, one could examine whether the originality may be attributed to a human on a case-by-case basis.[26]

Consider the banking group ING and Microsoft, which collaborated with art historians and technicians to create a portrait "by Rembrandt" using data and facial recognition techniques from 346 of the Dutch artist's paintings.[27] They examined as much data as possible from the paintings. This analysis led to the conclusion that the painting should be a portrait of a male, 30–40 years old, with some facial hair, facing to the right, with dark clothing and a collar. From there, the programmers extracted only features from paintings related to that specific profile. To create the painting from data, the

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24 U.S. COPYRIGHT OFFICE, COPYRIGHT BASICS 1 (2019), https://www.copyright.gov/circs/circ01.pdf.

25 Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 358 (1991).

26 Andres Guadamuz, *Artificial Intelligence and Copyright*, WIPO MAG. (Oct. 2017), https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html ("Some case law seems to indicate that this question could be solved on a case-by-case basis. In the English case of *Nova Productions v Mazooma Games* [2007] EWCA Civ 219, the Court of Appeal had to decide on the authorship of a computer game, and declared that a player's input 'is not artistic in nature and he has contributed no skill or labour of an artistic kind.' So considering user action case by case could be one possible solution to the problem.").

27 *Rembrandt Goes Digital*, ING (Apr. 6, 2016), https://www.ing.com/Newsroom/All-news/Rembrandt-goes-digital-.htm; *see also ING Presents: The Next Rembrandt*, NEXT REMBRANDT, https://www.nextrembrandt.com/ (last visited Sept. 18, 2019).

programmers used statistical analyses and algorithms to extract the features that make a Rembrandt a Rembrandt. They took parts of the face and compared them to enable them to create a Rembrandt eye, face, and ear. They used an algorithm to align the features and estimate the distance between the eyes, nose, and ears. To mimic brush strokes on the canvas, they used data to calculate the height of the paint on the painting and a 3D printer, resulting in the paint-like texture of the work.

It is no question that the decisions by the programmers and other humans involved with this project led to a more refined Rembrandt-style painting. So is the portrait the programmers' "own original mental conception?"[28] Perhaps the human originality is attributable to Rembrandt himself, insofar as the Next Rembrandt is based on the creative choices he made over 300 years ago. If so, would the copyright have expired before the work was even created?[29] Or is this merely a novel, but uncopyrightable, idea of using AI to create the "Next Rembrandt"?

We may analogize the Next Rembrandt or any AI-created work with the analysis of the photograph in *Burrow*. The Supreme Court held the "existence of those facts of originality, of intellectual production, of thought, and conception on the part of the author" endowed the photograph with copyright protection. It was the photographer's "mental conception" in selecting and arranging the subject's costume, determining the lighting, and arranging the scene that conferred the creativity sufficient for authorship.[30] But in the case of AI-created works, those creative choices and the actions that result in the creation of a work product are not necessarily reposed in the same individual—it is not Damien Hirst spinning the paint wheel or the photographer operating the camera. In the case of the Next Rembrandt, was it the programmer's "mental conception" and elements of selection that conferred the creativity for the portrait? Did the programmers use data like Rembrandt used brushes to create something new? Did they have any conception of what the resultant work would look like? Do they need to? Is this enough "creative spark"?[31] Or is the training data just facts about

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28 *See* Dani Deahl, *We've Been Warned About AI and Music for over 50 Years, but No One's Prepared*, THE VERGE (Apr. 17, 2019 10:30 AM), https://www.theverge.com/2019/4/17/18299563/ai-algorithm-music-law-copyright-human (Warner Music registered six individuals as authors who used AI to generate audio for 600 tracks, with one programmer noting "I have songwriting credits . . . even though I don't know how to write a song.").

29 17 U.S.C. § 302 (2019) (copyrights in works created after January 1, 1978 endure for the life of the author plus 70 years). Rembrandt died in 1669.

30 Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 54–55, 59–60 (1884).

31 Licensed users who create the document and slides, or who select the data and train the AI, own the fruits of their effort apart from the ones who provided the platform to execute their work; Amanda Levendowski, *How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem*, 93 WASH. L.

Rembrandt's paintings? Facts are not protected by copyright law. Was the AI a machine that merely provided the means of expressing the author's expressive vision?[32] Or did the AI displace the author all together?[33]

VI. TRAINING DATA AS FAIR USE?

The use of training data with AI algorithms to devise new "art" or "music" raises a variety of further issues. First, in contrast with the Rembrandt example, what if the project was to create a work in the style of a living—and still-active—artist? Could that alter the discussion about whether that artist should be the "originator" of an AI-generated work based on that artist's creative decisions that were used by the algorithms? Second, is the use of copyrighted work as training data "fair use"? The Copyright Act establishes the factors to be considered in determining whether a use is fair use:

> (1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;
> (2) the nature of the copyrighted work;
> (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
> (4) the effect of the use upon the potential market for or value of the copyrighted work.[34]

One could readily construct an argument that a project like Next Rembrandt, when trained using the entire oeuvre of a living artist (or even a substantial part of it), to create a new work (or ten or a thousand) in the same style could fail to satisfy these factors and be deemed not a fair use.

Of course, using a single artist's entire catalog as training data is one end of a spectrum. At the other end is "crowdsourced" data sets, where an AI algorithm is trained on many users' individual inputs and interactions with the AI. Each of those users' actions may transfer a little bit of know-how from the user to the AI, and in the aggregate, those little bits of know-how may add up to a fully competent decision model, but are there even any

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REV. 579, 592 (2018) ("[T]raining data must be well-selected by humans—training data infused with implicit bias can result in skewed datasets that fuel both false positives and false negatives.").

32 *See, e.g.*, *Burrow-Giles*, 111 U.S. at 60.

33 Shlomit Yanisky-Ravid, *Generating Rembrandt: Artificial Intelligence, Copyright, and Accountability in the 3A Era–the Human-Like Authors Are Already Here–A New Model*, 2017 MICH. ST. L. REV. 659, 675 (2017) (Human input is necessary for the work "to have any sort of creative content. An expert has become a tool for human creativity.").

34 17 U.S.C. § 107 (2019).

protectable rights in those individual bits of know-how? And if there are, wouldn't the use as training data constitute fair use (or something analogous under doctrines other than copyright)?

VII. THE FUTURE

Because of the human authorship requirement, many believe that much of the work generated using AI would not be copyrightable. Some legal commentators view this as problematic and have proposed changes to existing laws. Without establishing a period of protection, some argue that developers of AI would have no tangible incentive to continue to create, use, and improve AI's capabilities.[35] Some believe this trend could ultimately limit innovation by dissuading developers and companies from investing in AI research, leading to the decline of AI and innovation in this area.[36] On the other hand, if AI-generated works are protected, this could result in a virtually unlimited supply of copyrightable work. This may drive down the market value for AI-created works or have the potential to place further strain on human artists in a field that is already difficult to earn a living in.[37] There is also the question of whether the availability of copyright protection truly provides incentives for the generation of audio or visual works using AI. The Berkeley Technology Law Journal's 2008 survey on patenting and entrepreneurship showed a divergence from the traditional theory that patents provide an "incentive to invent," especially in the software industry.[38] The same may be true for the copyright system. One may plausibly infer that ING and Microsoft are probably not promoting the "Next Rembrandt" to capitalize on the art-market value of the painting itself. And if AI creators are viewed as artists in the traditional sense, history has shown artists are going to create art, regardless of incentives. Vincent Van Gogh created over 2,000 works of art before he died poor at the age of 37.[39]

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35 Daryl Lim, *AI & IP Innovation & Creativity in an Age of Accelerated Change*, 52 AKRON L. REV. 813 (2019).

36 Kalin Hristov, *Artificial Intelligence and the Copyright Dilemma*, 57 IDEA: J. FRANKLIN PIERCE FOR INTELL. PROP. 431, 438, 441–42 (2017).

37 Alexis Clements, *What Are the Chances? Success in the Arts in the 21st Century*, L.A. REV. BOOKS (Nov. 17, 2016), https://lareviewofbooks.org/article/chances-success-arts-21st-century/; Eileen Kinsella, *A New Study Shows that Most Artists Make Very Little Money, with Women Faring the Worst*, ARTNETNEWS (Nov. 29, 2017), https://news.artnet.com/market/artists-make-less-10k-year-1162295.

38 *See, e.g.*, Graham, Merges, Samuelson & Sichelman, *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1283–87 (2009).

39 *Vincent van Gogh Biography*, BIOGRAPHY (Apr. 27, 2017), https://www.biography.com/artist/vincent-van-gogh.

If AI-created works should be given protection, how should current laws be changed to extend protection? One proposal would permit AI to be named as authors or co-authors, and the owner of the AI would own the work.[40] Because "author" is not defined in the Constitution or the Copyright Act as being a human, this could be accomplished simply by interpreting the term "author" to include AI.[41] Another solution proposed is extrapolating the work for hire doctrine of the Copyright Act.[42] In its own publication, the Copyright Office has explained that "[i]f a work is made for hire, an employer is considered the author even if an employee actually created the work. The employer can be a firm, an organization, or an individual."[43] This is flatly contrary to the Copyright Office's requirement that an author be human. Applying the work-for-hire doctrine to AI, the AI owner would be the "employer" and the AI would be the "employee."[44] However, this, too, would raise thorny legal and conceptual issues. "Work for hire" is defined in the Copyright Act and requires that "the parties expressly agree in a written instrument signed by them that the work shall be considered a work made for hire."[45] Thus, in order for AI-created work to be considered work for hire, it would be necessary for the art-creating AI to additionally have the capacity to enter into contracts (and the ability to sign written instruments). At first blush, this seems even more of a stretch than the AI-authorship we have been discussing; however, if the "contract" could be a blockchain-based, algorithmic "smart contract,"[46] then perhaps the written contract requirement could end up being deemed a mere formality.

While AI authorship may seem possible with only a few minor shifts in existing law, the Copyright Office has not entertained the idea. For now, the true economic realities of such shift have only begun to be explored.

VIII. ARE AI-CREATED WORKS PATENTABLE?

On a separate track from the ongoing debate about copyright protection for AI-created works of art, there is also a debate about whether the patent laws can provide IP protection for AI-developed *inventions*.

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40 *See* Lim, *supra* note 35, at 836–37.

41 *See id*.

42 *See* Bridy, *supra* note 4, at 399.

43 U.S. COPYRIGHT OFFICE, WORKS MADE FOR HIRE 1 (2012).

44 *See* Lim, *supra* note 35, at 843–45.

45 17 U.S.C. § 101 (2019).

46 *See, e.g.*, Shermin Voshmgir, *Smart Contracts*, BLOCKCHAINHUB (July 2019), https://blockchainhub.net/smart-contracts/.

Artificially intelligent algorithms ("AIs") are really good at solving problems, whether designing new drugs[47] or devising novel ways to win at Mario Kart.[48] The AIs' solutions can often be something that no human would have thought of. Indeed these solutions may be commercially successful, may resolve long-felt but unmet needs, other (mere humans) may have failed, (human) experts may have doubted that the problem could be solved, the AI's solution may garner praise by others, and may use a solution that other (humans) have taught away from.[49] But can AIs "invent"? Can they be "inventors"? Or is "inventor" status reserved uniquely to humans?

These questions, which have been percolating for several years, have now ripened to a full-blown active debate in patent law. News reports of the first patent applications filed naming AIs as inventors were published in the summer of 2019. Led by Professor Ryan Abbott at the University of Surrey, a team of patent attorneys submitted two patent applications on behalf of an AI called "DABUS." According to the University of Surrey press release,[50] "One application claims a new type of beverage container based on fractal geometry, while the other claims a device for attracting enhanced attention that may help with search and rescue operations." The applications themselves are described in more detail on the Artificial Inventor website.[51] It has been reported that the UKIPO and the EPO have both determined that the inventions are patentably novel, but that the question of AI inventorship remains unresolved.[52]

Below is a figure from DABUS' patent application for a beverage container:

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47 Gregory Barber, *A Molecule Designed by AI Exhibits 'Druglike' Qualities*, WIRED (Sept. 2, 2019, 11:00 AM), https://www.wired.com/story/molecule-designed-ai-exhibits-druglike-qualities/.

48 YIZHENG LIAO, KUN YI & ZHE YANG, CS229 FINAL REPORT: REINFORCEMENT LEARNING TO PLAY MARIO (2012); *see also* HARRISON HO, VARUN RAMESH & EDUARDO TORRES MONTANO, NEURALKART: A REAL-TIME MARIO KART 64 AI (2017).

49 KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (listing secondary considerations concerning non-obviousness).

50 Laura Butler, *World First Patent Applications Filed for Inventions Generated Solely by Artificial Intelligence*, UNIV. SURREY (Aug. 1, 2019), https://www.surrey.ac.uk/news/world-first-patent-applications-filed-inventions-generated-solely-artificial-intelligence.

51 *Patent Applications*, ARTIFICIAL INVENTOR PROJECT, http://artificialinventor.com/patent-applications/ (last visited Sept. 17, 2019).

52 Matthew Bultman, *1st Patent Apps for AI-Created Inventions Filed in US, Europe*, LAW360 (Aug. 1, 2019, 6:54 PM), https://www.law360.com/articles/1184289/1st-patent-apps-for-ai-created-inventions-filed-in-us-europe.

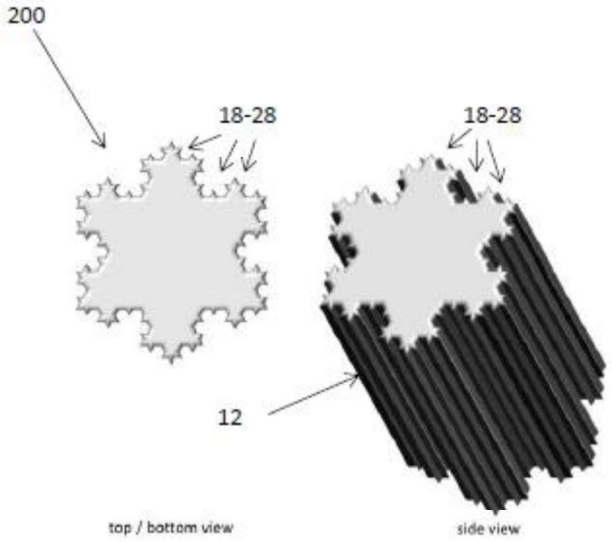

Fig. 6

Taking the question back to first principles, the term "inventor" is found in the Patent and Copyright Clause of the U.S. Constitution: "[The Congress shall have power] To 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."[53] The Patent Act employs language suggestive that inventors must be humans. Section 101 provides, "*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 . . . ."[54] Section 102 adds, "A *person* shall be entitled . . . ."[55]

Scholars have published extensive and thoughtful analyses of the issues arising from the introduction of AI agents to intellectual property law. One recent example is "AI & IP: Innovation & Creativity in an Age of Accelerated Change," by professor Daryl Lim.[56] Lim argues that the existing statutory and case law, in effect, limits "inventors" of patents to natural persons—

53 U.S. CONST. art. I, § 8, cl. 8 (emphasis added).

54 35 U.S.C. § 101 (2019) (emphasis added).

55 *Id.* § 102.

56 Lim, *supra* note 35.

humans.[57] In particular, he notes that the Patent Act defines "inventor" as "the individual . . . who invented or discovered the subject matter of the invention."[58] In turn, Lim argues, the Dictionary Act defines "individual" to include "every infant member of the species homo sapiens who is born alive at any stage of development."[59] However, the full text of section 8(a), when read together with section 1 of the Dictionary Act, does not clearly limit "individual" to natural persons. Section 8(a) states, "the words 'person,' 'human being,' 'child,' and 'individual,' shall include every infant member of the species homo sapiens who is born alive at any stage of development." In other words, these four terms include human infants, but the definition does not expressly limit "individual" to natural persons. Section 1 of the Dictionary Act makes clear that "person" must be construed broadly to include both humans and companies.[60] To be sure, the usage of "individual" in these three statutes invites an inference that the term is limited to natural persons, but the statutes do not explicitly say so.

Thus, courts have sometimes been called upon, in various contexts, to determine whether "individual" is limited to natural persons. For example:

- Construing the Torture Victim Protection Act, the Supreme Court held that "this Court routinely uses 'individual' to denote a natural person, and in particular to distinguish between a natural person and a corporation."[61] Earlier, several courts of appeals had reached the same conclusion (citing the Dictionary Act).[62]
- Following the *Mohamad* case, the Ninth Circuit interpreted "individual" in the Freedom of Information Act to mean a single human being.[63]
- Under the Ethics in Government Act's fee provision, "individual" describes a natural person.[64]
- In pre-*Mohamad* cases, the Bankruptcy Code's use of "individual" has sometimes been interpreted to mean

57 *Id.*

58 35 U.S.C. § 100(f) (2019).

59 Lim, *supra* note 35, at 858 (citing 1 U.S.C. § 8(a) (2019)).

60 1 U.S.C. § 1 (2019) ("[T]he words 'person' and 'whoever' include corporations, companies, associations, firms, partnerships, societies, and joint stock companies, as well as individuals.").

61 Mohamad v. Palestinian Auth., 566 U.S. 449, 454 (2012).

62 *E.g.*, Bowoto v. Chevron Corp., 621 F.3d 1116, 1126–27 (9th Cir. 2010); Kiobel v. Royal Dutch Petrol. Co., 621 F.3d 111, 112 n.23 (2d Cir. 2010).

63 Animal Legal Def. Fund v. U.S. Dep't of Agric., 933 F.3d 1088, 1093–94 (9th Cir. 2019).

64 *In re* N. (Gadd Fee Application), 12 F.3d 252, 254 (D.C. Cir. 1994).

"natural persons," as distinguished from corporations, but has sometimes been interpreted to include corporations.[65]

- On the other hand, a criminal statute prohibiting damage to protected computers causing damage to one or more "individuals" has been construed to include both natural persons and corporations.[66]

Thus, it seems that, in the U.S. at least, the federal statutory meaning of "individual"—and therefore "inventor"—seems to be fairly soundly established as limited to natural persons. But this is not nearly the end of the debate. Weighty discussions of whether AIs should have some form of "personhood," and on what terms, have been circulating for more than 25 years.[67] Several years ago, the European Parliament drew significant publicity for proposing a form of "electronic personhood" for robots and AIs. In a Draft Report with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103 (INL)), the Committee on Legal Affairs proposed the creation of a new category of electronic personhood and included a call for the European Commission "to elaborate criteria for an 'own intellectual creation' for copyrightable works produced by computers or robots."[68] (Notably, there was not also a parallel call to action relating to patenting.). The proposal drew considerable media attention at the time, though the purpose of the report was "to ensure that robots are and will remain in the service of humans."[69] More recently, discussions concerning

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65 *See In re* Jove Eng'g, Inc. v. I.R.S., 92 F.3d 1539, 1551 (11th Cir. 1996) (limited to natural persons); s*ee also In re* Goodman, 991 F.2d 613, 619 (9th Cir. 1993) (collecting cases, noting that Third and Fourth Circuits had interpreted "individual" in Bankruptcy Code to include corporations, but rejecting that interpretation).

66 United States v. Middleton, 231 F.3d 1207, 1210 (9th Cir. 2000). *But see* United States v. Hilton, 701 F.3d 959, 967 (4th Cir. 2012) (construing statute protecting "individuals" as victims of identity theft as limited to natural persons).

67 *See, e.g.*, Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1239 (1992) (considering a theoretical framework for the question, drawing a distinction between "personhood" and "humanity," and drawing no clear conclusions).

68 *Draft Report of the Committee on Legal Affairs*, 2015/2103(INL) (May 31, 2016), https://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf?redirect.

69 *E.g.*, James Vincent, *Giving Robots 'Personhood' Is Actually About Making Corporations Accountable*, THE VERGE (Jan. 19, 2017, 10:45 AM), https://www.theverge.com/2017/1/19/14322334/robot-electronic-persons-eu-report-liability-civil-suits; *see also* Alex Hern, *Give Robots 'Personhood' Status, EU Committee Argues*, THE GUARDIAN (Jan. 12, 2017), https://www.theguardian.com/technology/2017/jan/12/give-robots-personhood-status-eu-committee-argues. The Guardian quoted attorney Ashley Morgan of Osborne Clark on the implications of the EU proposal,

AI personhood have expanded to the estate planning context.[70] However, in a 2018 press release concerning its priorities, the European Commission made no mention of either the personhood or IP aspects of the proposal.[71]

Indeed, even as we in the United States may find ourselves focusing the debate on the meaning of "individual" in the statutory text, the debate may be different in other countries that have different statutory requirements. As the *U.S. Manual for Patent Examining Procedure* ("MPEP") notes, "The requirement that the applicant for a patent be the inventor is a characteristic of U.S. patent law not generally shared by other countries."[72] And, as noted above, a group of academics in the United Kingdom is pressing for the issuance of patents with AIs as inventors and has provided arguments in favor of such patenting under U.K. law.[73]

In August 2019, not long after the news reports about the AI's patent applications, what had been a largely academic debate in the United States broke through into active policy discussions. On August 27, 2019, the USPTO published in the Federal Register[74] a request for comments on twelve questions concerning patent law as applied to AI inventions. The request for comments broadly defines "AI inventions" to include both inventions that use AI and inventions that are developed by AI, and the questions accordingly reflect the broad scope of these topics. Relevantly to the question of inventorship, the questions include the following:

- 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?

If I create a robot, and that robot creates something that could be patented, should I own that patent or should the robot? If I sell the robot, should the intellectual property it has developed go with it? These are not easy questions to answer, and that goes right to the heart of this debate.

70 Alexandra M. Jones, *Old Days Are Dead and Gone: Estate Planning Must Keep Its Head Above Water with the Changing Tide of Technology*, 11 EST. PLAN. & COMMUNITY. PROP. L.J. 161, 167 (2018).

71 European Commission Press Release IP/18/3362, Artificial Intelligence: Commission Outlines a European Approach to Boost Investment and Set Ethical Guidelines (April 25, 2018), https://europa.eu/rapid/press-release_IP-18-3362_en.htm. *See also* Thomas Burri, *The EU is Right to Refuse Legal Personality for Artificial Intelligence*, EURACTIV (May 30, 2018), https://www.euractiv.com/section/digital/opinion/the-eu-is-right-to-refuse-legal-personality-for-artificial-intelligence/.

72 USPTO MANUAL FOR PATENT EXAMINING PROCEDURE § 2137.01 (2018).

73 *See* Robert Jehan, *Should an AI System Be Credited As an Inventor*, ARTIFICIAL INVENTOR PROJECT (Aug. 24, 2019), http://artificialinventor.com/should-an-ai-system-be-credited-as-an-inventor-robert-jehan/.

74 Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44889 (2019).

- Are there any patent eligibility considerations unique to AI inventions?
- Does AI impact the level of a person of ordinary skill in the art? If so, how? For example: Should assessment of the level of ordinary skill in the art reflect the capability possessed by the AI?
- Are there any new forms of intellectual property protections that are needed for AI inventions, such as data protection?

Without a doubt, many commentators will weigh in on this now-hot topic. In his *Skilled in the Art* column published the same day as the USPTO notice,[75] IP journalist Scott Graham collected some initial reactions to these questions. As Graham reports, "consensus could prove tricky to achieve here." Graham interviewed Ryan Abbott, the professor from the University of Surrey who has filed AI-invented patent applications, as well as a number of Silicon Valley patent practitioners. The practitioners expressed varying degrees of skepticism about the notion of AI-as-inventor, articulating variously that inventors must be human (even if heavily machine-assisted in their inventions) and that the existing patent laws could not support non-human inventors without some major overhauls—and perhaps without stressing the existing "one-size-fits-all" patent system to the breaking point.

IX. OBVIOUSNESS AND ENABLEMENT

In addition to the overriding question whether AIs can be inventors, the introduction of AIs into the inventive process will have other knock-on effects in the patent law, particularly where the patent law uses the level of ordinary skill in the art as a benchmark. For example, a claimed invention is unpatentable under if it "would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains."[76] If an AI can be an inventor, is the person of skill in the art (POSITA) against which the AI's inventive contribution is measured a human or another AI? Would the obviousness of DABUS' beverage can design be measured against the knowledge and skill of human beverage-can designers or against other AIs? If the former, why is it fair to measure the AI against a human-developed level of skill in the art (and vice-versa)? If the latter, are there any limitations on the AIs level of

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75 Scott Graham, *Skilled in the Art*, LAW.COM (Aug. 27, 2019), https://www.law.com/2019/08/27/skilled-in-the-art-the-pto-has-questions-about-ai-our-experts-offer-some-answers/.

76 35 U.S.C.S. § 103 (2019).

skill in the art? Is every AI *sui generis*, effectively meaning that there can be no POSITA yardstick, or is every AI potentially chargeable with all the knowledge on the Internet, potentially meaning that everything is obvious (and therefore unpatentable) to an AI?

Similarly, the written description of a patent must enable a POSITA to make and use the claimed invention.[77] This, too, raises a host of issues. Consider just one: if the POSITA for an AI's invention is another AI, how should the enabling disclosure be expressed? Does it even need to be understandable or readable by humans? Might section 112(a)'s written description requirement be satisfied in an AI-invented patent by a data dump of machine code?

X. CONCLUSION

How this conversation plays out is going to be interesting. It raises some of our long-held and deepest-seated anxieties and optimism about the peril and promise of technology (indeed, the European Parliament's report opens by invoking Mary Shelley's Frankenstein) and tests the boundaries of the patent laws in the U.S. and elsewhere—likely in ways that were not considered when the initial language was drafted. On this latter point, we should consider Professor Chander's closing observation in his 2014 article, *How Law Made Silicon Valley*[78]:

> The legal moves described here in the United States have helped facilitate the "wow" of the World Wide Web, but they might also usher in the "yuck." We need to ensure that in our zeal for promoting the Internet enterprise, we do not haphazardly create the conditions for a dystopia.

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77 *See id.* § 112(a) (2019).

78 Anupam Chander, *How Law Made Silicon Valley*, 63 EMORY L.J. 639, 693 (2014).