RECOGNIZING ARTIFICIAL INTELLIGENCE (AI) AS AUTHORS AND INVENTORS UNDER U.S. INTELLECTUAL PROPERTY LAW

by
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ABSTRACT

U.S. IP law has grappled with the issue of non-human authorship and inventorship since the middle of the twentieth century when computer systems were first used in the generation of music and imaginative ideas. Today's advanced Artificial Intelligence (AI) systems have "created" numerous works including musical compositions, art, writings, recipes, and potentially patentable inventions. However, common-law, along with the policies and procedures of the U.S. Copyright Office and the U.S. Patent and Trademark Office, rejects the idea of non-human authorship or inventorship. These doctrines are not based off statutory requirements but on assumptions about computer capabilities stemming from an analysis done in the mid-twentieth century, almost 40 years ago.

Other contributors to this question have denied that AI authorship should ever be allowed or that AI should be treated as inert tools of creation no different than cameras or photocopiers. However, both approaches fail to appreciate the independent creation of modern AI's that process information in ways much like human brains—well beyond simple mechanical devices using simple mathematical algorithms.

Thus, this paper argues for recognition of AI authorship and inventorship. To that end, this paper presents a framework to analyze when such rights should be recognized based on (1) the subject matter (i.e., independence of the work) and (2)

the causation (i.e., independence of the AI). In addition, the framework introduces an IP rights assignment regime like "work-for-hire" and "employed-to-invent" based on the nexus between the AI and the natural persons programming and/or using it. This approach avoids the complication of naming an AI as a legal or natural person under the law.

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I. INTRODUCTION

[1]   Artificial Intelligence (AI) is a booming field, yet the current United States intellectual property (IP) legal system may serve as a disincentive for future investments. Last year alone, over 550 startups using AI as a core part of their products raised $5 billion in funding, and over 60% of all such funding went to American companies.[1] Yet courts, like the United States Copyright Office (Copyright Office) and the United States Patent and Trademark Office (USPTO), do not recognize non-human authors or inventors, creating a potentially gray area when AI is used to aid in the generation of creative works and inventions.[2] A core assumption in today's law is that it is uniquely *human* ingenuity and creativity that is an essential element for copyrights and inventions.[3] Yet, today's AI systems often exhibit expression and independent creativity that we might otherwise

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[1] *See The 2016 AI Recap: Startups See Record High in Deals and Funding*, CB INSIGHTS, Jan. 19, 2017, https://www.cbinsights.com/blog/artificial-intelligence-startup-funding/, https://perma.cc/JD5H-YBXH (last visited Mar. 14, 2017).

[2] *See* Jonathan Siderits, *The Case for Copyrighting Monkey Selfies*, 84 U. CIN. L. REV. 327, 331, 336–37 (2016).

[3] *See* Christina Rhee, *Urantia Foundation v. Maaherra*, 13 BERKELEY TECH. L.J. 69, 75–76 (1998); *see also* David Nimmer, 11 NIMMER ON COPYRIGHT § 808.7(C) (2017) ("Human Authorship A motion picture must contain creative human authorship. A motion picture created by a non-human author, created by a purely mechanical process, or generated solely by preexisting software is not copyrightable.").

attribute to humans.[4] Such systems further the public interest, which is one of the core purposes of IP law.[5]

[2]   For example, when challenged with the need to expand both the quantity and quality of its news articles, the Associated Press (AP) turned to an unlikely source: a ghost writer in the form of an AI program.[6] Working with Automated Insights, the AP now generates millions of articles, all written by AI.[7] The AP has thus been able to serve the public by developing a broader set of news stories than it would otherwise be able to afford.[8] But, the use of AI in writing these stories brings up a question of ownership: does this ghost writer deserve the status of "author" or is it merely an inert tool of creation, nothing more than a fancy analog of a word processor?

[3]   This paper will begin with a review of the current state of AI, then turn to an examination of the legal treatment of non-human authors and

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[4] *See* Scott Barry Kaufman, *The Philosophy of Creativity*, SCI. AM., May 12, 2014, https://blogs.scientificamerican.com/beautiful-minds/the-philosophy-of-creativity/, https://perma.cc/9AS2-DLJG (last visited Feb. 13, 2018).

[5] *See What Is Intellectual Property?*, WORLD INTELL. PROP. ORG., http://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf, https://perma.cc/VWH3-W2XB (last visited Feb. 13, 2018).

[6] *See* Ross Miller, *AP's 'robot journalists' are writing their own stories now*, THE VERGE, (Jan. 29, 2015, 11:55 AM), https://www.theverge.com/2015/1/29/7939067/ap-journalism-automation-robots-financial-reporting, https://perma.cc/6EPA-78J9 (last visited Mar. 22, 2018).

[7] Telephone Interview with Jim Kennedy, Senior Vice President, Strategy and Enterprise Development, Associated Press (Mar. 17, 2017); *see also Associated Press: The Associated Press Uses Wordsmith to transform raw earnings data inti thousands of publishable stories, including hundreds more quarterly earnings stories than previous manual efforts*, AUTOMATED INSIGHTS, (Feb. 12, 2018, 2:42 PM), https://automatedinsights.com/case-studies/associated-press, https://perma.cc/48WD-ZPBA (last visited Feb. 12, 2018, 2:42 PM).

[8] *See* AUTOMATED INSIGHTS, *supra* note 7.

inventors in U.S. intellectual property law, and finally, propose a change in the law to accommodate the designation of AI as authors and inventors. AI has advanced to the point where it can independently beat humans at the most complex games, compose works of art, and even generate potentially patentable inventions.[9] Nevertheless, the law axiomatically denies that any non-human may apply for a copyright based on cases going all the way back to the 1800's, whereby courts and the law have grappled with fundamental questions of what it means to be creative and inventive.[10] To that end, the law must change to recognize the reality of the advances of AI and shed the prejudices and postulations of the past.

[4]   Thus, to be consistent with the purpose of intellectual property law—to serve the public interest in the advancement of arts and sciences—United States law must recognize AI authorship and inventorship. This paper proposes a framework whereby AI may be granted ownership rights along with a necessary rights assignment scheme. The first step of the

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[9] *See* Geoff Brumfiel, *Forget Chess. A.I. Masters Wickedly Complex, Chinese Game of 'Go'*, NPR, (Jan. 27, 2016, 1:10 PM), https://www.npr.org/sections/thetwo-way/2016/01/27/464566551/forget-chess-ai-masters-wickedly-complex-chinese-game-of-go, https://perma.cc/Y7T5-9RAG (last visited Mar. 22, 2018); *see also* Jason Lohr, *Artificial intelligence drives new thinking on patent rights*, HOGAN LOVELLS: LIMEGREEN IP NEWS (July 15, 2016), https://www.limegreenipnews.com/2016/07/artificial-intelligence-drives-new-thinking-on-patent-rights/, https://perma.cc/Z3QK-MRA3 (last visited Feb. 13, 2018 1:33 PM); *see also A New AI Can Write Music as Well as a Human Composer*, FUTURISM, https://futurism.com/a-new-ai-can-write-music-as-well-as-a-human-composer/, https://perma.cc/QFA6-B4XK (last visited Feb. 12, 2018, 3:29 PM). *But see* Michael Andor Brodeur, *Can art be created by algorithms?*, BOSTON GLOBE, Aug. 4, 2017, https://www.bostonglobe.com/arts/2017/08/03/can-art-created-algorithms/2MGWapvSfJVJOl8Sq1OIPO/story.html (contemplating the value and "art-ness" of a work created without effort and contemplation), https://perma.cc/EZS7-X6DT (last visited Mar. 22, 2018); *and* David Pogue, *Is Art Created by AI Really Art?*, SCI. AM., Feb. 2018, https://www.scientificamerican.com/article/is-art-created-by-ai-really-art/, https://perma.cc/P3L9-3GJL (last visited Mar. 22, 2018).

[10] *See* U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES §§ 306, 313.2 (3d ed. rev. 2017) (citing *Trade-Mark Cases*, 100 U.S. 82, 94 (1879) and *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 58 (1884)).

framework contains two essential prongs in answering if an AI is sufficiently creative to gain recognition as an author or inventor: (1) the *subject matter* of the AI's output and (2) the AI's *causation* in development of the work or invention. The *subject matter* prong dives into the question of originality, while the *causation* prong dives into the question of independent creativity. Since similar rules have been applied by courts to determine both copyright and patent eligibility, adopting such a framework could rely on existing case law.[11] Additionally, for AI works that pass the test, the law must be revised to support assignment of those IP rights to natural or legal persons, drawing from the work-for-hire and employed-to-invent assignment mechanisms that exist today.

II. BY MIMICKING HUMAN MENTAL PROCESSES, TODAY'S AI SYSTEMS ARE SMART AND CREATIVE – A PREVIEW OF MORE ADVANCES TO COME

A. AI Systems Have Already Demonstrated Intelligence, Creativity, and Inventiveness

[5]   AI itself is a branch of computer science that attempts to replicate human intelligence in computer systems.[12] The central goals of AI include reasoning, knowledge, planning, learning, natural language processing (e.g., understanding and speaking languages), perception, and the ability to move and manipulate objects.[13] While some question the ability of machines to ever attain the same intelligence of human beings, AI has made substantial steps in awareness, memory, learning, anticipation, and experience; hallmark characteristics demarking consciousness.[14]

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[11] *See* 17 U.S.C. §§ 102–04 (2018); *see also* 35 U.S.C. § 101 (2018).

[12] *See* STUART J. RUSSELL & PETER NORVIG, ARTIFICIAL INTELLIGENCE: A MODERN APPROACH 2–3, 14 (3d ed. 2010).

[13] *See id.* at 2–3.

[14] *See* Cade Metz, *What the AI Behind AlphaGo Can Teach Us About Being Human*, WIRED, May 19, 2016, https://www.wired.com/2016/05/google-alpha-go-ai/ (describing

[6]   No matter the philosophical arguments, it's quite possible that AI could soon develop a cure for certain types of cancer or write the next great American novel. Today, AI is being used in major research hospitals, in the entertainment industry, and across the publishing world.[15] But the real history of AI starts with the fight against Nazi Germany.

[7]   In May of 1940, during the height of World War II, the electronic computer designed and built by Alan Turing successfully cracked encrypted messages that had been sent by the Nazi command to its naval fleet.[16] While

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the understanding and intuition the AI algorithm AlphaGo displayed in beating world champion Go player Lee Sedol), https://perma.cc/USQ7-YPY7 (last visited Mar. 25, 2018); *see also* Clive Thompson, *What is I.B.M.'s Watson?*, N.Y. TIMES MAG., June 16, 2010, http://www.nytimes.com/2010/06/20/magazine/20Computer-t.html (discussing the "natural language" AI algorithm Watson and its preparations to debut as a competitor on Jeopardy), https://perma.cc/W5AU-U978 (last visited Mar. 25, 2018). *See generally* BERNARD J. BAARS, A COGNITIVE THEORY OF CONSCIOUSNESS (1988) (suggesting the criteria for consciousness are definition and context setting, adaptation and learning, editing, flagging and debugging, recruiting and control, prioritizing and access-control, decision-making or executive function, analogy-forming function, metacognitive and self-monitoring function, and auto-programming and self-maintenance).

[15] *See* Michael Brenner, *Machine Learning and AI in the Media Industry*, DIGITALIST MAG., Dec. 18, 2017, http://www.digitalistmag.com/customer-experience/2017/12/18/machine-learning-ai-in-media-industry-05639773, https://perma.cc/BLD5-LVGE (last visited Mar. 25, 2018); *see also* Arlene Weintraub, *Hospitals Utilize Artificial Intelligence to Treat Patients*, U.S. NEWS & WORLD REP. (Oct. 31, 2017, 11:00 AM), https://www.usnews.com/news/healthcare-of-tomorrow/articles/2017-10-31/hospitals-utilize-artificial-intelligence-to-treat-patients, https://perma.cc/E4FK-XKDS (last visited Mar. 25, 2019); *and* Holly Lynn Payne, *Why Book Publishing Seeks Artificial Intelligence*, HUFFINGTON POST (June 19, 2017, 10:51 PM), https://www.huffingtonpost.com/entry/why-book-publishing-seeks-artificial-intelligence_us_59482841e4b0961faacbe5d6, https://perma.cc/L5XK-7A8M (last visited Mar. 25, 2018).

[16] *See* Ralph Erskine, *Allied Breaking of Naval Enigma*, https://uboat.net/technical/enigma_breaking.htm, https://perma.cc/3BS9-CAXS (last visited Mar. 4, 2018).

the idea of an independent calculating device had been around since Charles Babbage created a mechanical difference engine,[17] the advent of electronic, digital computing devices in the 1940's spurred the beginning of the "information age," whereby computer systems were utilized to not only aid in fighting wars, but to greatly expand the industrial revolution and propel technological societies to new heights.[18] Along with automation of tedious calculations, computer systems have been developed for even more advanced behaviors, from data analysis to business process automation.[19]

[8]   As Alan Turing had predicted in 1945, AI has further enabled these systems to expand well beyond simple mathematical tasks, impressing many world champion mental game players.[20] Alan Turing's prophecy was that we might have a computer that could learn beyond its original instructions: "[i]t would be like a pupil who had learnt much from his master, but had added much more by his own work. When this happens, I feel that one is obliged to regard the machine as showing intelligence."[21] Fast forward fifty years, and we have seen machines displaying much of what Turing described. In 1997, Gary Kasparov, world chess champion, lost

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[17] *See The Babbage Engine*, COMPUTER HIST. MUSEUM, http://www.computerhistory.org/babbage/, https://perma.cc/W6ZS-S5Y8 (last visited Feb. 28, 2018).

[18] *See* Larry Murray, *14 Key Points in Computer Development Since 1940,* WIKIBON BLOG, Sept. 18, 2009, http://wikibon.org/blog/timeline-of-computer-development/, https://perma.cc/U4MH-ZAJP (last visited Mar. 25, 2018).

[19] *See* KENNETH BALDAUF & RALPH STAIR, SUCCEEDING WITH TECHNOLOGY: COMPUTER SYSTEM CONCEPTS FOR REAL LIFE 23 (4th ed. 2010).

[20] *See* A.M. Turing, *Computing Machinery and Intelligence*, 59 MIND Q. REV. 236, 433 (1950) (discussing the concept of machines thinking and the imitation game).

[21] Gil Press, *Alan Turing Predicts Machine Learning and The Impact of AI on Jobs*, FORBES (Feb. 19, 2017, 1:44 PM), https://www.forbes.com/sites/gilpress/2017/02/19/alan-turing-predicts-machine-learning-and-the-impact-of-artificial-intelligence-on-jobs/#72bcc06d1c2b, https://perma.cc/KFF5-9HL7 (last visited Mar. 27, 2018).

a match to IBM's Deep Blue computer, remarking that he could "smell" a new form of intelligence across the table; and in 2016, Lee Sedol, one of the best players of the Chinese game Go, was beaten 4-1 by Google's AlphaGo program.[22] Watching the match, three-time European Go champion Fan Hui called AlphaGo's moves "so beautiful."[23] Both games are incredibly difficult to master, and the greatest players in the world rely on strategy, creativity, and intuition to beat their opponents.[24] However, both games rely on a set of logical rules that make playing them appear to be in the "wheelhouse" for computational systems.[25] Yet, in 2011, IBM's Watson took on a more challenging human game, Jeopardy!, which requires the seemingly insurmountable tasks of understanding written language, deducing precise answers to clever and humorous clues, retrieving answers quickly, and answering out loud in the form of a question.[26] Ultimately, Watson defeated two of the greatest Jeopardy! champions of all time, including Ken Jennings, who was convinced that Watson's artificial brain worked essentially the same way as his own.[27]

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[22] Toby Walsh, *First chess, then Jeopardy, Then Go. Now Poker too has fallen to AI*, THE STRAITS TIMES (Feb. 1, 2017, 5:00 AM), http://www.straitstimes.com/opinion/first-chess-then-jeopardy-then-go-now-poker-too-has-fallen-to-ai, https://perma.cc/BC2K-5ECT (last visited Mar. 27, 2018).

[23] Metz, *supra* note 15.

[24] *See id*.

[25] *See id*.; *see also* Walsh *supra* note 23.

[26] *See* Thompson, *supra* note 15.

[27] *See* Ken Jennings, *My Puny Human Brain*, SLATE (Aug. 16, 2011, 11:04 PM) http://www.slate.com/articles/arts/culturebox/2011/02/my_puny_human_brain.html, https://perma.cc/R9BF-YT3E (last visited Mar. 14, 2017).

[9]   While defeating world champions at chess, Go, and Jeopardy! is impressive, AI is also being used to create sophisticated works of art.[28] As early as 1956, Martin Klein and Douglas Bolitho programmed a computer to compose various songs (as many as 4,000 each hour) including one they tried (but failed) to register with the Copyright Office called *Push Button Bertha*.[29] Fast forward to today, projects like Google Magenta use a simulated "human brain" of neural networks to compose music without the aid of specific algorithms or human input,[30] and IBM's Watson was used to edit a movie trailer by analyzing a completed film for thematic highlights and splicing them together to foreshadow the longer story.[31]

[10]   On the invention side, computers have been used to develop ideas and potentially patentable inventions throughout the last twenty years.[32] For example, computer scientist Stephen Thaler used his own neural networks to develop a "Creativity Machine" which he credits with being the inventor of the subject matter to his 1998 patent, "Neural Network Based Prototyping System and Method."[33] Further, the Creativity Machine has formulated

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[28] *See* Matt McFarland*, Google's Computers Are Creating Songs. Making Music May Never Be the Same*, WASH. POST (June 6, 2016), https://www.washingtonpost.com/news/innovations/wp/2016/06/06/googles-computers-are-creating-songs-making-music-may-never-be-the-same/?utm_term=.55226125405c, https://perma.cc/4389-VN6N (last visited Mar. 27, 2018).

[29] *See* Annemarie Bridy, *The Evolution of Authorship: Work Made by Code*, 39 COLUM. L. J. & ARTS 395 (2016).

[30] *See* McFarland, *supra* note 29.

[31] *See* John R. Smith, *IBM Research Takes Watson to Hollywood with the First "Cognitive Movie Trailer"*, Aug. 31, 2016, https://www.ibm.com/blogs/think/2016/08/cognitive-movie-trailer/, https://perma.cc/B92N-JZ5V (last visited Mar. 27, 2018).

[32] *See* Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C.L. REV. 1079, 1079–82 (2016).

[33] *Id*. at 1083–85.

chemical formulas for new ultra-hard materials which could easily be enhanced to include known methods of making composites so that it can be reduced to practice without substantial assistance from any person – meeting the general obligations of patentable compounds.[34] Other examples include computer systems using genetic algorithms (an approach to solving problems by mimicking evolutionary genetic concepts) to independently re-create several previously patented inventions.[35] Finally, IBM's Watson has been enhanced to support what IBM calls "computational creativity" by utilizing deductive reasoning combined with access to massive amounts of information.[36] As one example, IBM developed new techniques for Watson and provided it with vast data related to nutrition, flavor compounds, the molecular structure of foods, and tens of thousands of recipes.[37] In response, Watson evaluated a staggeringly large number of potential food combinations and generated various recipes using different food ingredients, many of which have been surprising to human chefs.[38] It is likely that Watson has discovered several potentially patentable recipes, as the combination of ingredients might create a new composition of matter, or the steps involved in creating food may be considered a sufficiently inventive process.[39]

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[34] *See* Ralph D. Clifford*, Intellectual Property In the Era of the Creative Computer Program: Will the True Creator Please Stand Up?*, 71 TUL. L. REV. 1675, 1695 (1997).

[35] *See* Ryan Abbott*, Hal the Inventor: Big Data and Its Use by Artificial Intelligence*, *in* BIG DATA IS NOT A MONOLITH 193 (Cassidy R. Sugimoto et al., eds., 2016).

[36] *See Computational Creativity*, IBM, http://www.research.ibm.com/cognitive-computing/computational-creativity.shtml#fbid=IWY0_ThKwWv, https://perma.cc/P7EZ-R8G8 (last visited Feb. 15, 2018).

[37] Abbott, *supra* note 33, at 1090.

[38] *See id.* at 1091.

[39] *See id*. (noting that recipe patents are still obtained; *see e.g.*, U.S. Patent No. 8,354,134 (filed Dec. 22, 2005)).

B. Future AI Will be Even More Capable

[11]   Today's advances in AI are impressive, yet they represent just the elementary capabilities of forthcoming AI systems. Generally, there are three types of AI systems: weak AI, strong AI, and superintelligence.[40] Weak AI systems, represented by IBM's Deep Blue chess champion or Thaler's Creativity Machine, have relatively narrow uses such as playing a game or developing solutions for narrow questions, respectively.[41] On the other hand, strong AI represents intelligence that is generalized and more like human mental capabilities, such as reasoning and problem solving.[42] These types of systems could, in theory, replace human beings in the workforce and could be capable of the same level of invention and creativity as any individual person.[43] Finally, there is superintelligence, a form of artificial intelligence that "radically outperforms the best human minds in every field, including scientific creativity, general wisdom, and social skills."[44]

[12]   While superintelligence may be many decades or more away, weak AI and strong AI systems exist in some form today. Weak AI is playing (and winning) many complex human games; providing major advances in human productivity; creating numerous artworks (including music, poetry, visual designs, and videos); and supporting industrial systems for security,

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[40] *See* Sean Illing, *Why Not All Forms of Artificial Intelligence Are Equally Scary*, Vox (Mar. 8, 2017, 9:40 AM). https://www.vox.com/science-and-health/2017/3/8/14830108/artificial-intelligence-science-technology-robots-singularity-bostrom, https://perma.cc/M2P8-BF6G (last visited Mar. 27, 2018).

[41] *See id.*

[42] *See id.*

[43] *See id.*

[44] *Id.*

stability, and reliability.[45] Strong AI, on the other hand, is still in its infancy, but many predict that 2017 was the "tipping point" for AI as technology giants – including Microsoft, Google, Amazon, IBM, and Intel – had established AI as a guiding future for their company (or at least crafted new offerings to democratize AI).[46] For example, Google, the company behind AlphaGo, has developed the DeepMind AI which "learns" and acquires skills as it tackles a range of different tasks – modeled on the same concepts of how the human brain works.[47] Additionally, IBM's Watson, with its approach to deductive reasoning and generalized usage across industrial fields, is IBM's attempt to build a strong AI system.[48] Clearly, advances in AI will continue with such great investments so long as the appropriate incentives are there.

III. UNITED STATES IP LAW FAILS TO RECOGNIZE NON-HUMAN CREATORS

A. United States Copyright Law does not Recognize Non-Human Authors

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[45] *See generally* Illing, *supra* note 41.

[46] *See* Sharon Gaudin, *After a big 2016, next year may be A.I. tipping point*, COMPUTERWORLD (Dec. 27, 2016, 3:00 AM), https://www.computerworld.com/article/3151397/artificial-intelligence/after-a-big-2016-next-year-may-be-ai-tipping-point.html, https://perma.cc/JF4H-N29L (last visited Mar. 27, 2018).

[47] *See* Ian Sample, *Google's DeepMind Makes AI Program that Can Learn Like a Human*, THE GUARDIAN, Mar. 14, 2017, https://www.theguardian.com/global/2017/mar/14/googles-deepmind-makes-ai-program-that-can-learn-like-a-human, https://perma.cc/7AMS-F5NP (last visited Mar. 27, 2018).

[48] *See* Margaret Rouse, *IBM Watson Supercomputer*, TECH TARGET, http://whatis.techtarget.com/definition/IBM-Watson-supercomputer, https://perma.cc/WZH9-U9L8 (last visited Feb. 23, 2018).

[13]   Axiomatically, the Copyright Office does not allow for non-human authors, no matter how smart an AI may be.[49] The Copyright Act of 1976 (and previous Copyright Acts of 1790 and 1909) provides that a copyright ownership "vest initially in the author or authors of the work,"[50] remaining quiet on the definition of "author" in § 101, which contains all other definitions under the Act.[51] Nevertheless, back in 1956 when Klein and Bolitho attempted to register the computer-generated song *Push Button Bertha*, the Copyright Office rejected them out-of-hand, instructing them that no one had ever registered music written by a machine before.[52] By 1973, this was fortified into the practices of the Copyright Office, such that copyrightable works must owe their origin to a "human agent."[53] This remains the practice of the Copyright Office today.[54]

[14]   Though the Copyright Office did not have direct statutory backing for their policy, the federal courts have taken seemingly consistent views in interpreting the law.[55] In *Community for Creative Non-Violence v. Reid*, the Supreme Court defined the author as the party who creates a work, clarifying that it must be a "…*person* who translates an idea into a fixed, tangible expression…"[56] In *Uranti Foundation v. Maaherra*, the Ninth

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[49] *See* U.S. COPYRIGHT OFFICE, *supra* note 11.

[50] 17 U.S.C.S. § 201(a).

[51] *See* 17 U.S.C.S. § 101.

[52] *See* Bridy, *supra* note 30, at 395.

[53] *See* U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 2.8.3 (1st ed. 1973) (stating works are not copyrightable if they do not "owe their origin to a human agent.").

[54] *See* U.S. COPYRIGHT OFFICE, *supra* note 11.

[55] *See* Copyright and the Public Domain § 2.17.

[56] Cmty. for Creative Non-Violence v. Reid, 490 U.S. 730, 737 (1989) (emphasis added) (citing 17 U.S.C. § 102).

Circuit demarcated authorship by the "first *human* beings who compiled, selected, coordinated, and arranged [the work]."[57] Finally, in *Aalmuhammed v. Lee*, the Ninth Circuit made clear "an author … will likely be a *person*."[58]

[15]   While no explicit reason has been given for this consistent expectation that authors be human, it appears that courts put a heavy weight on the idea of inspiration – presuming it to be uniquely human.[59] In *Burrow-Giles Lithographic Co. v. Sarony*, the court defined the author as "… he to whom anything owes its origin; originator; maker; one who completes a work of science or literature."[60] Additionally, in *Bleistein v. Donaldson Lithographing Co.*, the court held that the author's unique personality and reaction to nature is the essence of a copyrightable work.[61] Modern copyright law draws from the Supreme Court case of *Feist Publications, Inc. v. Rural Telephone Service Co., Inc.* that requires a copyrightable work to possess "… some creative spark."[62] Additionally, as Justice O'Connor penned, "the *sine qua non* of copyright is originality… [which] must be original to the author."[63] Thus, the aspects of originality and creativity are critical to the question of authorship, and if we define such aptitudes as exclusively human, then AI can never be an author.[64]

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[57] Urantia Foundation v. Maaherra, 114 F.3d 955, 958 (9th Cir. 1997) (emphasis added).

[58] Aalmuhammed v. Lee, 202 F.3d 1227, 1234 (9th Cir. 2000) (emphasis added).

[59] *See* Annemarie Bridy*, Coding Creativity: Copyright and the Artificially Intelligent Author*, 2012 STAN. TECH. L. REV. 5, 5 (2012).

[60] *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 58 (1884).

[61] *See Bleistein v. Donaldson Lithographing Co.,* 188 U.S. 239, 250 (1903).

[62] *Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 499 U.S. 340, 345 (1991).

[63] *Id*.

[64] *See* Bridy, *Coding Creativity*, *supra* note 60, at 9.

[16]   As early as 1965, the Copyright Office was confronted with issues related to questions of computer authorship, but such problems were ultimately dismissed out-of-hand.[65] That year, several people attempted to register works at least partially authored by computers.[66] To address the problem, Congress created the National Commission on New Technological Uses of Copyrighted Works (CONTU) to study the impact of new technologies on copyright law, including the creation of works by computer systems.[67] CONTU's final report, published in 1978, matter-of-factly concluded that it would be impossible for works to be created independently by computers as: (1) computers are nothing more than passive tools of creation; (2) the development of AI is too hypothetical to raise concerns; and (3) there is no reasonable basis to believe that a computer contributes the necessary "authorship to a work produced through its use."[68] These conclusions seem to be based on the same reasoning that the courts applied generally to copyright: the "inventive spark" required for copyright was fundamentally missing from computer systems, and such capabilities are unique to humans.[69]

[17]   While not directly involving AI systems, the case of *Naruto v. Slater* (the "Monkey selfie" case) is instructive in understanding how courts today examine the question of whether non-human authors can apply for copyright protection.[70] Photographer David J. Slater was in Indonesia to

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[65] *See id.* at 22.

[66] *See id.*

[67] *See id.*

[68] Bridy, *Coding Creativity*, *supra* note 60, at 22–23.

[69] *See id.* at 24.

[70] *See* Naruto v. Slater, 2016 U.S. Dist. LEXIS 11041, at *10 (N.D. Cal. Jan. 28, 2016).

take pictures of wildlife, when a 6-year-old male macaque named Naruto picked up his camera and "took" several images of himself.[71] The People for the Ethical Treatment of Animals sued to obtain authorship status for Naruto; however, the court relied on Copyright Office guidelines and the case law cited above, to rule that Naruto could not be an author: any such argument "should be made to Congress and the President, not to [a judge]."[72] The case was dismissed with the court's ruling that the "Act d[id] not confer standing upon animals like Naruto."[73]

[18]   The conclusion to be drawn is that the Copyright Office and courts demand creativity—*human* creativity. Under current United States copyright law, if a human creates a work, it may be copyrightable.[74] If a computer creates a work, it is not copyrightable. The paradoxical question is thus whether two identical works, one created by a human and the other created independently by an AI, would be treated differently. The answer appears to be clear: yes. Applying the context, the history, and the legal analysis of the Monkey Selfie case, autonomously created AI works would be rejected by the Copyright Office, just as it rejected *Push Button Bertha* back in 1956. There appears to be a deliberate indifference to the realities of AI in 1956 versus AI in 2018.

[19]   Though the law requires a human to obtain a copyright, non-natural persons may hold the copyright via the doctrine known as work-for-hire.[75] Generally, when an employee acts within the scope of their employment,

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[71] *See id.* at *1, *3.

[72] *Id.* at *10.

[73] *Id.* at *2.

[74] *See* U.S. COPYRIGHT OFFICE, *supra* note 11.

[75] *See* Matthew R. Harris, *Copyright, Computer Software, and Work Made for Hire*, 89 MICH. L. REV. 661, 662 (1990) (discussing the creation of the work for hire doctrine).

the hiring party is granted ownership of the copyright.[76] This can be an individual or a legal person, such as an employer.[77] Common examples of work-for-hire include: "[a] software program created by a staff programmer within the scope of his duties . . . , [a] newspaper article written by staff journalists . . . , musical arrangement[s] written . . . by a salaried arranger, [or] [a] sound recording created by staff engineers of a record company."[78] In all such cases, the copyright ownership is passed via work that is prepared by an employee within the scope of their employment, or a work specially ordered or commissioned for use where the parties explicitly agree via a signed, written instrument.[79]

B. United States Patent Law does not Recognize Non-Human Inventors

[20]   Like U.S. copyright law, U.S. patent law does not specifically define the term "inventor,"[80] but prominently suggests that human development is required.[81] The America Invents Act (AIA) defines the subject matter of patents as "any new [or] useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor[e], subject to the conditions and requirements of

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[76] *See id*.

[77] *See* U.S. COPYRIGHT OFFICE, CIRCULAR 9: WORKS MADE FOR HIRE 1 (2012), https://www.copyright.gov/circs/circ09.pdf, https://perma.cc/2EPV-XNUG (last visited Mar. 27, 2018).

[78] *Id*. at 2 (listing "work-for-hire" examples).

[79] *See id*. at 1 (defining "work made for hire").

[80] *See* U.S. CONST. art. I, § 8, cl. 8 (referencing term "inventor").

[81] *See* 35 U.S.C.S § 112(a) (2018) (describing required actions of inventor); *see also* 17 U.S.C.S. § 112(a)(A) (2018) (describing required actions by a legal organization for protecting copyrighted material).

this title."[82] During passage of the 1952 Patent Act, which originated this language, testimony before Congress famously declared that such subject matter is made up of "anything under the sun that is made by *man*."[83] Though such testimony hardly creates a limitation, it provides insight into how the drafters thought of inventors: as human beings. This is further reinforced by rules promulgated by the USPTO's Commissioner of Patents, requiring inventors to provide information such as their family name and place of residence when applying for a patent.[84] The USPTO's Manual of Patent Examining Procedure also provides that "[t]he threshold question in determining inventorship is who conceived the invention. Unless a *person* contributes to the conception of the invention, he is not an inventor."[85]

[21]   Unlike copyright law, patent law specifically requires individuals to be named as inventors.[86] Consequently, legal entities such as a corporation cannot be named as an inventor.[87] As the Federal Circuit made clear, "only natural persons may be 'inventors.'"[88] However, inventors may treat their patents like personal property that may be assigned to another entity,

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[82] 35 U.S.C.S. § 101 (2018).

[83] Clifford, *supra* note 35, at 1696–97 (emphasis added).

[84] *See* 37 C.F.R. § 1.41(a), (d) (2016).

[85] 2016-2100 MANUAL PAT. EXAMINING PROC. [MPEP] § 2137.01 (2014) (emphasis added).

[86] *See* 17 U.S.C.S. § 101 (2018) (mentioning legal entities being the authors of a work); 35 U.S.C.S. § 100(f) (2018) (stating that "[t]he term 'inventor' means the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention.").

[87] *See* 35 U.S.C.S. § 100(f) (2018).

[88] Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237, 1248 (Fed. Cir. 1993) (referring to 35 U.S.C. § 115-118).

including non-natural persons, such as corporations.[89] In fact, employees in IP-intensive industries usually agree, via employment agreements, to assign patents developed during their work to their employer.[90] While AI systems would not qualify as natural persons, it is important to note that patent law requires all inventors to be named on a patent or it may be held invalid or unenforceable.[91] Though an error in such patent may be corrected via a filing, it does not avoid potential invalidation.[92]

[22]   Like the "creative spark" required of authors in copyright law, patent law requires "non-obvious" discoveries or "inventive concepts" by its inventors.[93] To survive a challenge against obviousness, courts consider four "factual issues: (1) the scope and content of any prior art, (2) the differences between prior art and the claims [of the invention], (3) the level of ordinary skill of [practitioners] in the art, and (4) [the] relevant secondary considerations" such as commercial success, surprise by other experts, etc.[94] Thus, an inventor must make a substantial leap forward beyond then-existing alternatives to achieve patentable inventions.[95] This has been

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[89] *See* Abbott, *supra* note 33, at 1092 n.101 ("About ninety-three percent of patents are assigned to organizations (rather than individuals).").

[90] *See id.*

[91] *See id.* at 1080; *see also* Advanced Magnetic Closures, Inc. v. Rome Fastener Corp., 607 F.3d 817, 828 (Fed. Cir. 2010) ("[W]hen named inventors deliberately conceal a true inventor's involvement, the applicants have committed inequitable conduct and the patent is unenforceable even as to an innocent co-inventor.").

[92] *See, e.g.*, Beco Dairy Automation, Inc. v. Glob. Tech Sys., Inc., 104 F. Supp. 3d 1023, 1036 (E.D. Cal. 2015).

[93] *See* Intellectual Ventures I, LLC v. Symantec Corp., 838 F.3d 1307, 1315, 1324 (Fed. Cir. 2016).

[94] Princeton Biochemicals, Inc. v. Beckman Coulter, Inc., 411 F.3d 1332, 1336 (Fed Cir. 2005).

[95] *See generally* Townsend v. Smith, 17 C.C.P.A. 647, 651 (C.C.P.A. 1929) (discussing the process of the conception of an invention).

described as the "mental part of the inventive act."[96] Additionally, though the AIA's language regarding the subject matter for patents is quite broad, the Supreme Court has made clear that there are exceptions such as "laws of nature, natural phenomena, and abstract ideas," that cannot be patented.[97] In such cases, the Court demands that inventors demonstrate some type of "inventive concept" beyond ineligible patent subjects.[98]

[23]   Though the law openly requires a natural person inventing via a mental process, the USPTO may have already granted several patents with non-human inventors, albeit not explicitly and not necessarily with their knowledge.[99] As previously mentioned, the Creativity Machine and subsequent Invention Machine were used to develop ideas that were ultimately patented.[100] Additionally, as cited earlier, IBM Watson may have developed several patentable food products and/or recipes.[101] A specific example is provided by Dr. John Koza, who is a pioneer in the space of generic algorithms.[102] Dr. Koza was granted a patent entitled "Apparatus for Improved General-Purpose PID and non-PID Controllers," which used his Invention Machine to generate and evaluate improvements to a known controller system without the aid of a "database of expert knowledge[,] and without knowledge about existing controllers."[103] The prosecution history

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[96] *Id*.

[97] Mayo Collaborative Serv. v. Prometheus Labs., Inc., 566 U.S. 66, 70 (2012).

[98] *See* Alice Corp. Party Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014).

[99] *See* Abbott, *supra* note 33, at 1099.

[100] *See id*. at 1086–87.

[101] *See id*. at 1090–91.

[102] *See id*. at 1086–88.

[103] *Id*. at 1087.

makes no mention of the AI used to develop the invention, nor did Dr. Koza disclose the use of the AI in developing his idea.[104] The patent was issued even though Dr. Koza admitted that "the whole invention was created by a computer."[105] Regardless of the actual process used to create the invention, the USPTO seems to require only that a natural person be registered for the patent, and that the patent application meets its other stringent requirements.[106]

[24]   To date, there appears to be no case law or controversies related to non-human inventors, though the copyright analysis done in the Monkey Selfie case could likely be applied in a parallel manner to a patent case. As the USPTO appears to require a natural person to be named as inventor, it is likely that an AI would not qualify as a sole inventor, and likely not even as a joint inventor. Analysis beyond that would be entirely speculative, leaving a question about what would happen if IBM or others were to attempt patenting inventions made entirely by their AI systems.

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[104] *See id*. at 1085–87.

[105] *See* Abbott, *supra* note 33, at 1088.

[106] *See* U.S. PATENT & TRADEMARK OFFICE [USPTO], REQUIREMENTS OF A PETITION, https://www.uspto.gov/patents-application-process/petitions/01-requirements-petition, https://perma.cc/QB2W-E8J5 (last visited Mar. 27, 2018).

C. United States Law does not Recognize Legal Personhood for AI Systems

[25]   United States law recognizes ownership of IP as alienable personal property rights.[107] Thus, both copyrighted works[108] or patents may be transferred or licensed.[109] In the case of copyrights, the initial ownership is vested in: (1) the author(s) of the work, (2) an employer by an employee as work-for-hire, or (3) an employer by a freelancer as work-for-hire.[110] For patents, initial ownership is vested in: (1) the inventor(s) of the patent; (2) an employer via pre-invention assignments (i.e., explicit contract); or (3) an employer for an employee who was "employed to invent"[111] (i.e., implicit assignment contracts).[112] While ownership may be assigned to the natural person who authored or invented the IP, it may also be assigned to non-natural persons via work-for-hire or assignment contracts.

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[107] *See* Thomas G. Field, Jr., *IP Basics: Managing Intellectual Property*, UNIV. N.H., FRANKLIN PIERCE CTR. FOR INTELL. PROP. 1 (2015), https://scholars.unh.edu/cgi/viewcontent.cgi?article=1223&context=law_facpub, https://perma.cc/W45J-Z5TM (last visited Mar. 27, 2019) ("IP is intangible, but the parallels to tangible property are many. Everything accurately called 'property' represents alienable, divisible and legally enforceable rights.").

[108] *See* 17 U.S.C.S. § 204(a) (2018).

[109] *See* U.S. PATENT & TRADEMARK OFFICE, PATENTS ASSIGNMENTS: CHANGE & SEARCH OWNERSHIP ("[T]he original owner may transfer ownership to another entity or party, through an 'assignment'. . ..''), https://www.uspto.gov/patents-maintaining-patent/patents-assignments-change-search-ownership, https://perma.cc/853P-QM35 (last visited Mar. 27, 2018).

[110] *See* 17 U.S.C.S. § 201(a), (b) (2018).

[111] U.S. v. Dubilier Condenser Corp., 289 U.S. 178, 187–88 (1933) ("One employed to make an invention . . . is bound to assign to his employer any patent obtained. The reason is that he has only produced that which he was employed to invent.").

[112] *See id.* at 213–14.

[26]   However, the law does not contemplate the idea of legal personhood for an AI system.[113] Even if an AI were to meet the challenges set forth to establish authorship or inventorship, there are even more substantial hurdles that such systems would need to overcome to be given the same legal rights as natural persons (i.e., missing some essential capability such as not being a human, not having a soul, not having a consciousness, not expressing intentionality, not having feelings, not possessing interests, or not having free will).[114] Nevertheless, the law recognizes legal personhood for business corporations and government entities–legal persons that certainly lack the intelligence and will of humans.[115] Such "legal persons" often hold constitutional rights and duties such as the right to sue or be sued[116] or the free exercise of religion[117] based on the close relationship they have with their human shareholders.[118] Unlike these truly "artificial entities," strong AIs could ultimately achieve independent rights such as free speech (i.e., entirely apart from any human associations).[119] Regardless, the reason the

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[113] *See* Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1231–32, 1284–85 (1992) (stating that no AI currently possesses the sort of capacities that would justify judicial inquiry into the question of legal personhood).

[114] *See id*. at 1262–74.

[115] *See id*. at 1238–40.

[116] Toni M. Massaro & Helen Norton, *Siri-Ously? Free Speech Rights and Artificial Intelligence*, 110 NW. U. L. REV. 1169, 1180 (2016) (discussing how legal persons hold legal rights and duties, but these rights may be divergent to the moral or natural rights that a human may have).

[117] *See, e.g.*, Burwell v. Hobby Lobby Stores, Inc., 134 S. Ct. 2751 (2014) (holding that for-profit corporations are "persons" and that closely held corporations hold free exercise of religion rights).

[118] *See id*. at 2759.

[119] *See* Massaro & Norton, *supra* note 117, at 1193–94 (stating that strong AI could obtain first amendment rights independent from their human creators).

law recognizes legal personhood for businesses is the nexus between the natural persons (i.e., the owners) and the corporate or government entity.[120] Thus, a similar analysis—the nexus between an AI system and natural persons—would be appropriate to navigate the rights that could be obtained by AIs.

IV. RECOGNITION FOR AI OWNERS REQUIRES A NEW LEGAL TEST

A. The Law Must Recognize and Incentivize the Use of AI

[27]   Impressed with their initial results, the AP has expanded their use of AI.[121] Today, the AP uses Automated Insights to generate news stories for financial services and minor league sports.[122] In fact, the millions of stories output by the AP's AI outpaces all other major media companies combined.[123] In the future, the AP hopes to use the technology to edit stories for use in different mediums; for example, a story written for online publication would be written quite differently than a story intended to be read on the air by newscasters.[124] Additionally, the AP hopes that AI can provide different styles of news stories based on the expectations of

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[120] *See* Stephen M. Bainbridge, *Community and Statism: A Conservative Contractarian Critique of Progressive Corporate Law Scholarship*, 82 CORNELL L. REV. 856, 859–60 (1997) (describing the development of the "nexus-of-contracts" theory of the firm by law and economics scholars).

[121] Telephone Interview with Jim Kennedy, *supra* note 7.

[122] *See* Paul Sawers, *Associated Press expands sports coverage with stories written by machines*, VENTUREBEAT (July 1, 2016, 3:25 AM), https://venturebeat.com/2016/07/01/associated-press-expands-sports-coverage-with-stories-written-by-machines/, https://perma.cc/F38C-TYVM (last visited Mar. 27, 2018).

[123] *See* Lance Ulanoff, *Need to Write 5 Million Stories a Week? Robot Reports to the Rescue*, MASHABLE, July 1, 2014, http://mashable.com/2014/07/01/robot-reporters-add-data-to-the-five-ws/#890n2EvFSgqn, https://perma.cc/C5LT-6VP4 (last visited Mar. 2, 2018).

[124] *See id*.

consumers of individual publications, such as the New York Times, as opposed to Buzzfeed.[125] Finally, the AP anticipates their own AI will integrate with Amazon's AI, Alexa, to provide customizable stories for individual households.[126]

[28]   The AP's use of AI serves the interest of the public, just as United States IP law was created to serve the interest of the public. This has been emphasized time and again by the Supreme Court: while the system provides for exclusive rights for authors and inventors, "the[ir] reward … is wholly secondary" compared to society;[127] "[t]he sole interest of the United States … [is] the general benefits derived by the public from the labors of authors;"[128] and "encouragement of individual effort by personal gain is the best way to advance public welfare . . . ."[129]

[29]   While some may feel uncomfortable with incentivizing AI systems that can generate more works than a human, the Supreme Court has rejected the argument that protections are a reward for the "sweat of the brow" in producing works.[130] Instead, our laws recognize contributions driven by originality and creativity, even if such advances come with minimal investment in resources.[131] Such contributions are evidenced by the AP example—where an AI's contribution to society is substantial.

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[125] *See id*.

[126] Telephone Interview with Jim Kennedy, *supra* note 7.

[127] U.S. v. Line Material Co., 333 U.S. 287, 316 (1948) (Douglas, J., concurring).

[128] Sony Corp. of Am. v. Universal City Studios, 464 U.S. 417, 429 (1984) (citing Chief Justice Hughes' opinion in Fox Film Corp. v. Doyal, 286 U.S. 123, 127 (1932)).

[129] Mazer v. Stein, 347 U.S. 201, 219 (1954).

[130] *Feist Publications*, 499 U.S. at 374.

[131] *See* Andrew J. Wu, *From Video Games to Artificial Intelligence: Assigning Copyright Ownership to Works Generated by Increasingly Sophisticated Computer Programs*, 25 AIPLA Q. J. 131, 150–51 (1997).

[30]   Given the bright-line expectations of the Copyright Office and the USPTO, authors and inventors merely side-step the question of AI ownership by selecting not to disclose the use of AI in their registrations and applications.[132] For example, the USPTO has not issued any guidelines related to AI inventorship, has not mentioned the issue in any publication, nor has it been an issue in any published litigation; thus, it is likely that patent applications have not attempted to list AIs as potential inventors[133] (including applications written by inventors who credit AI with the actual subject matter). Equally, the Copyright Office's guidelines indicating that AIs cannot be authors make clear that any such attempt to register a work would be met with resistance.[134]

[31]   Thus, an important question is raised: by disclosing that their stories are generated with the use of an AI, does the AP put their legal copyright at risk? Today, the AP believes that there is no legal dispute—stating that they clearly own the copyright to everything generated by Automated Insights.[135] As the AP continues to push the boundaries of writing style, the ownership assumption may be challenged, especially when the AP does little to contribute to the expression with anything other than the facts of the story.

B. Previous Analysis on AI Ownership

[32]   If a work is sufficiently creative to achieve copyright or patent status where an AI is involved, who should be the owner of the work?

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[132] *See* Abbott, *Hal the Inventor*, *supra* note 36, at 12.

[133] *See id*.

[134] *See* COPYRIGHT OFFICE, *supra* note 11.

[135] Telephone Interview with Jim Kennedy, *supra* note 7.

1. The User of an AI as the owner

[33]   Historically, courts award ownership to artists or inventors who use machines, which are regarded as merely inert tools.[136] As CONTU determined back in 1978,

> [t]he computer, like a camera or a typewriter, is an inert instrument, capable of functioning only when activated either directly or indirectly by a human . . . [T]he computer affects the copyright status of a resultant work no more than the employment of a still or motion-picture camera, a tape recorder, or a typewriter.[137]

[34]   As early as 1986, the Congressional Office of Technology Assessment questioned CONTU's conclusions: "[i]t is misleading . . . to think of programs as inert tools of creation . . . [It] begs the question of whether interactive computing employs the computer as co-creator, rather than as an instrument of creation."[138] Yet, the analysis done in 1978 and the questions asked in 1986 are some 30 to 40 years removed from the sophisticated capabilities of today's AI.[139]

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[136] *See* Wu, *supra* note 132, at 149 (discussing that artists could claim copyright protection on authentic works irrespective of a machine's role in the configuration of the work).

[137] NAT'L COMM'N ON NEW TECH. USES OF COPYRIGHTED WORKS, FINAL REPORT, 44–45 (1978).

[138] Wu, *supra* note 132, at 150 (quoting U.S. CONG. OFFICE OF TECH. ASSESSMENT, INTELLECTUAL PROPERTY RIGHTS IN AN AGE OF ELECTRONICS AND INFORMATION, OTA-CIT-302, 72–73 (1986)).

[139] *See, e.g.*, U.S. CONG. OFFICE OF TECH. ASSESSMENT, *supra* note 139 (discussing the questions and concerns that were relevant during that time about 30 years ago).

[35]   Fundamentally, courts regard the human user of such machines as the owner of its output, since they assume that it is human originality and creativity that drives the creation of the work.[140] However, as commentators have observed, an AI that could take over the creative process entirely on its own would throw current notions of originality "upside down."[141] Nevertheless, some argue that AI "creativity" is merely rote rule following of an algorithm more analogous to "slavish copying."[142] However, those that detract from the potential for AI creativity fail to distinguish between deep-learning approaches that mimic human mental process versus general purpose algorithms that merely automate pre-defined rules and steps.[143] Such criticism is based on a misunderstanding of advanced AI and relies merely on anecdotal understandings.

[36]   AI systems that utilize deep-learning, neural networks, and other approaches that do not dictate the purely mechanical creation of works should be considered a potential author separate and apart from their human operator. The focus of IP law should be to recognize the contributions of the creator. Just as the court ruled in *Sarony*, the author is "… [the] originator; maker; one who completes a work of science or literature."[144] When the user provides little to no guidance for the creation of the IP, the user's ownership in such must be void.

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[140] *See* WU, *supra* note 133, at 150–51.

[141] Edward Lee, *Digital Originality*, 14 VAND. J. ENT. & TECH. L. 919, 934 (2012).

[142] James Grimmelmann, *There's No Such Thing as a Computer-Authored Work - and It's a Good Thing, Too*, 39 COLUM. J. L. & ARTS 403, 408 (2016).

[143] *See id*. at 409 ("All creativity is also algorithmic in the sense that we could encode the work as a program making completely explicit what the creator did to produce it").

[144] Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 57–58 (1884).

2. The Programmer of an AI as the Owner

[37]   Perhaps then, as some would argue, the ownership of the IP should belong to the creator of the AI.[145] Certainly, it was the programmer who invested the time, energy, and creativity to create the AI tool. However, this point of view makes the same false assumptions that some critics have made in arguing against any AI ownership of IP: it assumes that the programmer explicitly programmed the AI with step-by-step instructions.[146] Advanced AI programs using neural networks and deep learning start out as a dumb set of models that improve through training.[147] For example, if you want to teach a neural network to recognize cats, you don't tell it to look for whiskers, ears, fur, and eyes; instead, you simply show it thousands of pictures of cats and eventually it can recognize them on its own.[148] If it keeps making mistakes, you don't change the program, you just keep coaching it.[149] This is the same method used to teach humans via experiential learning.[150] Just as it isn't always clear how a child learns to read, the results from these networks are often surprising to the programmers themselves.[151]

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[145] *See* Lee, *supra* note 142, at 940.

[146] *See* Jason Tanz, *Soon We Won't Program Computers. We'll Train Them Like Dogs*, WIRED (May 17, 2016, 6:50 AM), https://www.wired.com/2016/05/the-end-of-code/, https://perma.cc/UBA7-D8EH (last visited Mar. 27, 2018).

[147] *See id.*

[148] *See id.*

[149] *See id.*

[150] *See* Elissa Gilbert, *Artificial Intelligence: Teaching Machines to Learn Like Humans*, INTEL, Aug. 21, 2017, https://iq.intel.com/artificial-intelligence-teaching-machines-to-learn-like-humans/, https://perma.cc/9NTW-T5JN (last visited Mar. 27, 2018).

[151] *See,* Tanz, *supra* note 148. In 1996, I published my master's project on part-of-speech tagging using recurrent neural networks, achieving a 99.6% success rate; that was far better than I could ever be, and I did not understand how it made its predictions.

[38]   A further issue is economic. If the programmer of the AI retains the rights by default, then a user who wishes to use the tool for monetary benefit may forfeit their rights to someone else.[152] For example, the use of IBM's Watson AI to develop new drugs by a pharmaceutical research company might compromise the ability to receive a patent in their own name, creating a clear disincentive to using a system like Watson. Why invest the time and money but give the rewards to IBM?

3. The AI as owner

[39]   Some critics appear to be adamantly opposed to the idea of AI ownership of IP.[153] "Someday it might make sense … but if that day ever comes, copyright will be the least of our concerns."[154] This all-or-nothing ostrich-head hiding does little to recognize the creative contribution of AI systems and merely attempts to frighten any suggestion away with doomsday like predictions. Still, others argue that IP law's economic pursuits are inconsistent with the idea of AI ownership since the AI lacks the discretion to decide whether or not to create future artistic works.[155] Yet equally, this presupposes that an AI should only be granted ownership rights when it achieves similar capabilities to natural persons, completely ignoring analogous legal personhood as is found in corporations and government entities.[156] Such corporate ownership merely grants legal personhood based on the nexus between natural persons (i.e., shareholders) and the

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[152] *See* Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185, 1207 (1985).

[153] *See* Grimmelmann, *supra* note 143, at 403.

[154] *Id*.

[155] *See* Wu, *supra* note 132, at 159.

[156] *See* Solum, *supra* note 114, at 1258–59.

corporation.[157] Why can't the nexus between a creative AI and the natural person programmers and users provide an equally useful solution?

C. A Proposed Framework for AI Ownership

[40]   This paper proposes that the law and courts should (1) recognize sufficiently creative AIs as authors and inventors matched with (2) AI IP rights assignment to natural or legal persons (i.e., business or government entities). First, the law must put in place a test to determine if or when an AI might be granted such a status. Second, in such a case, the law must put in place an assignment regime that recognizes ownership by the appropriate party, including default rules and conditions of assignment.

1. The Test for an AI Author or Inventor

[41]   The first part of the framework is to recognize when an AI has sufficiently met the qualifications to be named author or inventor. Just like natural persons, the first part of this analysis is to make sure the subject matter is appropriate for legal protection.[158] The second part of the analysis is evaluation of the independent creativity associated with AI. In both steps of this analysis, the approach should borrow heavily from established case law.

a. Eligible Subject Matter: Independence of the Work

An AI has created eligible subject matter if the creation is original and developed independently from mere instructions provided by a programmer.

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[157] *See* Bainbridge, *supra* note 121.

[158] *See* 35 U.S.C. §101 (2018).

[42]   The proposed approach would use a similar test as provided by common-law today.[159] Under both copyright and patent law, eligible subject matter is embodied by works that express novelty, invention, and originality.[160] Copyright law eligible subject matter covers literary, musical, dramatic, choreographed, pictorial, sculptural, audio-visual, sound recording, and architectural works.[161] However, copyrightable works must be more than mere imitations, requiring independent creation from an original.[162] On the patent side, assuming there is sufficient "inventiveness," the subject matter may be "anything under the sun:" processes, machines, manufactures, or compositions of matter.[163]

[43]   Further, patent law requires that inventions be non-obvious and have utility,[164] and patents must depart from previous teaching or obvious improvements.[165] Since both patents and copyrights thus require independence from previous works, the test for an AI's eligible subject matter boils down to the same common law tests as applied to natural persons. Thus, the AI must be shown to execute as an independent creator.

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[159] *See Alice Corp.*, 134 S. Ct. at 2355 (following two-step analysis for patent subject matter); Baker v. Selden, 101 U.S. 99, 100–01 (1880) (articulating that copyrights protect expressions, not ideas).

[160] *See e.g.*, *Sarony*, 111 U.S. at 58–59 (an engraving, a painting, and a print embody the intellectual conception of its author since each involves novelty, invention, and originality); Hotchkiss v. Greenwood, 52 U.S. 248, 264–65 (1851) (there is no novelty in the use of methods previously known before, only in the creative substitutions).

[161] *See* 17 U.S.C. § 102 (2018).

[162] *See e.g.*, Meshwerks v. Toyota Motor Sales U.S.A.*,* 528 F.3d 1258, 1263 (10th Cir. 2008) (a 3-dimensional model of a Toyota vehicle was merely a copy of the originally designed car and thus ineligible for copyright).

[163] Clifford, *supra* note 35, at 1697.

[164] *See* 35 U.S.C. §§ 101, 103 (2018).

[165] *See* 35 U.S.C. § 103 (2018).

In other words, an AI that runs through a set of step-by-step functions or an algorithm would fail under this test while an AI that develops its capabilities through learning or training would not. Examples:

- *Push Button Bertha*: the subject matter would be ineligible since the music was developed as the output of a simple, mathematical algorithm (i.e., the work was developed by the programmers with the AI providing mere variations).[166]

- *AP Stories Using Automated Insights*: the subject matter would be ineligible since the AI uses templates and pre-generated phrases supplied by the AP editorial team in the step-by-step construction of stories (i.e., the core of the subject matter was developed by the AP).[167]

- *Google's Project Magenta*: the subject matter would be eligible since Google's AI relies on deep-learning and neural networks to create original pieces of music.[168]

- *IBM's Chef Watson*: the subject matter would be eligible since Watson relies on inductive reasoning to develop non-obvious recipes and food items.[169]

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[166] *See* Charles Ames, *Automated Composition in Retrospect: 1956-1986*, in 20 LEONARDO 169, 170 (1987).

[167] *See Natural Language Generation-Associated Press*, AUTOMATED INSIGHTS, https://automatedinsights.com/case-studies/associated-press, https://perma.cc/44L4-CGV7 (last visited Feb. 16, 2018).

[168] *See* McFarland, *supra* note 29.

[169] *See Computational Creativity*, *supra* note 37.

b. Causation: Independence of the Creativity

An AI has caused the creation of a work or invention if there is "de minimus" human direction and the AI's creation process is not merely rote or mechanical.

[44]   The second prong of the test is that the AI must be the cause of the creativity as opposed to merely a mechanical device under the authority of the author or inventor. In 1884, the Supreme Court was confronted with the use of a camera in creating photographs;[170] are images that are merely a copy of real-life copyrightable? The Court answered in the affirmative: a photograph may be copyrighted since the "mental conception" of the photographer in selecting and arranging the subject's costume, determining the lighting, and arranging of the scene was sufficient for authorship.[171] However, the creativity in that case lies with the photographer as opposed to the camera since ownership lies with the originator (or source of causation) in determining authorship.[172]

[45]   For example, in the case of *Andrien v. Southern Ocean County Chamber of Commerce*, the Third Circuit made clear that if the final effort to embody a work is purely "rote or mechanical," the authorship lies elsewhere, stating that there is a "fundamental distinction" between an original work of authorship and the multitude of ways in which it can be embodied.[173] Equally, it is clear that the use of technology during the invention process, such as using a modern word processor to keep lab notes, does not cross into the realm of technology being an inventor.[174] The real

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[170] *See Sarony*, 111 U.S. at 54.

[171] *Id*. at 54–55, 60.

[172] *See* Shyamkrishna Balganesh, *Causing Copyright*, 117 COLUM. L. REV. 1, 54 (2017).

[173] Andrien v. S. Ocean Cty. Chamber of Commerce, 927 F.2d 132, 135 (3d Cir. 1991) (citing H.R. REP. NO. 94-1476, *reprinted in* 1976 U.S.C.C.A.N. 5659, 5666).

[174] *See id*. at 134–35.

question for an AI arises when the *de minimus* contribution of a human is involved. If an AI had selected the costume, adjusted the lighting, arranged the scene, and generated a photograph, would the Court answer that such a "mental conception" was sufficient for copyright? Thus, the test for causation comes down to the AI's role as either rote/mechanical or creative. Examples:

- *Camera*: the causation would lie outside of a camera even with intelligent settings like auto-focus, auto lighting, and color correction (i.e., the device is merely mechanical and under the creative authority of the photographer)

- *AI Lab Assistant*: the causation would not live with a lab assistant—even including a natural person—since the work would be performed under the authority of the inventor (i.e., the lab assistant is not the cause of the inventive step)

- *Next Generation AP Stories:* the AI could be the cause, assuming a new version of Automated Insights that selects words, stylizes phrases, and picks the tone of the stories (i.e., the creative expression is now under the control and authority of the AI).

c. Passing the Test

[46]   For a work that satisfies both prongs of the test—whereby an AI causes the independent creation of eligible subject matter under its own authority—the IP rights would be granted to the AI either as an author or an inventor. For example, if Automated Insights created a neural-network based AI that learned from training and ongoing teaching to create highly stylized stories and content, the AI itself would be named the author of the stories. However, such a suggestion begs the question of legal ownership of such rights since an AI is not currently considered a natural or legal

person.[175] Such a quandary can be resolved through a system of assignment of those rights.

2. Assignment of IP rights

[47]   Today, many (if not most) works are authored or invented by natural persons and then assigned to legal persons such as business or government entities.[176] In the world of copyright, such assignment occurs via implicit agreements (i.e., as a work-for-hire within the scope of employment), as a work specially ordered or commissioned as a collective work, or explicitly via employment or other contractual agreements.[177] Such assignment of copyrights from natural persons to legal persons also limits the term of exclusive rights.[178]

[48]   On the patent side, assignment can occur via explicit agreements (such as employment or contractual agreements) or via implicit agreements (such as the "hired-to-invent" doctrine).[179] If an AI were to be recognized as the author or inventor, a similar approach could be applied to assign the

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[175] *See Natural Person*, MERRIAM-WEBSTER, https://www.merriam-webster.com/legal/natural%20person, https://perma.cc/36XC-3655 (last visited Feb. 13, 2018 2:26 PM) ("a human being as distinguished from a person (as a corporation) created by operation of law"); *see also Legalis Homo*, MERRIAM-WEBSTER, https://www.merriam-webster.com/dictionary/legalis%20homo, https://perma.cc/88WT-QHWY (last visited Feb. 13, 2018 2:26 PM) ("one possessing full legal capacity under Old English law and not debarred of any of his rights in court (as to make oath, testify, and serve as juror) by outlawry, excommunication infamy, or disqualification…").

[176] *See* Abbott, *supra* note 33.

[177] *See* 17 U.S.C. § 101 (2018) ("A work made for hire is: (1) work prepared by an employee within the scope of his or her employment; or (2) a work specially ordered or commissioned for use as a contribution to a collective work […]").

[178] *See* 17 U.S.C. § 302 (2018) (stating that the duration of the copyright can last 95 years from the first publication or 120 years from creation for a work made for hire contrasted with a non-work made for hire copyright where the duration is for the lifetime of the author plus 70 years).

[179] *See* Teets v. Chromally Gas Turbine Corp., 83 F. 3d 403, 407 (Fed. Cir. 1996).

rights to natural persons or legal persons. While the AI would be named author or inventor, the rights would immediately be assigned to: the creator/programmer of the AI, the user of the AI, or as a joint work. In all such cases, the assignment could be to a natural person or a legal person. The assignment scheme should be as follows:

(1) Explicit license agreements: as specified within a license agreement for use of the AI, the ownership of IP rights would be written within the agreement. For example, IBM could license Watson for use and explicitly grant all IP rights to the licensee.

(2) Explicit contractual agreements: as specified within a contractual agreement, the ownership of IP rights would be written within the agreement. As opposed to a license agreement, such contractual rights could cover situations in which the AI is used on behalf of a company, such as the arrangement between the AP and Automated Insights.

(3) Implicit agreement: following the "employed to invent" model, the specific purpose for using the AI could assign the IP rights to the user when the AI was specifically purchased for purposes of developing IP. This would be the default rule in absence of an explicit license agreement or written contract. For example, if a pharmaceutical company failed to include a clause for IP ownership within a license agreement or contractual agreement, where the facts make it clear that they are using the AI specifically for the creation of patentable drugs, the "employed to invent" doctrine would apply such that the pharmaceutical company would own the rights. In contrast, if an AI was purchased for purposes of helping to automate business tasks but had created a patentable process, the AI's inventor rights would go to the programmer since the AI had not be purchased and used specifically to help create patentable processes.

V. CONCLUSION

[49]   To provide incentives for investment in AI, the United States legal system must adapt to the realities of today's AI and eliminate the gray areas that exist in the law. AI systems are already creating works that, if authored by a human, would be deemed copyrightable.[180] AI systems are also involved in inventing concepts that, if invented by a human, would also be deemed patentable.[181] Yet, the current law requires humans to side-step the issue and merely register their works and inventions with silence regarding where the true creativity may primarily lie.[182]

[50]   To eliminate this confusion and potential risk, United States intellectual property law must recognize AI systems as authors and inventors. Since advanced AI systems use techniques based on human brains, there is no fundamental reason why they cannot be recognized as performing "mental processes" analogous to humans. Courts already recognize and distinguish when works are original or inventions are sufficiently novel—not by considering the intelligence of the natural person, but by looking to the facts surrounding the creation.

[51]   The two-part test proposed would eliminate the guesswork and risk of AI IP rights by recognizing the true creators while allowing natural (or legal) persons to reap the benefits and control the interests. The first prong (the subject matter prong) recognizes that the AI's creation must be independent from the underlying code or program, and the second prong (the causation prong) requires that the AI be more than a mere rote or mechanical machine. This ensures a clear demarcation between inert tools or creation and truly creative AIs. Finally, by assigning the works via

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[180] *See* U.S. COPYRIGHT OFFICE, *supra* note 11.

[181] *See* Erica Fraser, *Computers as Inventors – Legal and Policy Implications of Artificial Intelligence on Patent Law*, 13 SCRIPTED, J.L. TECH. & SOC'Y, 305, 306–07 (2016).

[182] *See* Clifford, *supra* note 35, at 1696–97; *see generally* Margot Kaminski, *Authorship, Disrupted: AI Authors in Copyright and First Amendment Law*, 51 U.C. DAVIS L. REV. 589, 590–98 (2017) (discussing the framing of artificial intelligence through the lens of copyright law).

explicit or implicit rights assignment, there is no requirement for a recognition of an AI to be a legal or natural person—what might otherwise be a substantial hurdle.