What if Artificial Intelligence Wrote This? Artificial Intelligence and Copyright Law

Victor M. Palace

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Abstract

The increasing sophistication and proliferation of artificial intelligence has given rise to a provoking question in copyright law: Who is the copyright owner of a work created by autonomous artificial intelligence? In other words, when a machine learns, thinks, and acts without human input, and it creates a work, what person should own the copyright, if any? This Note explains why this is a pressing question and why current laws and practices fail to address the issue. It then analyzes the arguments for and against the possible choices: the artificial intelligence, the user, the programmer, the company that owns the artificial intelligence, and entrance into the public domain. Finally, this Note arrives at the conclusion that the work's immediate entrance into the public domain is the solution.

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INTRODUCTION

It is the dawn of a new era: the era of artificial intelligence.[1] For millions of years, the human brain has been the most complex and most powerful machine in the world. Analytical reasoning, imagination, and intuition have allowed humans to thrive and rise to the top. Indeed, society has long recognized the value of the human intellect by affording legal protection to intellectual creations. The Founding Fathers protected intellectual creations under the Patent and Copyright Clause of the United States Constitution, which seeks "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[2] As complex and powerful as the human brain is, however, current technology is sometimes able to match, if not surpass, its capabilities. This has led to a provoking question in copyright law: Who is the copyright owner of a work created by autonomous artificial intelligence?

To answer this, an example of "autonomous artificial intelligence" is helpful. Imagine artificial intelligence that does not require any human input to learn, think, or act. Like a baby, it starts out utterly naïve and incapable of doing anything of substance. It tries to perform a task and fails, but—much like a child—it learns. This repeats over and over. After some time, not only has the machine mastered the task, it has become one of the world's best.

This is the story of AlphaGo Zero, the first artificial intelligence to learn *tabula rasa*—meaning from a "clean slate," without any human

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1. This Note uses "artificial intelligence" to refer to a computer algorithm capable of accomplishing tasks that generally require human intelligence, such as creating pictures, songs, and writings. *See Artificial Intelligence*, OXFORD DICTIONARIES, https://en.oxford dictionaries.com/definition/us/artificial_intelligence [https://perma.cc/XEW2-YVKA] (defining "artificial intelligence" as "[t]he theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages").

2. U.S. CONST. art. I, § 8, cl. 8.

input.[3] AlphaGo Zero started out with no prior knowledge of the game Go except for its rules.[4] Nonetheless, after forty days of playing against itself, it outperformed the algorithm that defeated the world's best human Go player.[5] This is the type of artificial intelligence on which this Note focuses. For purposes of this Note, "autonomous artificial intelligence" is artificial intelligence where the only human inputs are the initial algorithm and the "rules"; the machine performs the learning, thinking, and acting. Legal tension arises from the fact that it is not immediately clear who owns the copyright of a work created by such a machine.

To resolve this, Congress and the federal courts may choose to grant the copyright for such works to the artificial intelligence, the user, the programmer, or the artificial intelligence company. Or they may choose to grant no copyright at all; that is, they may choose to place such works into the public domain immediately upon creation, where everyone would be free to use them. This Note explains why this tension is a pressing issue, why current copyright law fails to address it, and why the last choice, immediate entrance into the public domain, is the solution.

Part I explains why Congress or the federal courts will soon have to make this choice. It provides a brief historical outline and current developments regarding computers to conclude that the sophistication of artificial intelligence will continue to increase. This Part also discusses the increasing popularity of artificial intelligence to highlight the urgency of the issue. It concludes that the continuing increase in sophistication and popularity of artificial intelligence will soon force Congress or the federal courts to act.

Part II explains why current copyright law fails to address the question. It discusses congressional silence, judicial reluctance, and the Copyright Office's rules. This Part then explains why the only source of guidance, the Copyright Office's rules, is based on law that is blind to the issue. It concludes that the Copyright Office's rules are ambiguous and antiquated and thus fail to properly answer the question.

Part III explains the arguments for and against the possible choices: the artificial intelligence, the user, the programmer, the company that owns the artificial intelligence, and entrance into the public domain. It then compares the arguments to conclude that immediate entrance into the public domain is the answer.

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3. *See* Demis Hassabis & David Silver, *AlphaGo Zero: Learning From Scratch*, DEEPMIND, https://deepmind.com/blog/alphago-zero-learning-scratch/ [https://perma.cc/8LYX-JSSN].

4. *Id.*

5. *Id.*

I. CONGRESS OR THE FEDERAL COURTS WILL SOON BE REQUIRED TO
SAY WHO OWNS THE COPYRIGHT FOR WORKS MADE BY AUTONOMOUS
ARTIFICIAL INTELLIGENCE

This Part explains the urgency of the copyright ownership question for works created by autonomous artificial intelligence. To do this, it discusses two ever-increasing aspects of artificial intelligence: sophistication and popularity.

A. *The Sophistication of Artificial Intelligence Will Continue to Increase*

In 1965, the Register of Copyrights reported to Congress his concerns about computer-generated work.[6] The report stated that the rise of computer technology brought with it a difficult copyright question: For a work that is partly generated by a computer, where is the line between human and computer authorship?[7] Apparently perturbed by the question, Congress established the National Commission on New Technological Uses of Copyrighted Works (CONTU) to research, among other things, this issue.[8] At the time, CONTU found the answer "obvious" because artificial intelligence had not yet come to be.[9] It stated that a "computer, like a camera or a typewriter, is an inert instrument, capable of functioning only when activated either directly or indirectly by a human."[10] Thus, CONTU argued, the copyright always belonged to the user.[11] However, the technological landscape has change dramatically since then.

By the 1980s, computer-generated works had become popular.[12] By the 1990s, computers were capable of originality. For example, Racter,[13]

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6. *See* U.S. COPYRIGHT OFFICE, SIXTY-EIGHTH ANNUAL REPORT OF THE REGISTER OF COPYRIGHTS 5 (1965), https://www.copyright.gov/reports/annual/archive/ar-1965.pdf [https://perma.cc/E55P-XEUF].

7. *See id.*

8. National Commission on New Technological Uses of Copyrighted Works, Pub. L. No. 93-573, § 201, 88 Stat. 1873 (1974).

9. NAT'L COMM'N ON NEW TECH. USES OF COPYRIGHTED WORKS, FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS 44–45 (1978), https://babel.hathitrust.org/cgi/pt?id=mdp.39015026832934 [https://perma.cc/RUA7-AT2J].

10. *Id.* at 44.

11. *Id.* at 45.

12. *See, e.g.*, Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185, 1196 (1986) (stating that in 1986 "there [was] no question but that many machine-generated works [were] already available, and that in the future they [were] expected to become ever more complex, sophisticated and valuable").

13. *See* Terry Nasta, *Thief of Arts*, PC MAG., Dec. 25, 1984, at 62, https://books.google.com/books?id=azbgSlPdJawC&lpg=PP1&pg=PA62 [https://perma.cc/38HU-FMQ9] (reviewing RACTER, THE POLICEMAN'S BEARD IS HALF CONSTRUCTED (1984)).

a computer program designed to generate prose and poetry,[14] wrote the book *The Policeman's Beard is Half Constructed*.[15] Similarly, Hal,[16] a computer program designed to write like American author Jacqueline Susann,[17] co-wrote the book *Just This Once*.[18] Finally, Creativity Machine,[19] itself a patented device,[20] created an invention that was later patented.[21] Nowadays, artificial intelligence is present in almost every aspect of daily life, including travel-booking,[22] psychological therapy,[23] and even legal work.[24] Not surprisingly, "45% of 800 executives surveyed . . . said they expected an artificial intelligence machine will sit on a company's board of directors by the year 2025."[25] Likewise, "[35%] of surveyed law firm leaders say they can envision first-year associates being replaced by artificial intelligence . . . and [47%] said they can envision paralegals being replaced."[26] And perhaps most interestingly, "[c]ombined results from surveys of artificial intelligence experts

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14. *See* 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 5.01[A] (Matthew Bender & Co. 2018) (1963).

15. RACTER, THE POLICEMAN'S BEARD IS HALF CONSTRUCTED (1984).

16. *See* John Boudreau, *A Romance Novel with Byte: Author Teams Ups with Computer to Write Book in Steamy Style of Jacqueline Susann*, L.A. TIMES (Aug. 11, 1993), http://articles.latimes.com/1993-08-11/news/vw-22645_1_jacqueline-susann [https://perma.cc/J2ZL-TTBK].

17. *See* NIMMER & NIMMER, *supra* note 14; Tal Vigderson, Note, *Hamlet II: The Sequel? The Rights of Authors vs. Computer-Generated "Read-Alike" Works*, 28 LOY. L.A. L. REV. 401, 402–03 (1994).

18. SCOTT FRENCH & HAL, JUST THIS ONCE (1993).

19. *See* Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1085 (2016).

20. *See* U.S. Patent No. 5,659,666 (filed Oct. 13, 1994).

21. *See* U.S. Patent No. 5,852,815 (filed May 15, 1998).

22. *See* Elaine Glusac, *Meet Your New Data-Driven Travel Agent*, N.Y. TIMES (July 10, 2017), https://www.nytimes.com/2017/07/10/travel/meet-your-next-travel-agent-diy-artificial-intelligence.html [https://perma.cc/59BN-RNBP].

23. *See, e.g.*, Gale M. Lucas et al., *It's Only a Computer: Virtual Humans Increase Willingness to Disclose*, 37 COMPUTERS HUM. BEHAV. 94, 94 (2014).

24. *See* Steve Lohr, *A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet.*, N.Y. TIMES (Mar. 19, 2017), https://www.nytimes.com/2017/03/19/technology/lawyers-artificial-intelligence.html [https://perma.cc/AF5Y-8BC6].

25. Lucy Marcus, *Is This a Truly Robot-Proof Job?*, BBC NEWS (Sept. 22, 2015), http://www.bbc.com/capital/story/20150921-is-this-a-truly-robot-proof-job [https://perma.cc/S9VZ-VM24].

26. Debra Weiss, *Will Newbie Associates Be Replaced by Watson? 35% Of Law Firm Leaders Can Envision It*, ABA J. (Oct. 26, 2015, 7:42 AM), http://www.abajournal.com/news/article/will_associates_be_replaced_by_watson_computing_35_percent_of_law_firm_lead/ [https://perma.cc/V4S9-52TV].

estimate a 50% chance of human-level machine intelligence by 2040 and a 90% probability by 2075."[27]

Although current technology seems to be approaching the physical limit of computational power per unit area (a trend called "the end of Moore's law"[28]),[29] experts nonetheless believe that computational power will continue to increase due to breakthroughs in other areas of computer engineering.[30] Moreover, the advent of "quantum computing"[31] is expected to revolutionize artificial intelligence—Microsoft, for example, has stated that its artificial intelligence would learn at least "30 times faster" as a result of quantum computing.[32] In short, artificial intelligence will continue to become more and more sophisticated, increasingly blurring the line between human and computer authorship, until Congress or the federal courts are forced to act.

B. *Works Created by Artificial Intelligence Are Everywhere*

Due to the tremendous advances in artificial intelligence, works subject to copyright laws are now regularly created by autonomous algorithms. This is prominent in three areas: music,[33] pictures,[34] and

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27. Robert C. Denicola, *Ex Machina: Copyright Protection for Computer-Generated Works*, 69 RUTGERS U. L. REV. 251, 256 (2016).

28. "Moore's law" is named after Gordon E. Moore, who predicted that the number of transistors per chip (which is proportional to computational power) would double every two years. *See* Thomas L. Friedman, *Moore's Law Turns 50*, N.Y. TIMES (May 13, 2015), https://www.nytimes.com/2015/05/13/opinion/thomas-friedman-moores-law-turns-50.html [https://perma.cc/2CEF-KHFN].

29. *See* Thomas N. Theis & H.-S. Philip Wong, *The End of Moore's Law: A New Beginning for Information Technology*, 19 COMPUTING SCI. & ENGINEERING 41, 41 (2016).

30. *See id.* at 44 (commenting that research will simply switch from miniaturization to new devices, integration techniques, and architectures).

31. "Quantum computing" refers to the use of subatomic particles in computing instead of conventional silicon-based transistors. *See Quantum Computer*, OXFORD DICTIONARIES, https://en.oxforddictionaries.com/definition/quantum_computer [https://perma.cc/7HKQ-Z8YG].

32. Allison Linn, *With New Microsoft Breakthroughs, General Purpose Quantum Computing Moves Closer to Reality*, MICROSOFT (Sept. 25, 2017), https://news.microsoft.com/features/new-microsoft-breakthroughs-general-purpose-quantum-computing-moves-closer-reality/ [https://perma.cc/VQL2-6YVK].

33. Musical works have long received the protection of copyright laws. *See, e.g.*, 17 U.S.C. § 106(4), (6) (2012) (granting copyright owners the exclusive right "to perform the copyrighted [musical] work publicly").

34. As with musical works, pictorial works have long been protected by copyright laws. *See, e.g.*, *id.* § 106(5) (granting copyright owners the exclusive right "to display the copyrighted [pictorial] work publicly").

writings.[35] The first category is music. Watson Beat,[36] Jukedeck,[37] and WaveNet[38] are examples of artificial intelligence systems capable of creating music without any human input.[39] Watson Beat, for example, "composes music by 'listening' to at least 20 seconds of music, and then creates new tracks."[40] The results are tracks that cost a fraction of what hiring a musician would, and the tracks can be used as background music for videos, games, and commercials.[41] A famous example of Watson Beat's work is the song *Not Easy*,[42] which was created by Grammy-nominated producer Alex da Kid in collaboration with Watson Beat.[43] "Watson Beat . . . looked at composition of [over 26,000 Billboard Hot 100 songs] to find useful patterns between various keys, chord progressions and genres."[44] Then, Alex would issue commands to Watson Beat like, "[g]ive me something that sounds romantic," or, "give me something that sounds like something I want to dance to."[45] Watson Beat would then produce an "original piece" that Alex would use as inspiration.[46]

The next category is pictures. DeepDream[47] is an example of artificial intelligence capable of creating original pictures without human

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35. As with musical and pictorial works, literary works have long received the protection of copyright laws. *See, e.g.*, *id.* (granting copyright owners the exclusive right "to display the copyrighted [literary] work publicly").

36. *See* Kelly Shi, *Beats by AI*, IBM Res. (July 27, 2016), https://www.ibm.com/blogs/research/2016/07/beats-by-ai/ [https://perma.cc/S32U-8LBP].

37. *See About*, Jukedeck, https://www.jukedeck.com/about [https://perma.cc/3LN8-887X].

38. *See* Aäron van den Oord et al., *WaveNet: A Generative Model for Raw Audio*, DeepMind (Sept. 8, 2016), https://deepmind.com/blog/wavenet-generative-model-raw-audio/ [https://perma.cc/9HW6-AY72].

39. *See* Alex Marshall, *From Jingles to Pop Hits, A.I. Is Music to Some Ears*, N.Y. Times (Jan. 22, 2017), https://www.nytimes.com/2017/01/22/arts/music/jukedeck-artificial-intelligence-songwriting.html [https://perma.cc/S5B7-KPQ9].

40. Shi, *supra* note 36.

41. *See* Marshall, *supra* note 39.

42. Alex da Kid, Not Easy (KIDinaKORNER 2016), https://open.spotify.com/album/4K6Zqkm3dZQncMmunPIl9O [https://perma.cc/8RWQ-UNFQ] (stream through Spotify).

43. *See A Collaboration by Alex Da Kid + IBM Watson*, IBM, https://www.ibm.com/watson/music/noteasy/ [https://perma.cc/5VZQ-GTBX].

44. *Id.*

45. IBM Cognitive Business, *Alex Da Kid and Watson Make Music Together*, Medium (Feb. 1, 2017), https://medium.com/cognitivebusiness/alex-da-kid-and-watson-make-music-together-c251908c1bca [https://perma.cc/4JXZ-8LHC].

46. *Id.*

47. Deep Dream Generator, https://deepdreamgenerator.com/ [https://perma.cc/4ZAZ-4TX7].

direction.[48] In a nutshell, DeepDream analyzes a photograph, guesses what it is, and then enhances certain features based on the guess.[49] The results are "haunting, hallucinogenic imagescapes"[50] that resemble the original photographs but are nonetheless uniquely different.[51] Moreover, DeepDream is able to create pictures seemingly out of nothing by interpreting images of random noise, zooming in, and interpreting and zooming in repeatedly.[52] The results are dream-like pictures that are purely the product of DeepDream's artificial intelligence.[53]

The final category is writings. Automated Insights[54] and Narrative Science[55] are two companies that allow customers to create automated narratives, "many with no human intervention."[56] The following is an example of Narrative Science's work, which describes the third quarter of the 2011 game between the Wisconsin Badgers and the University of Nevada, Las Vegas, (UNLV) Rebels:

> Wisconsin appears to be in the driver's seat en route to a win, as it leads 51-10 after the third quarter.
>
> Wisconsin added to its lead when Russell Wilson found Jacob Pedersen for an eight-yard touchdown to make the score 44-3. The Badgers started the drive at UNLV's 28-yard line thanks to a Jared Abbrederis punt return.
>
> A one-yard touchdown run by Montee Ball capped off a two-play, 42-yard drive and extended Wisconsin's lead to 51-3. The drive took 42 seconds. The key play on the drive was a 41-yard pass from Wilson to Bradie Ewing. A punt return gave the Badgers good starting field position at UNLV's 42-yard line.
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> A 69-yard drive that ended when Caleb Herring found Phillip Payne from six yards out helped UNLV narrow the

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48. *See* Alexander Mordvintsev et al., *Inceptionism: Going Deeper into Neural Networks*, GOOGLE RES. BLOG (June 17, 2015), https://research.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html [https://perma.cc/YQ5X-2NE9].

49. *See* Cade Metz, *How A.I. Is Creating Building Blocks to Reshape Music and Art*, N.Y. TIMES (Aug. 14, 2017), https://www.nytimes.com/2017/08/14/arts/design/google-how-ai-creates-new-music-and-new-artists-project-magenta.html [https://perma.cc/QLQ8-VLSR].

50. *Id.*

51. *See* Mordvintsev et al., *supra* note 48.

52. *See id.*

53. *See id.*

54. AUTOMATED INSIGHTS, https://automatedinsights.com/ [https://perma.cc/2AZX-C2BY].

55. NARRATIVE SCI., https://narrativescience.com/ [https://perma.cc/KE96-YAHW].

56. Shelley Podolny, Opinion, *If an Algorithm Wrote This, How Would You Even Know?*, N.Y. TIMES (Mar. 7, 2015), https://www.nytimes.com/2015/03/08/opinion/sunday/if-an-algorithm-wrote-this-how-would-you-even-know.html [https://perma.cc/S4VN-Q29U].

> deficit to 51-10. The Rebels threw just three passes on the drive.
>
> UNLV will start the fourth quarter with the ball at the 41-yard line.[57]

Such works have become very popular. The Associated Press, for example, uses Automated Insights to produce more than 3,000 financial reports per quarter, and Forbes uses Narrative Science for similar efforts.[58]

In conclusion, due to the increasing popularity and sophistication of artificial intelligence, Congress or the federal courts will soon be required to declare the copyright owner of works created by autonomous artificial intelligence.

II. Current Copyright Laws Fail to Address the Question of Copyright Ownership for Works Made by Autonomous Artificial Intelligence

This Part explains why current copyright laws fail to adequately address the copyright ownership question. To do this, it analyzes three types of sources: Congress, the federal courts, and the Copyright Office.

A. *Congress and the Federal Courts Have Yet to Address Autonomous Artificial Intelligence*

Congress has remained silent on the issue of artificial intelligence, and there appears to be only one recent action on the topic. In May 2017, Congress recognized that "[a]rtificial intelligence is no longer science fiction" and established the Artificial Intelligence Caucus.[59] The Caucus is designed "to inform policymakers of the technological, economic and social impacts of advances in AI and to ensure that rapid innovation in AI and related fields benefits Americans as fully as possible."[60] Without more, however, this action fails to provide guidance as to copyright ownership for works made by autonomous artificial intelligence.

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57. *FINAL: Wisconsin 51, UNLV 17*, Big Ten Network (Sept. 1, 2011), http://btn.com/2011/09/01/first-quarter-wisconsin-20-unlv-0/ [https://perma.cc/9WD5-F28D]; *accord* Steve Lohr, *In Case You Wondered, a Real Human Wrote This Column*, N.Y. Times (Sept. 10, 2011), http://www.nytimes.com/2011/09/11/business/computer-generated-articles-are-gaining-traction.html [https://perma.cc/69W5-PHN4].

58. Podolny, *supra* note 56.

59. Press Release, John K. Delaney, U.S. Congressman, Delaney Launches Bipartisan Artificial Intelligence (AI) Caucus for 115th Congress (May 24, 2017), https://delaney.house.gov/news/press-releases/delaney-launches-bipartisan-artificial-intelligence-ai-caucus-for-115th-congress [https://perma.cc/DHW6-7A24].

60. *Id.*

Similarly, federal courts have yet to face a copyright case involving artificial intelligence. The only case that has addressed nonhuman authorship is *Naruto v. Slater*.[61] There, a monkey named Naruto took pictures of itself using photographer David Slater's camera, and Slater subsequently published the pictures in a book.[62] The People for Ethical Treatment of Animals (PETA) sued Slater for copyright infringement, alleging that Slater's display, advertisement, and sales of the book violated Naruto's copyright.[63] The court dismissed the case, holding that Naruto lacked standing because "[an animal] is not an 'author' within the meaning of the Copyright Act."[64] Therefore, *Naruto* stands for the proposition that works created by animals belong to the public domain.[65]

Although this holding is a useful starting point, it fails to squarely address autonomous artificial intelligence. Importantly, works created by animals lack users, programmers, and companies that could be deemed the copyright owners. Indeed, it was the idea of granting standing to an animal that troubled the court in *Naruto*.[66] Because works made by autonomous artificial intelligence have users, programmers, and companies—who could theoretically have standing—this judicial precedent fails to properly address the question of copyright ownership for such works.

In sum, Congress and the federal courts have yet to address the issue of copyright ownership for works made by autonomous artificial intelligence.

B. *The Copyright Office's Human Authorship Requirement Fails to Properly Address Autonomous Artificial Intelligence*

In arriving at its holding, the court in *Naruto* deferred to the Copyright Office.[67] It noted that "[w]hen interpreting the Copyright Act, the courts defer to the Copyright Office's interpretations in the appropriate circumstances."[68] The court accepted the Office's Human Authorship Requirement, discussed below, without discussion.[69] Because Congress

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

62. *Id.* at *1.

63. *Id.*

64. *Id.* at *4.

65. *See id.*

66. *See id.* at *3 ("[I]f Congress and the President intended to take the extraordinary step of authorizing animals as well as people and legal entities to sue, they could, and should, have said so plainly." (quoting Cetacean Cmty. v. Bush, 386 F.3d 1169, 1179 (9th Cir. 2004))).

67. *Id.* at *4.

68. *Id.* (alteration omitted) (quoting Inhale, Inc. v. Starbuzz Tobacco, Inc., 755 F.3d 1038, 1041 (9th Cir. 2014)).

69. *Id.*

or a federal court could similarly rely on the Office's requirement when addressing a work made by autonomous artificial intelligence, a thorough analysis of the Office's requirement is due.

The Copyright Act[70] states that a copyright shall be granted for an "original work[] of *authorship* fixed in any tangible medium of expression," yet it does not define "authorship."[71] Nonetheless, the Office has established the Human Authorship Requirement, which states that "[t]o qualify as a work of 'authorship' a work must be created by a human being."[72] That is, "the Office will refuse to register a claim if it determines that a human being did not create the work."[73] The requirement's application is straightforward in the context provided by the Office. For example, the Office states that it will refuse to grant a copyright for "driftwood that has been shaped . . . by the ocean"[74] because no one contributed to the creative process.[75] However, in the context of autonomous artificial intelligence, this requirement is ambiguous and antiquated and thus fails to properly address the copyright ownership question.

First, the Office's application of the Human Authorship Requirement is ambiguous with respect to autonomous artificial intelligence. The Office states that it "will not register works produced by a machine . . . that operates randomly or automatically without any creative input or intervention from a human author."[76] While this rule seems to encompass artificial intelligence, the examples provided by the Office make this unclear. As to music, the Office states that it will not register the result of "[t]ransposing a song from B major to C major";[77] however, Watson Beat, Jukedeck, and WaveNet, do more than just transpose songs as they are able to renovate styles and create new tracks.[78] As to pictures, the Office states that it will not register the result of "a mechanical weaving process that randomly produces irregular

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70. Pub. L. No. 94-553, 90 Stat. 2541 (1976) (codified as amended at 17 U.S.C. §§ 101–810 (2012)).

71. 17 U.S.C. § 102(a) (emphasis added); *see id.* § 101.

72. U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 313.2 (3d ed. 2017), https://www.copyright.gov/comp3/docs/compendium.pdf [https://perma.cc/RY7T-G6KE]. It should be noted, however, that the *Compendium* is not binding and does not have the force and effect of law. It merely "provides instruction to agency staff regarding their statutory duties and provides expert guidance." *Id.* intro., at 1.

73. *Id.* § 306.

74. *Id.* § 313.2.

75. *See id.* § 306.

76. *Id.* § 313.2.

77. *Id.*

78. *See* Marshall, *supra* note 39.

shapes in the fabric without any discernible pattern";[79] however, DeepMind does more than just create irregular patterns as it is able to create landscapes from random noise images.[80] As to writings, the Office fails to provide an example.[81] Therefore, the application of the Human Authorship Requirement to autonomous artificial intelligence is ambiguous.

Second, the support behind the Human Authorship Requirement fails to acknowledge autonomous artificial intelligence and is thus antiquated. To support the requirement, the Office quotes language from two cases: *In re Trade-Mark Cases*[82] and *Burrow-Giles Lithographic Co. v. Sarony*.[83] The Office states:

> The copyright law only protects "the fruits of intellectual labor" that "are founded in the creative powers of the mind." *Trade-Mark Cases*, 100 U.S. 82, 94 (1879). Because copyright law is limited to "original intellectual conceptions of the author," the Office will refuse to register a claim if it determines that a human being did not create the work. *Burrow-Giles Lithographic Co. v. Sarony*, 111 U.S. 53, 58 (1884).[84]

First, it must be noted that both cases are more than a century old, meaning they predate the advent of computers by more than half a century.[85] Therefore, their technological contexts shed no light on copyright ownership for works made by autonomous artificial intelligence. Moreover, a close inspection reveals that the cases serve as a poor foundation for the broad bar against nonhuman authorship.

The Office cites *Trade-Mark Cases* for the proposition that "copyright law only protects 'the fruits of intellectual labor' that 'are founded in the creative powers of the mind.'"[86] In *Trade-Mark Cases*, three trademark infringers challenged the constitutionality of the federal trademark statutes.[87] The prosecution offered two sources of constitutional power:

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79. *See* U.S. COPYRIGHT OFFICE, *supra* note 72.

80. *See* Mordvintsev et al., *supra* note 48.

81. *See* U.S. COPYRIGHT OFFICE, *supra* note 72.

82. 100 U.S. 82 (1879).

83. 111 U.S. 53 (1884); *see* U.S. COPYRIGHT OFFICE, *supra* note 72, § 306.

84. U.S. COPYRIGHT OFFICE, *supra* note 72, § 306.

85. The Electronic Numerical Integrator and Computer (ENIAC), first revealed in 1946, is considered the first computer. *See* Frank da Cruz, *Programming the ENIAC*, COLUM. UNIV. COMPUTING HIST. (Apr. 24, 2017), http://www.columbia.edu/cu/computinghistory/eniac.html [https://perma.cc/F34E-GYNP].

86. *See* U.S. COPYRIGHT OFFICE, *supra* note 72, § 306 (quoting *In re* Trade-Mark Cases, 100 U.S. 82).

87. *See In re* Trade-Mark Cases, 100 U.S. at 91–92.

the Patent and Copyright Clause and the Commerce Clause.[88] In relevant part, the Supreme Court held that trademarks were not "writings" under the Patent and Copyright Clause because

> while the word ["]writings["] may be liberally construed, as it has been, to include original designs for engravings, prints, [etc.], it is only such as are original, and *are founded in the creative powers of the mind*. The writings which are to be protected are *the fruits of intellectual labor*, embodied in the form of books, prints, engravings, and the like. The trademark may be, and generally is, the adoption of something already in existence as the distinctive symbol of the party using it.[89]

Therefore, *Trade-Mark Cases* stands for the proposition that Congress cannot regulate trademarks under the "writings" language of the Patent and Copyright Clause.[90] Because trademarks have little in common with works made by nonhumans, this case serves as a shaky foundation for the Office's broad rule.[91] Moreover, the Court in *Trade-Mark Cases* emphasized originality.[92] This indicates that as long as the autonomous artificial intelligence's work is original enough—"books, prints, engravings, and the like"[93]—the Court would deem it "writings" under the Patent and Copyright Clause and thus copyrightable. Therefore, the Office's ban against nonhuman works is antiquated in light of *Trade-Mark Cases*.

Next, the Office cites *Burrow-Giles* for the proposition that "copyright law is limited to 'original intellectual conceptions of the author.'"[94] In *Burrow-Giles*, photographer Sarony sued lithographic company Burrow-Giles, alleging copyright infringement of Sarony's photograph of Oscar Wilde.[95] Burrow-Giles retorted that because photographs merely reproduced people and objects, they were neither "writings" nor created by an "author" under the Patent and Copyright Clause.[96] The Supreme Court held that they were:

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88. *See id.* at 93–95.

89. *Id.* at 94 (emphasis added and omitted).

90. *See id.*

91. *See* Abbott, *supra* note 19, at 1100–01 ("[I]t seems unwise to put much emphasis on dicta from more than a century ago to resolve the question of whether nonhumans could be authors . . . .").

92. *In re* Trade-Mark Cases, 100 U.S. at 94 (emphasizing the word "original").

93. *Id.*

94. U.S. COPYRIGHT OFFICE, *supra* note 72, § 306 (quoting Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 58 (1884)).

95. *See* Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 54 (1884).

96. *See id.* at 56.

By ["]writings["] in that clause is meant the literary productions of those authors, and congress very properly has declared these to include all forms of writing, printing, engravings, etchings, etc., by which the ideas in the mind of the author are given visible expression. The only reason why photographs were not included in the extended list in the act of 1802 is probably that they did not exist, as photography, as an art was then unknown, and the scientific principle on which it rests, and the chemicals and machinery by which it is operated, have all been discovered long since that statute was enacted.

. . . .

We entertain no doubt that the constitution is broad enough to cover an act authorizing copyright of photographs, so far as they are representatives of *original intellectual conceptions of the author*.[97]

Therefore, *Burrow-Giles* stands for the proposition that the original aspects of a photograph are copyrightable.[98] While the Copyright Office requires a human to make the original choices,[99] the Court in *Burrow-Giles* never addressed that issue.[100] Rather, the Court focused on originality,[101] as in *Trade-Mark Cases*,[102] which indicates that as long as the choices made by the autonomous artificial intelligence are original enough—"writing, printing, engravings, etchings, etc."[103]—the resulting photograph should be copyrightable.

Moreover, the Court in *Burrow-Giles* stated that the reason photographs had not been included in the then Copyright Act was because photographs had not existed,[104] and unless they could be distinguished

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97. *Id.* at 58 (emphasis added).

98. *See id.*

99. *See* U.S. COPYRIGHT OFFICE, *supra* note 72, § 306 ("[T]he Office will refuse to register a claim if it determines that a *human being* did not create the work." (emphasis added)).

100. See *Burrow-Giles*, 111 U.S. at 54, 56, 58.

101. *See id.* at 60 (holding for plaintiff only after noting that "the photograph in question . . . is a 'useful, new, harmonious, characteristic, and graceful picture, and . . . plaintiff made the same . . . entirely from his own original mental conception, to which he gave visible form by posing the said Oscar Wilde in front of the camera, selecting and arranging the costume, draperies, and other various accessories in said photograph, arranging the subject so as to present graceful outlines, arranging and disposing the light and shade, suggesting and evoking the desired expression, and from such disposition, arrangement, or representation, made entirely by plaintiff, he produced the picture in suit'" (third omission in original)).

102. *See supra* text accompanying note 92.

103. *Burrow-Giles*, 111 U.S. at 58.

104. *See id.* ("The only reason why photographs were not included in the extended list in the act of 1802 is probably that they did not exist, as photography, as an art, was then unknown, and

from what was then copyrightable (for example, maps, charts, and designs) they should be similarly copyrightable.[105] In other words, the Court instructed for the word "writings" to be interpreted in light of current technologies and practices.[106] Under a similar analysis, the word "authors" must include autonomous artificial intelligence. The reason autonomous artificial intelligence has not been included in the Copyright Act is because such technology has never existed, and unless works made by such machines can be distinguished from works created by what is now deemed an author (that is, humans) their works should be similarly copyrightable. Therefore, the Office's broad ban against nonhuman authorship is antiquated in light of *Burrow-Giles*.

In sum, because the Copyright Office's Human Authorship Requirement is ambiguous and antiquated with regards to works made by autonomous artificial intelligence, the requirement fails to properly address them.

III. POSSIBLE CHOICES: ARGUMENTS FOR AND AGAINST EACH APPROACH

Because there is no proper guidance from Congress, the federal courts, or the Copyright Office as to who would own the copyright of a work made by autonomous artificial intelligence, an analysis of all reasonable copyright allocations is required. This Part analyzes the arguments for and against each approach, and it separates them into three categories: (1) the artificial intelligence as copyright owner; (2) the user, programmer, or artificial intelligence company as copyright owner; and (3) immediate entrance into the public domain. It concludes that the best choice is immediate entrance into the public domain.

A. *The Artificial Intelligence as Copyright Owner*

The first approach is allocating copyright ownership to the artificial intelligence itself by defining the term "author" to include artificial intelligence.[107] In effect, this argument seeks to amend § 101 of the Copyright Act to the following:

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the scientific principle on which it rests, and the chemicals and machinery by which it is operated, have all been discovered long since that statute was enacted.").

105. *See id.* at 57 ("Unless, therefore, photographs can be distinguished in the classification on this point from the maps, charts, designs, engravings, etchings, cuts, and other prints, it is difficult to see why Congress cannot make them the subject of copyright as well as the others.").

106. *See id.*

107. *See* Kalin Hristov, *Artificial Intelligence and the Copyright Dilemma*, 57 J. FRANKLIN PIERCE CTR. INTELL. PROP. 431, 440–41 (2017).

> *An "author" may be a natural person or a computer for purposes of this Act.*

As previously mentioned, the Copyright Act grants a copyright for an "original work[] of authorship fixed in any tangible medium of expression,"[108] yet it defines neither "authorship" nor "author."[109] The argument for this approach states that as long as the requirements of originality and fixation—"the two 'fundamental criteria of copyright protection'"—are met, the copyright should be granted to the creating entity.[110]

As for originality, the law is settled that a minimal amount of originality will suffice regardless of the artistic merit.[111] In *Alfred Bell & Co. v. Catalda Fine Arts*,[112] the court noted that

> nothing in the Constitution commands that copyrighted matter be strikingly unique or novel. . . . All that is needed to satisfy both the Constitution and the statute is that the "author" contributed something more than a "merely trivial" variation, something recognizably "his own." Originality in this context "means little more than a prohibition of actual copying." No matter how poor artistically the "author's" addition, it is enough if it be his own.
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> . . . .
>
> [E]ven if [the author's] substantial departures from the paintings were inadvertent, the copyrights would be valid. A copyist's bad eyesight or defective musculature, or a shock caused by a clap of thunder, may yield sufficiently distinguishable variations. Having hit upon such a variation unintentionally, the "author" may adopt it as his and copyright it.[113]

Therefore, a work is original unless it is an exact copy of something else.[114] Because the artificial intelligence at issue do not merely copy

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108. 17 U.S.C. § 102(a) (2012).

109. *Id.* § 101.

110. *See* Samuelson, *supra* note 12, at 1197, 1199 (quoting H.R. REP NO. 1476, at 51 (1976)).

111. *See* NIMMER & NIMMER, *supra* note 14, § 2.01[B][1].

112. 191 F.2d 99 (2d Cir. 1951).

113. *Id.* at 102–05 (footnotes omitted) (first quoting Chamberlin v. Uris Sales Corp., 150 F.2d 512, 513 (2d Cir. 1945) and then quoting Hoague-Sprague Corp. v. Frank C. Meyer, Inc., 31 F.2d 583, 586 (E.D.N.Y. 1929)).

114. *See id.* at 103.

another's work,[115] the resulting works are sure to meet the low standard of originality.[116]

As for fixation, the Copyright Act states that the work must be "fixed in any tangible medium of expression, now known or later developed, from which [it] can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."[117] In *Midway Manufacturing Co. v. Dirkschneider*,[118] a video-game manufacturer brought suit alleging copyright infringement.[119] The defendant argued, among other things, that the copyrights on the videogames were invalid for lack of fixation.[120] The court disagreed:

> Under [the Copyright Act], it is clear that the plaintiff's audiovisual works are fixed in the printed circuit boards. The printed circuit boards are tangible objects from which the audiovisual works may be perceived for a period of time more than transitory. The fact that the audiovisual works cannot be viewed without a machine does not mean the works are not fixed.[121]

Therefore, a work is fixed when it is on readable electronic hardware.[122] Because works created by artificial intelligence can be stored in a computer's memory and computer memory can be read using a computer, such works are fixed.[123] In sum, because the works created by artificial intelligence are able to meet the two statutory requirements of originality and fixation, the argument goes, they ought to be the owners of the resulting copyright.[124]

The main arguments against this approach are standing[125] and wasted incentive.[126] First, as previously mentioned, only humans have standing under the Copyright Act.[127] Granting standing to artificial intelligence

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115. *See supra* notes 33–58 and accompanying text.

116. *See* Samuelson, *supra* note 12, at 1199.

117. 17 U.S.C. § 102(a) (2012).

118. 543 F. Supp. 466 (D. Neb. 1981).

119. *Id.* at 472.

120. *Id.* at 479.

121. *Id.* at 480.

122. *See id.*

123. *See id.*

124. *See* Samuelson, *supra* note 12, at 1199 ("Machines may be capable of exhibiting sufficient originality to qualify for copyright, and may be able to express that originality in a tangible form. What basis, then, would there be for denying a copyright to a computer?").

125. *See* Hristov, *supra* note 107, at 441.

126. *See* Samuelson, *supra* note 12, at 1199.

127. *See* Naruto v. Slater, No. 15-CV-04324-WHO, 2016 WL 362231, at *4 (N.D. Cal. Jan. 28, 2016) ("The issue for me is whether Next Friends have demonstrated that the Copyright Act confers standing upon [an animal]. In light of the plain language of the Copyright Act, past judicial

would lead to many unsettling questions: Who enforces the right? What remedies should artificial intelligence be granted? What other rights should artificial intelligence receive?[128] Although these questions may one day have to be answered, there is currently no pressing need because sentient artificial intelligence has yet to come.[129] Second, the Patent and Copyright Clause makes clear that copyright law was established to incentivize people to create works by offering them exclusive rights,[130] thereby "promot[ing] the Progress of Science and useful Arts."[131] Currently, computers need no incentive to create; they merely require electricity to create.[132] Thus, the financial incentive that results from a copyright would be meaningless to a computer.[133]

In sum, while an autonomous artificial intelligence might be the statutory creator of its work under the Copyright Act, allocating the copyright to the artificial intelligence would result in overwhelming and unnecessary legal uncertainty, and it would be contrary to the goal of the Patent and Copyright Clause.

B. *The User, Programmer, or Artificial Intelligence Company as Copyright Owner*

The second approach is allocating copyright ownership to the user, programmer, or artificial intelligence company by expanding the "work for hire" doctrine. Under the Copyright Act, copyright ownership initially vests in the author.[134] However, in the case of a "work made for hire," ownership is transferred to the "employer."[135] Currently, a work is a "work made for hire" either when it is created by an employee or when, among other things, it is commissioned.[136] This argument seeks to add a third condition that includes works created by artificial intelligence.[137]

Special copyright ownership provisions exist for "computer-generated" works in the United Kingdom,[138] New Zealand,[139] and

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interpretations of the Act's authorship requirement, and guidance from the Copyright Office, they have not."), *aff'd*, 888 F.3d 418 (9th Cir. 2018).

128. *See* Hristov, *supra* note 107, at 441.

129. *See* Abbott, *supra* note 19, at 1114.

130. *See* Samuelson, *supra* note 12, at 1199.

131. U.S. CONST. art. I, § 8, cl. 8.

132. *See* Samuelson, *supra* note 12, at 1199.

133. *See* Hristov, *supra* note 107, at 444.

134. 17 U.S.C. § 201(a) (2012).

135. *Id.* § 201(b).

136. *Id.* § 101.

137. *See* Annemarie Bridy, *Coding Creativity: Copyright and the Artificially Intelligent Author*, 2012 STAN. TECH. L. REV. 5, 26 (2012).

138. *See* Copyright, Designs and Patents Act 1988, c. 48, § 9(3) (U.K.).

139. *See* Copyright Act of 1994, § 5(2)(a) (N.Z.).

Ireland.[140] There, "computer-generated" works are defined as works generated by computer where there is no human author.[141] Ownership for such works is allocated to "the person by whom the arrangements necessary for the creation of the work are undertaken."[142] Using this framework, this argument seeks to amend the definition of "work made for hire" to include the definition of "computer-generated."[143] More specifically, this argument seeks to amend § 101 of the Copyright Act to the following:

> A "work made for hire" is—
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> (1) a work prepared by an employee within the scope of his or her employment; or
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> (2) a work specially ordered or commissioned for use as a contribution to a collective work, as a part of a motion picture or other audiovisual work, as a translation, as a supplementary work, as a compilation, as an instructional text, as a test, as answer material for a test, or as an atlas, if the parties expressly agree in a written instrument signed by them that the work shall be considered a work made for hire. . . . ; *or*
>
> *(3) a work generated by a computer in circumstances such that there is no human author of the work.*[144]

With this amendment, copyright ownership for works created by artificial intelligence would vest in the "employer."[145] Determining the "employer" in any given case—between the user, the programmer, and artificial intelligence company—would be a question of fact likely determined under agency law.[146]

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140. *See* Copyright and Related Rights Act 2000, pt. II, ch. 2, § 21(f) (Act No. 28/2000) (Ir.).

141. *See* Copyright and Related Rights Act 2000, pt. I, § 2 (Act No. 28/2000) (Ir.); Copyright Act 1994, § 2 (N.Z.); Copyright, Designs and Patents Act 1988, c. 48, § 178 (U.K.).

142. Copyright and Related Rights Act 2000, pt. II, ch. 2, § 21(f) (Act No. 28/2000) (Ir.); Copyright Act 1994, § 5(2)(a) (N.Z.); Copyright, Designs and Patents Act 1988, c. 48, § 9(3) (U.K.).

143. *See* Bridy, *supra* note 137, at 27.

144. *See* 17 U.S.C. § 101 (2012); Bridy, *supra* note 137, at 27.

145. *See* 17 U.S.C. § 201(b).

146. *See* Cmty. for Creative Non-Violence v. Reid, 490 U.S. 730, 740–41 (1989) (holding that the term "employee" with respect to a "work made for hire" must be interpreted under agency law). However, some commentators argue that courts would need to move away from this approach with respect to artificial intelligence. *See, e.g.*, Hristov, *supra* note 107, at 442 ("An amendment of the Copyright Act . . . must diverge from the current agency law approach used to categorize the relationship between an employee and employer . . . ."). Factors could include the amount of user interaction required, which entity provides the required computational power, and whether access to the artificial intelligence is free of charge. *Cf.* Samuelson, *supra* note 12, at

There are several advantages to this approach. First, this approach would reward users, programmers, and artificial intelligence companies for the fruits of their labor.[147] Second, it would incentivize them to disclose any contribution by artificial intelligence in the creative process, where they may otherwise withhold this information due to fear of rejection during copyright registration.[148] Finally, and perhaps most importantly, the artificial intelligence market would benefit from the incentives.[149]

However, there are issues with each of these benefits. First, this approach would over-reward users, programmers, and companies.[150] The purpose of copyright law is to reward the "original intellectual conceptions of the author,"[151] thereby "promot[ing] the Progress of Science and useful Arts."[152] For this reason, a programmer may rightfully obtain a copyright for the code behind artificial intelligence;[153] on the other hand, a parent may not receive a copyright for the artistic works of his or her child.[154] The contribution by the user, programmer, and company is akin to that of parents: They aid in the conception of the entity that creates the work, rather than creating the work themselves. Thus, they would be rewarded despite not contributing to the intellectual conception of the work, contrary to the purpose of copyright law. Moreover, they could "own everything the program was *capable* of generating" by merely allowing the computer to run indefinitely.[155] Thus, they would be over-rewarded with an unlimited number of works

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1202–04 (arguing that users should be granted the copyright because they cause the work to be generated, polish the raw output, and buy or license the program).

147. *Cf.* Samuelson, *supra* note 12, at 1205 (acknowledging that "[t]he computer, after all, simply follows the instructions of the programmer" and that "it is fair to reward the programmer for the value attributable to this fruit of his intellectual labor, even though it may be fruit he had not envisioned").

148. *See* Hristov, *supra* note 107, at 450.

149. *Cf. id.* at 444–45 (arguing that programmers and companies should be granted copyright ownership because otherwise "society would likely see a significant decline in AI generated works and a decline in the overall development of the AI industry"); Samuelson, *supra* note 12, at 1227 (arguing that users should be granted copyright ownership because, much like traditional authors, "they are in the best position to take the initial steps that will bring a work into the marketplace").

150. *Cf.* Samuelson, *supra* note 12, at 1207–08 (arguing that granting the programmer copyright ownership would "over-reward[] the programmer").

151. *See* Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 58 (1884).

152. U.S. CONST. art. I, § 8, cl. 8.

153. *See* Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 702 (2d Cir. 1992) ("It is now well settled that the literal elements of computer programs, i.e., their source and object codes, are the subject of copyright protection.").

154. *Cf.* Abbott, *supra* note 19, at 1094–95 ("No one would exist without their parents contributing to their conception . . . but that does not make parents inventors on their child's patents.").

155. Samuelson, *supra* note 12, at 1208.

produced at an unprecedented rate. Finally, they would be fully rewarded even if they were not granted a copyright: the user would be able to freely use or build upon the work created by the autonomous artificial intelligence; the programmer would enhance his or her reputation and professional desirability;[156] and the artificial intelligence company would benefit from the sales, licensing, and advertisement revenues.[157] Therefore, this approach would over-reward users, programmers, and companies.

Second, honesty in copyright registration should be required, rather than hoped for. A sensible approach would be to require proof of conception for owners and users of artificial intelligence. And if the applicant knowingly omitted proof of conception or the fact that he or she owns or uses artificial intelligence—which could be discovered, for example, during litigation—then the copyright should be invalidated. This framework would provide a strong incentive for honesty.

Finally, while this approach could increase the market for artificial intelligence, it could also lead to access inequality. Under this approach, the "employer" of the artificial intelligence becomes the copyright owner.[158] Therefore, enticed with the highly lucrative opportunity of obtaining copyrights at an unprecedented rate, artificial intelligence companies may decide to hoard access to autonomous artificial intelligence, so as to always remain the "employers" and thus the copyright owners. This would mean that only a handful of software giants,[159] in only a handful of countries,[160] would have access to this technology. Commentators strongly warn about this type of access inequality, with one report from Stanford University stating that "AI could widen existing inequalities of opportunity if access to AI

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156. *See* Abbott, *supra* note 19, at 1106 (arguing that programmers have noneconomic reasons to build creative computers, including "to enhance their reputations, satisfy scientific curiosity, or collaborate with peers").

157. *Cf.* Samuelson, *supra* note 12, at 1207 ("By keeping the program to himself and copyrighting every piece of music . . . that the program generates, the programmer would be able to prevent others from obtaining interests in the program's output. If he does this, of course, the programmer will not make any money directly from the program, although he may profit from selling the output that the program generates. Thus, the programmer has a choice, and should not complain about the consequences of his choice to market the program.").

158. *See supra* note 145 and accompanying text.

159. *Cf. Who Is Winning the AI Race?*, MIT TECH. REV. (June 27, 2017), https://www.technologyreview.com/s/608112/who-is-winning-the-ai-race/ [https://perma.cc/ER3M-9MEY] (reporting a wide gap between the activity of the three leading artificial intelligence companies—Microsoft, Google, and IBM—and any other competing company).

160. *Cf.* Brian O'Keefe & Nicolas Rapp, *Here Are 50 Companies Leading the AI Revolution*, FORTUNE (Feb. 23, 2017), http://fortune.com/2017/02/23/artificial-intelligence-companies/ [https://perma.cc/ZLB6-D3J5] (reporting that the top fifty artificial intelligence companies in the world are located in only six different countries).

technologies . . . is unfairly distributed across society" because "[t]hese technologies will improve the abilities and efficiency of people who have access to them."[161] Thus, because this approach could foster a grab-all environment, it could result in access inequality, which commentators point out as one of the greatest concerns regarding artificial intelligence.

In sum, this approach would over-reward users, programmers, and companies, and it could lead to unequal access to artificial intelligence.

C. *Immediate Entrance Into the Public Domain*

The final approach is the work's immediate entrance into the public domain, whereby no copyright is granted, and everyone is free to use the artificial intelligence's work. According to this argument, because no person generates the artificial intelligence's work, no person should be awarded the copyright.[162] In effect, this argument seeks to amend § 201(a) of the Copyright Act to the following:

> (a) Initial Ownership.—
>
> Copyright in a work protected under this title vests initially in the author or authors of the work. The authors of a joint work are coowners of copyright in the work. *No copyright shall be granted for works generated by a computer in circumstances such that there is no human author of the work.*[163]

With this amendment, no copyright would be granted for works created by artificial intelligence.[164]

The biggest argument against this approach is lost incentive for programmers and artificial intelligence companies.[165] However, any loss

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161. PETER STONE ET AL., STANFORD UNIV., ARTIFICIAL INTELLIGENCE AND LIFE IN 2030: ONE HUNDRED YEAR STUDY ON ARTIFICIAL INTELLIGENCE 43 (2016), https://ai100.stanford. edu/sites/default/files/ai100report10032016fnl_singles.pdf [https://perma.cc/97JB-CSR2].

162. *See* Samuelson, *supra* note 12, at 1224 ("If there is no human author of the computer-generated work, the intellectual property system has assumed no one deserves to be rewarded for it.").

163. *See* 17 U.S.C. § 201(a) (2012). This added language is borrowed from the definition of "computer-generated" in the United Kingdom, New Zealand, and Ireland. *See supra* notes 138–41 and accompanying text.

164. *Cf. supra* notes 144–45 and accompanying text (arguing that a work created by artificial intelligence is "a work generated by a computer in circumstances such that there is no human author of the work").

165. *See* Samuelson, *supra* note 12, at 1225–26 ("[T]he legislature, the executive branch, and the courts seem to strongly favor maximizing intellectual property rewards, especially for high technology innovators. . . . For some, the very notion of output being in the public domain may seem to be an anathema, a temporary inefficient situation that will be much improved when

would likely be offset by other factors. First, as discussed earlier, the user, programmer, and companies would be fully rewarded despite a lack of copyright.[166] Moreover, as Judge Posner once stated, innovation in the software industry is "often incremental, quickly superseded, and less costly to develop, and innovators have a significant first-mover advantage."[167] Therefore, the artificial intelligence industry is likely to continue flourishing regardless of copyrights—as it has until now—because of the incentives inherent to the artificial intelligence industry. Finally, and perhaps most importantly, there is a fierce international race as to which country will lead humanity into the age of artificial intelligence. Russian President Vladimir Putin, for example, has called artificial intelligence the "future . . . of all of mankind," stating that "[w]hoever becomes the leader in this sphere will become the ruler of the world."[168] This race means that artificial intelligence research is likely to continue, with or without copyrights, as a matter of national pride and policy. In sum, there is little reason to believe that immediate entrance into the public domain would lead to any significant loss in incentives for programmers and artificial intelligence companies.

However, an argument can be made that all possible incentives should be given to programmers and companies to develop artificial intelligence for producing the "best" creative works, much like incentives should be given for finding the best discoveries in the scientific fields. Nevertheless, this argument is unpersuasive. For a scientific endeavor, such as antibody sequencing for cancer therapy,[169] it seems reasonable to maximize every possible incentive for programmers and companies to develop artificial intelligence for finding the best cancer therapy.[170] After all, humanity as a whole would benefit from such a cure. On the other hand, in creative fields there is no need to promote, for example, the creation of every

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individual property rights are recognized. Rights must be given to someone, argue those who hold this view; the question is to whom to give rights, not whether to give them at all.").

166. *See supra* notes 156–57 and accompanying text.

167. Ryan Abbott, *Hal the Inventor: Big Data and Its Use by Artificial Intelligence*, *in* BIG DATA IS NOT A MONOLITH 187, 195 (Cassidy R. Sugimoto et al. eds., 2016).

168. Radina Gigova, *Who Vladimir Putin Thinks Will Rule the World*, CNN (Sept. 2, 2017, 1:07 AM), http://www.cnn.com/2017/09/01/world/putin-artificial-intelligence-will-rule-world/index.html [https://perma.cc/TU65-HNY5].

169. *Cf.* Abbott, *supra* note 19, at 1118 (explaining how artificial intelligence could sequence antibodies for therapeutic purposes).

170. Such a cure is not difficult to envision, especially given the breakthroughs in cancer treatments due to recent technological advances. *See, e.g.*, Antonio Regalado, *Biotech's Coming Cancer Cure*, MIT TECH. REV. (June 18, 2015), https://www.technologyreview.com/s/538441/biotechs-coming-cancer-cure/ [https://perma.cc/HG6K-HD3T] (discussing biotechnological "treatments [that] work by removing molecular brakes that normally keep the body's T cells from seeing cancer as an enemy, and [which] have helped demonstrate that the immune system is capable of destroying cancer").

possible painting. There is simply no objective, humanitarian goal. For creative works, "[q]uality does trump quantity in every way."[171] Therefore, there is no need to give programmers and companies every possible incentive to develop artificial intelligence for creative works.

Finally, this approach provides a unique benefit: fostering cooperation between artificial intelligence and humans in the creative fields. Many fear that advances in artificial intelligence will lead to an increase in unemployment,[172] and some scholars have pointed to advances in technology as the cause of the increasing unemployment documented since the dawn of the millennium.[173] Much like automation during the Industrial Revolution displaced those who worked in agriculture,[174] artificial intelligence is estimated to displace roughly half of all jobs in the United States in the near future.[175] Indeed, some commentators call the rise of artificial intelligence the "4th Industrial Revolution" due to these predictions.[176] World-renowned physicist Stephen Hawking went as far as stating that "[t]he development of full artificial intelligence could

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171. Michael Kaiser, *Is It Quantity or Quality That Counts in the Arts?*, HUFFINGTON POST, https://www.huffingtonpost.com/michael-kaiser/is-it-quantity-or-quality_b_859278.html [https://perma.cc/L5KM-RYTT] (last updated July 9, 2011).

172. *See, e.g.*, Abbott, *supra* note 19, at 1117 ("With the expansion of computers into creative domains previously occupied only by people, machines threaten to displace human inventors.").

173. *See, e.g.*, David Rotman, *How Technology Is Destroying Jobs*, MIT TECH. REV. (June 12, 2013), https://www.technologyreview.com/s/515926/how-technology-is-destroying-jobs/ [https://perma.cc/MTU6-6PUY] ("In economics, productivity—the amount of economic value created for a given unit of input, such as an hour of labor—is a crucial indicator of growth and wealth creation. It is a measure of progress. . . . For years after World War II, the two lines closely tracked each other, with increases in jobs corresponding to increases in productivity. The pattern is clear: as businesses generated more value from their workers, the country as a whole became richer, which fueled more economic activity and created even more jobs. Then, beginning in 2000, the lines diverge; productivity continues to rise robustly, but employment suddenly wilts. By 2011, a significant gap appears between the two lines, showing economic growth with no parallel increase in job creation. Brynjolfsson and McAfee call it the 'great decoupling.' And Brynjolfsson says he is confident that technology is behind both the healthy growth in productivity and the weak growth in jobs.").

174. *See id.* ("At least since the Industrial Revolution began in the 1700s, improvements in technology have changed the nature of work and destroyed some types of jobs in the process. In 1900, 41 percent of Americans worked in agriculture; by 2000, it was only 2 percent.").

175. *See* Carl Benedikt Frey & Michael A. Osborne, *The Future Of Employment: How Susceptible Are Jobs To Computerisation?*, 114 TECH. FORECASTING & SOC. CHANGE 254, 265 (2017) ("According to our estimate, 47% of total US employment is in the high risk category, meaning that associated occupations are potentially automatable over some unspecified number of years, perhaps a decade or two.").

176. *See, e.g.*, Bernard Marr, *The 4th Industrial Revolution And A Jobless Future - A Good Thing?*, FORBES (Mar. 3, 2017), https://www.forbes.com/sites/bernardmarr/2017/03/03/the-4th-industrial-revolution-and-a-jobless-future-a-good-thing/#ea1bb2b44a5e [https://perma.cc/R433-4ACF].

spell the end of the human race,"[177] and Elon Musk, founder of Tesla Motors and SpaceX, has likewise compared artificial intelligence to "summoning [a] demon"[178]—and they are not alone.[179] Regardless of labels, it is clear that artificial intelligence is likely to drastically change the employment landscape in the near future, and it is imperative to ensure that humans remain an integral part of fields that do not necessarily require complete automation—such as the creative fields.[180] Immediate entrance into the public domain would help ensure just this. More specifically, human contribution would be required to obtain copyrights from the artificial intelligence's raw output.[181]

In sum, immediate entrance into the public domain is the best approach to resolving the question of copyright ownership of works created by autonomous artificial intelligence. The artificial intelligence industry will likely continue to thrive regardless of copyrights, and this approach would help ensure that humans remain an integral part of creative fields.

CONCLUSION

The increasing sophistication and proliferation of artificial intelligence has given rise to a pressing question: Who is the copyright owner of a work created by autonomous artificial intelligence? Thus far, Congress has remained silent on the issue, federal courts have yet to face the question, and the little guidance provided by the Copyright Office is ambiguous and antiquated. Out of the possible choices, immediate entrance into the public domain is the best option.

Allocation of copyright ownership to the artificial intelligence would lead to nonhuman standing, which would lead to unnecessary uncertainty in the legal system. This would also lead to lost incentives, which is contrary to the goals of the Patent and Copyright Clause of the Constitution. Likewise, allocation to the user, programmer, or artificial

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177. Rory Cellan-Jones, *Stephen Hawking Warns Artificial Intelligence Could End Mankind*, BBC NEWS (Dec. 2, 2014), http://www.bbc.com/news/technology-30290540 [https://perma.cc/EUV2-PSYW].

178. David Shukman, *How Safe Can Artificial Intelligence Be?*, BBC NEWS (Sept. 15, 2015), http://www.bbc.com/news/science-environment-34249500 [https://perma.cc/56UY-THLZ].

179. *See, e.g.*, Dion Dassanayake, *Bill Gates Joins Stephen Hawking in Warning Artificial Intelligence Is a Threat to Mankind*, EXPRESS (Jan. 29, 2015), https://www.express.co.uk/news/world/555092/Bill-Gates-Stephen-Hawking-Artificial-Intelligence-AI-threat-mankind [https://perma.cc/ZV46-6WV3] (noting that Microsoft founder Bill Gates agrees with Stephen Hawkins and Elon Musk regarding the dangers of artificial intelligence).

180. *See supra* notes 169–71 and accompanying text (arguing that there is no need to maximize every possible incentive for developing artificial intelligence for the creative fields).

181. *See supra* notes 162–64 and accompanying text (noting that, under this approach, a work created by artificial intelligence would enter the public domain only when there is a lack of human contribution).

intelligence company would lead to over-rewarding, and it could lead to unequal access to artificial intelligence. On the other hand, immediate entrance into the public domain would ensure that the users, programmers, and companies are adequately rewarded, and it would ensure that humans remain an integral part of the creative fields.