The Human Cause*

Daniel J. Gervais*

<a> 1. Introduction

Oxford University Professor Nick Bostrom's book *Superintelligence: Paths, Dangers, Strategies* describes an advanced future form of Artificial Intelligence (AI) of which he says it will be the last invention made by humans.[1] Though this 'superintelligence' belongs to the world of science-fiction, there is no doubt that there are 'challenges posed by highly intelligent (ro)bots participating with humans in the commerce of daily life'.[2] Nowhere are those challenges more manifest than when those machines are able to perform tasks that until recently only humans could, namely tasks anchored in our higher mental faculties, including human creativity and our ability to develop innovative technologies. The area of law that is most likely to feel the impact of this emergence of a second intelligent and potentially creative and inventive 'species' is intellectual property.[3]

The ability of AI to produce literary and artistic works and inventions matters on another level.[4] By now, we are used to letting robots perform much of the physical labor previously done

** Milton R. Underwood Chair in Law, Vanderbilt University. Send any comments to daniel.gervais@vanderbilt.edu This chapter is based in part on the auhtors'2020 Sir Hugh Laddie Lecture. The Author is grateful to the Editor both for his comments and for inviting a contribution that takes a radically different view than most other chapters in this volume.

[1] There is no universally agreed upon definition of Artificial Intelligence. The chapter adopts the definition used by the European Commission: 'Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals'.[emphasis added]. European Commission, Communication on 'Artificial Intelligence Europe', COM(2018) 237 final (April 25, 2018), online https://bit.ly/2HFft4J.

[2] WENDELL WALLACH & COLLIN ALLEN, MORAL MACHINES: TEACHING ROBOTS RIGHT FROM WRONG 189 (Oxford University Press, 2009).

[3] Admittedly, I use the term 'species' in a non-technical way in this context.

[4] In this chapter, human creativity and inventiveness will be referred to as 'natural', while machine creativity and inventiveness will be referred to as 'artificial', following the same logic as the terms 'natural language' and 'artificial intelligence'.

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by humans.[5] With less of *that* kind of work, our capacity to create art, music, literature, conversation, architecture, food, and more 'is likely to be more needed than ever'.[6] Yet, as things stand now, we are 'devoting huge scientific and technical resources to creating ever-more-capable AI systems, with very little thought devoted to what happens if we succeed'.[7] If machines become creators and inventors in our stead, will we be able to, as Keynes aptly put it, 'keep alive, and cultivate into a fuller perfection, the art of life itself'?[8] It is at least worth pondering. To state but one reason, changes in cultural productions and trends both lead and reflect societal changes, which in turn lead to political and, ultimately, legal changes. Literature in all forms, fine arts and music are among the most important vehicles to both mirror and propagate changes throughout society. If those cultural vehicles are made of art, books and lyrics created by AI machines, then those machines will control at least a part of cultural, societal and political change. Think of it as *self-driving culture*, and it will be a U-turn as far as human evolution is concerned.

This chapter cannot predict whether human authors and inventors will survive as a significant source of cultural production and technological innovation in the medium to long term. On a shorter time horizon, however, a fair question to ask is whether intellectual property *should* prioritize *human* (or natural) creativity and inventiveness or else treat machine and human productions on the same footing and accelerate the replacement of human creators and inventors. As used in this chapter, giving 'priority' would mean granting rights only in facially copyrightable or patentable productions that have a *human cause*, which can be provisionally defined for now as a sufficient link between one or more humans and the potentially copyrightable or patentable output.[9] This explains the double-entendre in the title of the chapter: while the chapter discusses whether intellectual property protection should only attach to

[5] On robots replacing human workers, *see* Bill O'Leary, *My Robot And Me*, 68:6 ELECTRICAL APPARATUS 18 (2015).

[6] STUART RUSSELL, HUMAN COMPATIBLE: ARTIFICIAL INTELLIGENCE AND THE PROBLEM OF CONTROL, 122 (Viking Press, 2019).

[7] *See* WALLACH & ALLEN, *supra* note 2, at 151.

[8] JOHN MAYNARD KEYNES, ESSAYS ON PERSUASION (New York: Norton, 1963) at 331.

[9] As used in this chapter, the term production encompasses (a) creations that may be protected by copyright, (b) designs, and (c) inventions that may be protectable by patents.

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creations and inventions that have an identifiable and sufficient human *cause*, it also implies that the future of humans (their 'cause') is involved. As the chapter explains below, the notion of cause used here is similar to proximate cause, not simple (or 'but for') cause.

One can use the US Constitution as a useful backdrop for the analysis. It is unique among constitutional documents in that it not only gives one level of government (federal) the power to make laws in the area of copyright and patents, it actually states what the purpose of those laws is, or should be: to 'Promote the Progress of Science and Useful Arts'. [10] What if the novelists, songwriters, journalists and inventors of tomorrow were machines? What if the role of humans—other than for the few who would profit from this situation—was relegated to reading novels and news, listening to music and buying new products produced by machines? Were the Founding Fathers thinking of 'progress' in those terms, that new art and science would be produced for its own sake, not for *human* progress? To answer, let us turn the knob all the way: if all humans died would the US Constitution's direction still be followed provided art and science continued to be produced—both *by* machines, and *for* machines?

We need not turn the knob all the way to find the path to a policy prescription. If machines can produce new drugs or literary and artistic works cheaper and faster than human creators, it a highly likely that industry will favour them over their human counterparts. In the copyright sphere, delegating to machines the task of helping us understand and interpret our world has profound consequences. It is through this interpretation that humans can become true agents in the world and ultimately change it. Delegating this very task to machines is thus pregnant with implications for the future for it changes its arc. It will not be complete obliteration of course. There will always be humans who write, pick up a paintbrush, or try to make a movie or sculpture, but if most of what we are given to read, watch or listen to comes from machines, much will be lost. If copyright protection is granted on outputs without a human cause, and assuming that the cost of machine productions will be lower (and machines will not ask for ongoing royalty payments or have reversion rights) then market forces will inescapably push for a replacement of human authors whenever it is commercially feasible.

[10] U.S. CONST, Art. 1, §8, cl.8. This chapter knows of no other constitutional document that does so.

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In science, if machines can do both basic science and develop new technologies, as examples in this volume demonstrate, private labs will hire fewer science PhDs. Science departments in universities will atrophy as the demand for human-made science contracts. The arc of the quest for a deeper and better understanding of the natural world that has animated humans arguably since the invention of fire will also be bent. In sum, our highest and noblest ideals will be delegated, at least in part to machines. This should perhaps give us pause.

While, as other chapters in this book illustrate, we can debate what exactly constitutes 'progress' (especially, one might add, from a postmodernist perspective), this chapter's normative sextant is that the term 'progress' must mean *human* progress, as many philosophers have done through the ages.[11] For example, Plato defended in his *Laws* the idea that the legal system is a way to support human progress.[12] Even Aristotle might have agreed as human flourishing is a core notion of his *Nicomachean Ethics*. According to this view, 'the invention of man is infinitely better contrived to advance the good and happiness of mankind, than any Utopian system that ever has been produced, by the warmest imagination'.[13] Of the imagination of a machine?

Let us begin by making three general points before diving deeper into the analysis. The first is that certain AI machines can be programmed to learn to *mimic* human mental processes. Part of the ongoing research in AI is precisely to make machines more like humans instead of a new, complementary type of intelligence. As a result, there is little doubt that machines already produce outputs that are often indistinguishable from human creations and inventions. From that perspective, giving rights on productions that look like copyright works or patentable inventions but made by machines strikes the author of this chapter as a new Turing test.[14] Normatively, it

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[11] *See generally* DANIEL GERVAIS, THE LAW OF HUMAN PROGRESS (Amsterdam: deLex, 2019).

[12] PLATO, LAWS, VII:680a-682d.

[13] HENRY H. KAMES, ESSAYS ON THE PRINCIPLES OF MORALITY AND NATURAL RELIGION, 86. S*ee also* J.J. Chambliss, *Human Development in Plato and Rousseau* 13:2 THE JOURNAL OF EDUCATIONAL THOUGHT 96, 98 (1979).

[14] That may remind the reader of the 'Turing test', a set of questions asked via teletype on any subject whatsoever. Unbeknownst to the questioner, some were answered by a human; others by a machine. Both the human being and the machine attempted to convince the questioner that it or she is the human and the other is not. *See* Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1236 (1992).

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would amount to rewarding the owner or user of a machine that can 'pass itself off' as human. Surely that illusion cannot be a solid normative foundation to obtain IP protection.[15]

Second, humans and machines are working ever closer together. This rapprochement will continue.[16] Humans depend on machines to perform many creative and inventive tasks, and indeed, machines have already changed how humans perform those tasks. In some cases, machines can help us achieve our aims better and faster. It is not always so. To take a simple example of a change in cognitive processes with a more ambivalent valence, people who started driving a car before GPSs were omnipresent can still drive in cities where they drove before the GPS without assistance from that technology, but are much less able to do so elsewhere without GPS.[17]A key question to answer in this context is, what happens over the medium to long term as we outsource creative or inventive work to machines? Humans, as a species, may lose on two fronts: diminished human expression, and reduced financial flows to human creators and inventors, who would no longer have the incentive, time or financial ability to learn and develop their craft. To say that creativity is human, that it is fundamentally connected with *humanness*, is not 'to impose a kind of chauvinism that privileges human-produced artifacts over those that are machine-made. Rather, it is to say that human communication is the very point of authorship as a social practice; indeed, as a condition of life'.[18]

The third and final general point is that there are proposals to short-circuit that entire discussion by giving 'person' status (which is not the same as 'human' status of course) to some

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[15] *See* SELMER BRINGGJORD & DAVID A. FERRUCCI, ARTIFICIAL INTELLIGENCE AND LITERARY CREATIVITY: INSIDE THE MIND OF BRUTUS xxvi (Mahwah, NJ : Lawrence Erlbaum Associates, 2000).

Passing off is tort notion borrowed from trademark law defined as 'when a producer misrepresents his or her own goods or services as those of another producer'. Laura Gasaway, *Origin of Goods in Trademark Law Does Not Mean Creator*; COPYRIGHT CORNER, Special Libr. Ass'n Info. Outlook, Nov. 1, 2003, at 7. See also 15 U.S.C. §1125(a) ('palming off'); and Dastar Corp. v. Twentieth Cent. Fox Film Corp., 539 U.S. 23, 28 n.1 (2003).

[16] One should not avoid is drawing the line between human and machine, which will not always be easy as cyborgization increases, but the legal system must be able to draw that line.

[17] Javadi, Amir-Homayoun et al., *Hippocampal and Prefrontal Processing of Network Topology to Simulate The Future*, 8 NATURE COMM. 14652 (2017), online: https://www.nature.com/articles/ncomms14652#citeas

[18] Carys Craig and Ian Kerr, *The Death of the AI Author*, 52 OTTAWA L REV 31-86 (2021).

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AI machines.[19] The root of the first word in the term 'artificial intelligence', namely 'artificial', is 'artifice', the definition of which is 'an ingenious device or expedient'.[20] This is apt because the proposal to give some AI machines legal personality may be just that, an expedient that circumvents the two underlying normative issues, namely whether such machines *should* be persons and *should* get IP rights.[21]

<a> 2. Brief Overview of the State of Play in AI

A significant portion of the literature exploring the interface between AI and the law adopts the distinction between *narrow* (or weak) and *general* (or strong) AI.[22] The distinction can be traced back to Ray Kurzweil's seminal piece *The Singularity Is Near*.[23] In this traditional categorization, narrow or weak AI 'is goal-oriented, designed to perform singular tasks—i.e. facial recognition, speech recognition/voice assistants, driving a car, or searching the Internet—and is very intelligent at completing the specific task it is programmed to do.'[24] It operates within a well-defined ' activity-context.'[25] In contrast, Artificial General Intelligence (AGI), or

[19] *See, e.g.,* Shawn Bayern, *Of Bitcoins, Independently Wealthy Software, and the Zero-Member LLC*, 108 NW. U.L. REV. 1485, 1497 (2014)

[20] 'Artifice', MERRIAM-WEBSTER DICTIONARY, https://www.merriam-webster.com/dictionary/.

[21] *See* David J. Calverley, *Imagining a Non-Biological Machine as a Legal Person*, 22 AI & SOC. 523 (2008). This is in line with a United Nations report, which noted that it would be 'highly counterintuitive to call [AI systems] 'persons' as long as they do not possess some additional qualities typically associated with human persons, such as freedom of will, intentionality, self-consciousness, moral agency or a sense of personal identity'.) UNESCO, World Comm. on the Ethics of Scientific Knowledge and Technology (COMEST), Rep. of Com. on Robotics Ethics, U.N. Doc. SHS/COMEST-10/17/2 REV., at 46 (Sept. 14, 2017).

[22] *See* Michael Guihot, Anne F. Matthew & Nicolas P. Suzor, *Nudging Robots: Innovative Solutions to Regulate Artificial Intelligence*, 20 VAND. J. ENT. & TECH. L. 385, 393 (2017). *See also* Shannon Vallor & George A. Bekey, *Artificial Intelligence and the Ethics of Self-Learning Robots*, in ROBOT ETHICS 2.0: FROM AUTONOMOUS CARS TO ARTIFICIAL INTELLIGENCE 339-340 (Patrick Lin, Keith Abney, & Ryan Jenkins eds., 2017); and Peter Stone et al., *Artificial Intelligence And Life In 2030*: *Report of the 2015 Study Panel* 6-9 (2016), https://ai100.stanford.edu/sites/default/files/ai_100_report_0831fnl.pdf.

[23] RAY KURZWEIL, THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY 206, 222 (Rick Kot ed., 2005).

[24] Serena Reece, *What Are The 3 Types Of AI? A Guide To Narrow, General, And Super Artificial Intelligence,* CODEBOTS, Jan. 31, 2020, online: https://codebots.com/artificial-intelligence/the-3-types-of-ai-is-the-third-even-possible

[25] Stephen Russell, Ira S. Moskowitz & Adrienne Raglin, *Autonomy and Artificial Intelligence: a Threat or Savior?*, in (W. F. Lawless, et al., eds), AUTONOMY AND ARTIFICIAL INTELLIGENCE: A THREAT OR SAVIOR?, 71, 73 (Springer, 2017).

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strong AI, 'is the concept of a machine with general intelligence that mimics human intelligence and/or behaviours, with the ability to learn and apply its intelligence to solve any problem. AGI can think, understand, and act in a way that is indistinguishable from that of a human in any given situation.'[26] A number of scholars go a step further. Nick Bostrom, who was mentioned in the opening paragraph, discusses the risks to humans of developing machines with a higher level still, which he dubbed 'superintelligence,' that is 'an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills.'[27] This Artificial Super Intelligence (ASI) 'is the hypothetical AI that doesn't just mimic or understand human intelligence and behaviour; ASI is where machines become self-aware and surpass the capacity of human intelligence and ability.'[28]

This chapter retains this traditional categorization but sticks to the first two categories (narrow and strong), as it sees the third (ASI) category as belonging to the world of sci-fi—at least for now. Machines can beat the best human masters at chess, Go, the gameshow *Jeopardy* and much more—even at an incomplete information game like poker.[29] Though undoubtedly very impressive, those achievements 'are much simpler than the *real world*: they are fully observable, they involve short time horizons, and they have relatively small state spaces and simple, predictable rules.'[30]

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[26] Reece, *supra* note 24.

[27] Nick Bostrom, *How Long Before Superintelligence*?, 5 LINGUISTIC & PHIL. INVESTIGATIONS 11, 11 (2006). Updated version (2008), online at https://www.nickbostrom.com/superintelligence.html.

[28] Reece, *supra* note 24.

[29] See Cade Metz, *In Two Moves, AlphaGo and Lee Sedol Redefined the Future*, WIRED, March 16, 2016, online: https://www.wired.com/2016/03/two-moves-alphago-lee-sedol-redefined-future/. The 'former' champion eventually retired as a result. *See* James Vincent, *Former Go Champion Beaten By DeepMind Retires After Declaring AI Invincible*, THE VERGE (Nov 27, 2019). The difference in the levels of complexity is not the only one between chess and Go. Chess is tactical while Go is best described as strategic. It requires a different kind of 'thinking.' Cade Metz, *In a Huge Breakthrough, Google's AI Beats a Top Player at the Game of Go*, WIRED, Jan. 27, 2016, online: https://www.wired.com/2016/01/in-a-huge-breakthrough-googles-ai-beats-a-top-player-at-the-game-of-go/. On IBM's DeepBlue beating the world chess grandmaster Gary Kasparov, *see IBM's 100 Icons of Progress: Deep Blue*, https://www.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/ [https://perma.cc/7SG3-UYST] On poker, see Tracey Lien, T., *Artificial Intelligence Has Mastered Board Games; What's The Next Test?* SEATTLE TIMES (March 20, 2016), online http://www.seattletimes. com/business/technology/artificial-intelligence-has-mastered-board-games-whats-the-next-test/

[30] RUSSELL, *supra* note 6, at 56. Emphasis added.

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This raises a related question, namely whether people will still have an incentive to play games like chess or Go professionally, even with the knowledge that an AI machine can beat the best humans, even with a few computer chips tied behind its back. I believe the answer is yes. I start from the premise that humans have always played and always will.[31] If you accept that premise, then if someone plays, say, chess, every day for years, they will become good at it. They can then enter the human "rankings" (eg grandmaster) system. Now, why would other players want to see those people play even if they know they cannot fight the machine and hope to win? For two main reasons. First, because humans are more likely to learn from watching other humans and not machines, whose "thinking" may not be the same as those of humans and who may not be able to explain their thinking to begin with.[32] Second, I posit that humans like to watch other humans "struggle."[33] To simplify to the extreme, this is why we watch sports but also, say, a "strong man" pulling a ton of bricks with ropes, something any half-decent pickup truck can do on a couple of cylinders. For similar reasons, I am much more worried about machines replacing songwriters and composers than about machines replacing live performers. People will likely want to see human artists/performers. It is thus essential in debates about the future of copyright to distinguish authors from performers, a well understood and fundamental distinction in the law of copyright and related rights.[34]

In the field of potentially patentable outputs, AI is now routinely used to accelerate and reduce the costs of pharmaceutical research, performing in silico research.[35] AI machines can find hidden patterns within large datasets and automate many predictions.[36] Outputs from AI in

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[31] *See generally* Juho Hamari& Lauri Keronen, *Why Do People Play Games? A Meta-Analysis*, 37:3 INT'L J. INF. MANAG'T, 125 (2017).

[32] The idea that humans and machines can both perform a function that can be described as "thinking" but do so differently is not new. *See e.g.*, PHILIP N. JOHNSON-LAIRD., HUMAN AND MACHINE THINKING (Hillsdale, NJ : L. Erlbaum Associates, 1993).

[33] *See* Michael Safi et al, *How Magnus Carlsen Won Chess Back From The Machines*, THE GUARDIAN (Dec. 12, 2021), available at https://bit.ly/33n4Mlu.

[34] *See* Daniel Gervais, *Related Rights in United States Law*, 65 J. COPYRIGHT SOC'Y U.S.A. 371-393 (2018).

[35] *See* Nic Fleming, *How Artificial Intelligence Is Changing Drug Discovery*, 557 NATURE 55 (2018).

[36] *See generally* AJAY K. AGRAWAL, JOSHUA S. GANS, & AVI GOLDFARB, PREDICTION MACHINES: THE SIMPLE ECONOMICS OF ARTIFICIAL INTELLIGENCE (Harv. Bus. Press, 2018).

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pharmaceutical research include disease diagnosis and prediction of drug efficacy[37] and support for drug design.[38] AI machines can choose which molecules possess suitable characteristics to address biological targets of interest.[39] AI can identify the optimal chemical structures to reduce toxicity and satisfy metabolic requirements, both of which can be costly and data-intensive processes.[40] They can improve the area of personalized medicine based on genetic markers.[41] That potential of AI to identify novel drugs that human researchers alone cannot detect has attracted investment from both start-ups and established pharmaceutical companies.[42] Also noteworthy, in what was perhaps a publicity stunt, Google announced that its AI machines can both make new inventions and apply for patents.[43]

In the fields of design and literary and artistic works, AI machines have composed polyphonic baroque music bearing the 'style' of Johann Sebastian Bach.[44.] 'Robot reporters' now routinely write news bulletins and sports reports, a process called 'automated journalism.'[45] AI

[37] *See* Gregor Guncar et al., *An Application Of Machine Learning To Hæmatological Diagnosis*, 8 SCIENTIFIC REPORTS 411 (2018), online: https://bit.ly/3qrclyS.

[38] *See* Hongmin Chen et al., *The Rise Of Deep Learning In Drug Discovery*, 23 DRUG DISCOVERY TODAY, 1241–1250 (2018).

[39] *See id.*

[40] *See id.*

[41] *See* Kit-Kay Mak & Mallikarjuna Rao Pichika, *Artificial Intelligence In Drug Development: Present Status And Future Prospects*, 24:3 DRUG DISCOVERY TODAY 773 (2019).

[42] *See* Lou Bowen & Lynn Wu, *Artificial Intelligence And Drug Innovation: A Large Scale Examination Of The Pharmaceutical Industry* 2 (2020), online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3524985.

[43] *See* Rose Hughes, *Deepmind: First Major AI Patent Filings Revealed*, IPKAT, June 7, 2018, online http://ipkitten.blogspot.com/2018/06/deepmind-first-major-ai-patent-filings.html. The reverse use of AI is true, namely to defeat patent applications, based on obviousness (to an AI expert) or novelty, by massive preemptive public disclosure of novel subject matter together with its utility. On the former, *see* Ryan Abbott, *Everything Is Obvious*, 66 UCLA L. REV. 2, 40 (2019). On the latter issue, *see* Daniel Gervais, *Exploring the Interfaces Between Big Data and Intellectual Property Law*, 10:3 J. INTELL. PROP., INF. TECH. & E-COMM. L. (2019), online: https://www.jipitec.eu/issues/jipitec-10-1-2019/4875.

[44] *See* Gaëtan Hadjeres & François Pachet, Deepbach: *A Steerable Model For Bach Chorales Generation* (Dec. 3, 2016) at 1, online: https://arxiv.org/pdf/1612.01010v1.pdf.

[45] *See* Corinna Underwood, *Automated Journalism – AI Applications at New York Times, Reuters, and Other Media Giants*, EMERJ (June 22, 2017, updated November 29, 2018), online: https://bit.ly/2Q84BTV. *See also* Lucia Moses, *The Washington Post's Robot Reporter Has Published 850 Articles In The Past Year*, DIGIDAYUK, Sept. 14, 2017, online: https://bit.ly/2xmkQSI.

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systems write poems that many people believe were written by a human author.[46] AI machines draft and analyze contracts.[47] A machine named e-David produces paintings using a complex visual optimization algorithm that 'takes pictures with its camera and draws original paintings from these photographs.'[48] AI machines can write scenes of animation movies and improve the design of objects or processes, thus generating productions that facially qualify as subject matter for copyright or design patent protection.[49] Let us now briefly see how AI does it.

<a> 3. How AI Works

In this section, the chapter reviews a few basic notions of AI that will be important as we attempt to draw conclusions later on.

The deployment of AI can be separated into steps. First, AI code is written. This code, as the technology stands now, is generally the work of human programmers—though that is changing--, and it can be split into pieces, such as a generic AI platform and specific apps developed for a precise purpose.[50] The code is mostly used to empower the next step, a process known as machine-learning, which today is 'the dominant AI technology.'[51] Machine-learning

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[46] *See* Samuel Gibbs, *Google AI Project Writes Poetry Which Could Make Vogon Proud*, THE GUARDIAN (May 17, 2016)

[47] *See* Kathryn D. Betts & Kyle R. Jaep, *The Dawn of Fully Automated Contract Drafting: Machine Learning Breathes New Life into A Decades-Old Promise*, 15 DUKE L. & TECH. REV. 216 (March 29 2017)

[48] *See* Shlomit Yanisky-Ravid, *Generating Rembrandt: Artificial Intelligence, Copyright, And Accountability In The 3a Era—The Human-Like Authors Are Already Here—A New Model*, [2017] MICH. ST. L. REV. 659, 662.

[49] On copyright, *see* Jane C. Ginsburg and Luke Ali Budiardjo, *Authors and Machines* 34 BERK. TECH. L. J. 343 (2019). The United States Court of Appeals for the Federal Circuit noted that processes 'that automate tasks that humans are capable of performing are patent-eligible if properly claimed.' McRO, Inc. v. Bandai Namco Games Am. Inc., 837 F.3d 1299, 1313 (Fed. Cir. 2016). For a discussion, *see* Ben Hattenbach & Gavin Snyder, *Rethinking the Mental Steps Doctrine and Other Barriers to Patentability of Artificial Intelligence*, 19 COLUM. SCI. & TECH. L. REV. 313, 317–18 (2018); and Mizuki Hashiguchi, *The Global Artificial Intelligence Revolution Challenges Patent Eligibility Laws*, 13 J. BUS. & TECH. L. 1, 13 (2017).

[50] On AI machines writing their own code, *see* Khari Johnson, *AI Could Soon Write Code Based on Ordinary Language*, WIRED (May 26, 2021), online: https://www.wired.com/story/ai-write-code-ordinary-language/ (accessed May 31, 2021).

[51] UK Information Commissioner's Office and Alan Turing Institute, Explaining How Decisions Are Made with AI, 7 (May 20, 2020), online: https://bit.ly/2zs68gi. *See also* Roberto Iriondo, Differences *Between AI and Machine Learning and Why it Matters*, DATA DRIVEN INVESTOR, (Oct. 15, 2018),

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can be *supervised* (by humans), or not. '*Unsupervised*' in this context means that the system is 'trained on a dataset without explicit instructions or labelled data.'[52] Situated between supervised and unsupervised learning, *reinforcement learning* is a third mode of machine-learning, in which humans verify what the machine has learned on its own and hopefully correct mistakes, often using sampling techniques.[53]

Machine-learning in all three modes is used both to discern and operationalize patterns in data.[54] It uses a set of 'computational methods using experience to improve [its] performance or to make accurate predictions.'[55] Using machine-learning, an AI system can 'automatically generate heuristics' and make autonomous determinations of various kinds.[56] It can adjust its 'behavior to enhance [its] performance on some task through experience.'[57] A machine can, for example, be shown pictures of cats and dogs and then learn the features of each so that it can distinguish cats and dogs it has never 'seen' before.[58] The quality of the learning process is obviously dependent on the quality of the training data, as some well-documented disastrous examples have brought to light.[59] This is a problem for uses of AI in a legal context, for example

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https://medium.com/datadriveninvestor/differences-between-ai-and-machine-learning-and-why-it-matters-1255b182fc6

[52] *See* UK Information Commissioner's, *id*.

[53] *See* Leslie Pack Kaelbling, Michael L. Littman & Andrew W. Moore, *Reinforcement Learning: A Survey*, 4 J. ARTIFICIAL INTELLIGENCE RES. 237 (1996).

[54] Michael Veale, *Governing Machine Learning that Matters*, PhD dissertation, 33 (2019), online: https://discovery.ucl.ac.uk/id/eprint/10078626/1/thesis_final_corrected_mveale.pdf.

[55] MEHRYAR MOHRI, AFSHIN ROSTAMIZADEH & AMEET TALWALKAR, FOUNDATIONS OF MACHINE LEARNING, 2D ED. 1 (MIT Press, 2018)

[56] WOLFGANG HERTEL, INTRODUCTION TO ARTIFICIAL INTELLIGENCE 102 (Springer, 2011). AI programmers use several different algorithmic techniques, depending (usually) on the task at hand. For a detailed overview, see Explaining How Decisions Are Made with AI, above note 51, Annex 2.

[57] Harry Surden, *Machine Learning and the Law*, 89 WASH. L. REV. 87, 89 (2014).

[58] See Amanda Levendowski, *How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem*, 93 WASH. L. REV. 579, 592 (2018)

[59] For example, when Google's AI created a link between images of African Americans and gorillas. *See* James Vincent, *Google 'Fixed' Its Racist Algorithm By Removing Gorillas From Its Image-Labeling* Tech, THE VERGE (Jan 12, 2018), online: https://www.theverge.com/2018/1/12/16882408/google-racist-gorillas-photo-recognition-algorithm-ai; or when a new Microsoft AI chatbot quickly turned racist by 'learning' on social media. *See* James Vincent, *Twitter Taught Microsoft's AI Chatbot to Be a Racist Asshole in Less Than a Day*, THE VERGE (Mar. 24, 2016), online: https://www.theverge.com/2016/3/24/11297050/tay-microsoft-chatbot-racist.

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when AI machines used in bail and sentencing decision-making reflect racial or socio-economic biases due to the poor quality of the training data that was selected.[60] Put bluntly, in some cases '[m]achine learning is a 'garbage in-garbage out' proposition.'[61] As the many examples of AI achievements in the previous Section demonstrate, however, machine-learning can also be both quite powerful and productive. In sum, the quality and size of the data 'are crucial to the success of the predictions made by the [AI] learner.'[62]

The machine-learning function can take the form of 'deep learning,' a subset of machine-learning using a layered structure of algorithms allowing the machine to learn and make predictions and *decisions on its own*.[63] Deep learning has been called 'the true challenge to artificial intelligence,' namely solving the tasks that are easy for people to perform but hard for people to describe formally—problems that we solve intuitively, that feel automatic, like recognizing spoken words or faces in images.'[64] With deep learning, one could say– acknowledging that metaphors are intellectual shortcuts—that the computer has its own, autonomous brain.[65] Importantly, deep learning is *automated* and often (if not almost always) removed from direct human input or control.[66]

There are various ways to make AI systems learn and perform better. One of them is the development of General Adversarial Networks (GANs), a technological path likely to grow the

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[60] Many claims were made along those lines in various press and other sources, the truth and a scope of which the Article cannot independently verify. *See, e.g.*, Cade Metz, *We Teach A.I. Systems Everything, Including Our Biases*, N.Y. TIMES (Nov. 21, 2019) ; Kari Paul, Healthcare *Algorithm Used Across America Has Dramatic Racial Biases*, THE GUARDIAN (Oct. 25, 2019); and Ed Pilkington, *Digital Dystopia: How Algorithms Punish the Poor*, THE GUARDIAN, (Oct. 14, 2019).

[61] Emily Berman, *A Government of Laws and Not of Machines*, 98 B.U. L. REV. 1277, 1302 (2018).

[62] MOHRI, ROSTAMIZADEH & TALWALKAR, *supra* note 55, 1.

[63] *See* Robert D. Hof, *Deep Learning : With Massive Amounts Of Computational Power, Machines Can Now Recognize Objects And Translate Speech In Real Time. Artificial Intelligence Is Finally Getting Smar*t, MIT TECH. REV., https://www.technologyreview.com/s/513696/deep-learning/

[64] IAN GOODFELLOW, YOSHUA BENGIO & AARON COURVILLE, DEEP LEARNING 1 (MIT Press, 2016).

[65] *See* Brett Grossfeld, *A Simple Way to Understand Machine Learning vs Deep Learning*, ZENDESK (July 18, 2017), online https://www.zendesk.com/blog/machine-learning-and-deep-learning/. *See also* Claudio Masolo, *Supervised, Unsupervised and Deep Learning*, TOWARDS DATA SCIENCE (May 7, 2017) online: https://bit.ly/2BydnE8.

[66] This has now gone mainstream. *See* William Vorhies, *Automated Deep Learning – So Simple Anyone Can Do It*, DATA SCIENCE CENTRAL (April 10, 2018), online: https://www.datasciencecentral.com/profiles/blogs/automated-deep-learning-so-simple-anyone-can-do-it.

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affordances of AI systems both qualitatively and quantitatively.[67] 'GANs' potential is huge, because they can learn to mimic any distribution of data. That is, GANs can be taught to create worlds eerily similar to our own in any domain: images, music, speech, prose.'[68] GANs can short-circuit the need for massive amounts of machine-learning and can produce much better outputs and have 'achieved remarkable results that had long been considered virtually impossible for artificial systems.'[69] More importantly, GANs are seen by some experts as 'an important stepping stone toward achieving *artificial general intelligence* [strong AI].'[70]

Machine-learning data can come from multiple sources, and AI machines often are 'continually connected to the Internet and will continually take in new information and new programming from multiple sources.'`[71] AI machines find *correlations and detect new patterns* in data.[72] Machines can for example correlate features such as voice to a series of characteristics such as sexual and political orientation, certain diseases, and much more.[73] Often, this predictive ability of AI machines is 'only' used with a commercial purpose, namely to determine individuals' preferences to sell them goods or services, but one can easily imagine far worse

[67] Indeed, Yann LeCun, FaceBook's AI Research Director and a professor at NYU, described GANs as 'the most interesting idea in the last 10 years in [machine learning].' Yann LeCun, *What Are Some Recent and Potentially Upcoming Breakthroughs in Deep Learning*? QUORA (Jul. 28, 2016). GANs are 'adversarial' because two machines work one against the other, creating a constant feedback loop that increases the quality of outputs. *See* AI WIKI, A BEGINNER'S GUIDE TO GENERATIVE ADVERSARIAL NETWORKS (GANS), https://skymind.ai/wiki/generative-adversarial-network-gan.

[68] More specifically, GANs use an actor-critic model, as one machine, called the generator, generates new data instances, the other, the discriminator, 'evaluates them for authenticity; i.e. the discriminator decides whether each instance of data it reviews belongs to the actual training dataset or not.' BEGINNER'S GUIDE, *id.*

[69] JAKUB LANGR AND VLADIMIR BOK, GANS IN ACTION: DEEP LEARNING WITH GENERATIVE ADVERSARIAL NETWORKS 3 (Manning Publications, 2019).

[70] See id.

[71] Jack M Balkin,, *The Path of Robotics Law*, 6 CAL L REV CIR 45, 54 (2015).

[72] Though not causal relationships. *See* Cary Coglianese & David Lehr, *Regulating by Robot: Administrative Decision Making in the Machine-Learning Era*, 105 GEO. L.J. 1147, 1157 (2017); and Nick Wallace, *EU's Right to Explanation: A Harmful Restriction on Artificial Intelligence*, TECHZONE 360 (Jan. 25, 2017), http://bit.do/Wallace_EU-Right-to-Explanation

[73] Ian Kerr & Jessica Earle, *Prediction, Preemption, Presumption: How Big Data Threatens Big Picture Privacy*, 66 STAN. L. REV. ONLINE, online: https://www.stanfordlawreview.org/online/privacy-and-big-data-prediction-preemption-presumption/.

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scenarios.[74] One risky feature of the use of AI machines in that context is that correlations are usually based on data concerning the behaviour of a given *population* but the impact is then directed at *individuals* who may or may not actually fit the population's behavioural patterns.[75]

<a> 4. Application to patent law

AI machines 'create a wide range of innovative, new, and non-obvious products and services, such as medical devices, drug synthesizers, weapons, kitchen appliances, and [other] machines'.[76] There is little doubt that AI machines can help innovate and that they can produce what looks facially like inventions as a matter of patent law.[77] The question that this chapter tackles is whether the law *should* provide patent protection for inventions in which human involvement is not demonstrably and sufficiently present.

Take DABUS, the test case in which the applicant named an AI machine as inventor.[78] The European Patent Office, US Patent & Trademark Office and, as of this writing, courts in the UK have found against the applicant and concluded that a *human* inventor must be named in a patent application.[79] Court decisions went the other way in Australia and South Africa.[80] Yet, stating that it this question is a mere matter of *naming* a human overlooks the actual normative issue. The underlying inquiry is whether patent law *requires* that a human be the actual *cause* of an invention.

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[74] *See id*.

[75] *See* Brent Daniel Mittelstadt et al., *The Ethics of Algorithms: Mapping the Debate*, BIG DATA & SOC'Y, July-Dec. 2016, at 5. *See also supra* note 73.

[76] Shlomit Yanisky Ravid & Xiaoqiong (Jackie) Liu, *When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3a Era*, 39 Cardozo L. Rev. 2215, 2219-2220 (2018).

[77] *See id*.

[78] On the USPTO, *see* Rebecca Tapscott, *USPTO Shoots Down DABUS' Bid For Inventorship,* IP WATCHDOG, May 4, 2020, online: https://www.ipwatchdog.com/2020/05/04/uspto-shoots-dabus-bid-inventorship/id=121284/;. For the EPO, *see* Bernt Hugenholtz, Daniel Gervais & João Pedro Quintais, *Trends and Developments in Artificial Intelligence: Challenges to the Intellectual Property Rights Framework*. Final Report (Nov 25, 2020), 100-104, online: https://www.ivir.nl/publicaties/download/Trends_and_Developments_in_Artificial_Intelligence.pdf.

[79] Thaler v Comptroller-General, UK Court of Appeal, 21 September 2021. At the EPO, it seems that the naming requirement is a mere formality. Patent offices rarely investigate actual inventorship.

[80] *See* chapters __ and __ in this volume.

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In functional terms, what are the legal requirements to be considered the 'inventor'? Is inventorship not necessary to claim that one should be named as an inventor? There are several ways to address this line of inquiry, but the fundamental starting point is that this is *not* a simple matter of applying and interpreting well-worn doctrines meant to separate ownership claims to an invention to which *multiple humans* may have contributed. Under both UK and US law as they now stand, there is little doubt that, under the current definition of inventorship, a mere subjective belief that one is entitled to a patent as a basis to claim inventorship is not the proper legal test.[81] A more thorough rethink is in order because the question is not the same as a multiple human inventor scenario. The novel question is: does a contribution to the 'conception' of the invention *by a nonhuman entity* legally qualify as inventorship as a matter of patent law? Asking the question this way should not obscure the fact that the same legal doctrines must also be tailored to novel types of *human* contribution to inventiveness, such as programming and teaching AI machines, that were not part of inventive processes until recently and which will gain prominence as AI machines get better at their job.

Under current law, the contribution of each claimed inventor must be identified.[82] This logically presupposes that we know who, or *what*, the inventor is. As just noted, two major patent offices and a court have found that one needs to identify one or more *human* inventors, while other judges disagree.[83] If one adopts the view that an inventor is a human notion under patent law, then one or more humans, working in their unique way, must be *causally related* to the invention.

A further, harder question will be to determine the role of patent incentives in that context. Economic analyses will be useful but they won't paint the full normative picture. Are we better off as a society (here again using human progress not disembodied technological change as a proper yardstick—how could it be otherwise?) issuing patents to machine-made inventions or not? Will doing so mostly accelerate innovation, or instead lead mostly to massive

[81] *See* Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1460 (Fed.Cir.1998) and *Thaler*, ibid.

[82] *See id.*

[83] *See id.*

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trolling?[84] This is at bottom an empirical matter. Because AI has become a standard tool in many fields of technology, empirical data about the production of new patents, the type of new technologies produced, the employment of human researchers and other relevant variables will become available, which in turn should allow for a better framing of normative measures to tackle the ongoing 'cyborgization' of innovation. It may be that human scientists will spend less time discovering and observing and more time interpreting data (and analysing interpretations of the data) provided by AI machines. While the positives are easy to identify (new pharmaceutical etc), on the negative side of the ledger, however, how this might impact our quest to understand nature and employment in applied sciences should be borne in mind.

As matters stand now, the chapters remains agnostic on the normative question but as matter of policy, it takes the view that those who claim we (humans) would be better off by granting patents on nonhuman inventions have the burden of proof primarily because this would result in applying a regulatory system meant to create incentives for one type of activity (innovation springing from the huma mind) to a different type of activity (innovation from machines), which may not require the same set of incentives.

<a> 5. Application to copyright law

Should we protect literary and artistic productions created without *natural* originality, meaning productions the creation of which does not involve in a material way a human creative process as *cause*?[85] This would be a significant normative jump for, as Professor Sam Ricketson—the co-author of the leading treatise on the Berne Convention—wrote, the 'need for authors to be 'human' is a longstanding assumption in national copyright laws'.[86] Doctrinally,

[84] A troll in patent law is 'a pejorative term describing a non-manufacturing patent owner who owns one or more patents and asserts the patent(s) against alleged infringers, with a desire typically to obtain settlement rather than actually trying any lawsuit'. Donald W. Rupert, *Trolling for Dollars: A New Threat to Patent Owners*, 21 INTELL. PROP. & TECH. L.J. 1, 3 (2009).

[85] This section provides a succinct overview of a more detailed argument presented elsewhere. *See* Daniel Gervais, *The Machine as Author*, 105 IOWA L. REV. 2053 (2020).

[86] Sam Ricketson, *People or Machines: The Berne Convention and the Changing Concept of Authorship*, 16 COLUM. J. L. & ARTS 1, 8 (1991-1992).

Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, as revised at Paris, July 24, 1971, 828 UNTS 221 [hereinafter Berne Convention]. The Berne Convention had 179 member States as of December 2020. The United States became a party to the Convention on March 1, 1989. See

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his observation seems entirely correct.[87] Indeed, that assumption dates back to well before the original (1886) text of the Berne Convention; it harkens back to the very roots of authors' rights, as the word author comes from the Latin *auctor*, or originator.[88] One could go further. The entire path of copyright history follows the milestones of human creativity. [89] Whether seen as a natural right—or even as a human right—or as an economic incentive, historically the focus of copyright has unquestionably been on productions of the human mind. If copyright had been designed as an investment protection scheme, or merely a scheme to disseminate 'things of value', then the investment of publishers would have been sufficient.[90]

We are now faced with a new entrant in the battle for recognition of authorship status. Does this new, intelligent 'species' bend, or break, the normative arc of copyright history? The first copyright statute—the Statute of Anne—provides a good argument against protecting artificial productions.[91] A set of arguments at the time was that, if authors had an obligation not to write libelous or otherwise unacceptable content, then authors should have a right in their writings.[92] This created a normative link that seems entirely convincing: *if one is responsible for one's writing, then one can legitimately ask for a right in protecting moral or material interests in that writing*.[93] The argument rests on the complementarity of responsibility and right, punishment and

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World Intellectual Property Organization, Contracting Parties: Berne Convention, https://www.wipo.int/treaties/en/ShowResults.jsp?lang=en&treaty_id=15 (accessed Dec. 15, 2020).

The treatise referred to is SAM RICKETSON AND JANE C GINSBURG, INTERNATIONAL COPYRIGHT AND NEIGHBOURING RIGHTS: THE BERNE CONVENTION AND BEYOND (2d ed, 2006).

[87] An analysis of multiple national laws led another scholar to a similar conclusion. *See* Andres Guadamuz, *Artificial Intelligence and Copyright*, WIPO MAGAZINE (Oct. 2017) ('Most jurisdictions, including Spain and Germany, state that only works created by a human can be protected by copyright'.), https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html.

[88] For a detailed account of this evolution, *see* Gervais, note 99 *supra*.

[89] *See id.*

[90] *See* MARK ROSE., AUTHORS AND OWNERS: THE INVENTION OF COPYRIGHT, 34-35 (Harvard Univ. Press, 1993)

[91] The Statute of Anne was the first common law copyright statute. Though adopted in England, it served as a basis for the first state statutes and the first US federal copyright act in 1790. *See* Oren Bracha, *The Adventures of the Statute of Anne in the Land of Unlimited Possibilities: The Life of A Legal Transplant*, 25 BERKELEY TECH. L.J. 1427, 1427-1429 (2010).

[92] *See* ROSE, *supra* note 90, at 34-35.

[93] Echoing the International Covenant on Economic, Social and Cultural Rights (ICESCR), art. 15(1)(c), Dec. 16, 1966, 993 U.N.T.S. 3 (which recognizes 'the right of everyone . . . [t]o benefit from the

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reward. [94] A similar point can be found in more modern work such as Foucault's discussion of the persona of the author. He put in parallel authorship and what he called 'penal appropriation', noting that '[t]exts, books, and discourses really began to have authors […] to the extent that authors became subject to punishment, that is, to the extent that discourses could be transgressive'.[95] There is little doubt in this author's mind that owners and programmers of AI machines will distance themselves faster than the speed of light if and when a machine they own or programmed produces infringing or libelous content, though many of them of course will not hesitate to claim exclusive rights if what the machine had produced is both non-infringing and commercially valuable. This would amount to treating machines better than humans, letting them eat the proverbial cake and have it too.

Why would artificial productions get a free pass? If the right/responsibility linkage served as the justification for copyright for human authors, should it not be applied to machine productions, and indeed to any other category of purported 'author'? This would mean that, once the machine production is not causally connected to one or more humans, then there should be no copyright in the production.[96] There is an echo of this view in a resolution adopted by the

protection of the moral and material interests resulting from any scientific, literary or artistic production of which he [or she] is the author'.). *See also* BEN SAUL, DAVID KINLEY AND JACQUELINE MOWBRAY, THE INTERNATIONAL COVENANT ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS, 1226-1229 (2014).

As of December 2020, the Covenant had 171 parties. The United States signed (but did not ratify) the Covenant in 1977. *See* United Nations, *International Covenant on Economic, Social and Cultural Rights*, (Jan. 3, 1976), online: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=IV-3&chapter=4&clang=_en (accessed Dec. 5, 2020).

A human rights-based approach can inform parts of copyright law, but in the past two decades copyright law at the international level has been shaped more by trade agreements than human rights. *See* Daniel Gervais, *Human Rights and the Philosophical Foundations of Intellectual Property*, IN RESEARCH HANDBOOK ON HUMAN RIGHTS AND INTELLECTUAL PROPERTY (Ch. Geiger, ed), 89, 90-93 (2015).

[94] *See* ROSE, *supra* note 90, at 35-36.

[95] Michel Foucault, *What is an Author,* in THE ESSENTIAL FOUCAULT: SELECTIONS FROM THE ESSENTIAL WORKS OF FOUCAULT 1954--1984, P. Rabinow & N. Rose, eds. (London, New York: 2003)

[96] It is unnecessary, therefore, to delve more deeply into which human proxy should be, by legal fiction, 'selected' as the most appropriate right holder. To use the term in Jane Ginsburg and Luke Ali Budiarjo, *Authors and Machines*, 34 BERK. TECH. L. J. 343, 439-442, the production is 'authorless'

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European Parliament on 20 October 2020, which recommended that regulators take into account 'the degree of human intervention [and] the autonomy of AI'.[97]

Ultimately, the risk of replacing humans in the act of creation, perhaps our noblest quest, is the principal consideration. Protecting machine outputs which will come at no ongoing cost and without the rights that a human creator would claim even after transferring her rights, like moral rights or rights reversion, means that market forces will lead to a fast replacement of human creators whenever possible. It will also change what we read, watch and listen to. Machines will create based on existing material combined with data about what humans are most likely to respond to, just like Facebook-or Meta—focuses on polarization instead of informed discussion. There will be more of the same, or worse. How that can arrest human development is unclear, but the risk is nonetheless real. Letting machines create the next waves of cultural development is fraught with existential risks. As with patents, anyone can make this claim or the opposite, however, because it remain ultimately a matter for empirical observation. Yet much of what can be lost in less than a generation may well justify applying a version of the precautionary principle before we put copyright and the full force of the market behind the replacement of human authors by machines.

<a> 6. Using Causation to Separate Human and Machine

Given the increasingly frequent conflation of human and machine contributions in the production of creative and innovative content, it seems safe to predict that there will be more productions that are *both* human and machine-made. As with works and inventions with multiple contributors, courts may be asked to determine *who*, if anyone, the author and/or right holder(s) should be. This is *not* the same inquiry as the one above, which was to decide *whether* machine productions should be protected to begin with. This second inquiry is about separating contributions, as might happen in any case of joint authorship or inventorship. Courts will need analytical tools to separate human and machine contributions even if, against the position taken in this chapter at least for copyrightable productions, the latter are ultimately found to be protectable.

[97] Intellectual Property Rights for the Development of Artificial Intelligence Technologies: European Parliament Resolution of October 20, 2020 (2020/2015(INI)), online: https://www.europarl.europa.eu/doceo/document/TA-9-2020-0277_EN.html.

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The test this chapter suggests is for a court to look for the *cause* of the originality (for copyright) or inventiveness or, 'contribution to conception' (for patents[98]). The notion of cause is well known in law. In tort law, causation can have two meanings: causation-in-fact (also known as 'simple cause'), and proximate causation (or 'legal cause').[99] Causation-in-fact is the 'but for' test, and often the easiest: would the outcome have occurred but for a person's (typically, the defendant in a tort case) conduct.[100] If a person's actions played a part—any part— in the outcome, then the answer is generally yes.[101] In the case of AI systems, several persons are typically involved in the creation and operation of AI machines, and many of them may thus make a 'but for' contribution to an action or decision. Then machines may make their own contribution.

The 'but for' causation does not suffice. Too many hands (and chips) may have played a role that is only tangentially related to the outcome, and yet enough to pass a strict 'but for' test. Hence, some form of IP 'proximate' causation suffused with the required normativity should be applied instead of simple cause. For example, every programmer who worked on an AI machine arguably meets the 'but for' threshold as a technical matter. Normatively, however, the chapter suggests that it is not sufficient. Identifying the source of the creative choices (copyright) or contribution to the actual conception of the invention (patent) is required.

The chapter suggests applying 'proximate' cause to IP because it provides both a vocabulary and analytical paths that are useful in this context. Naturally, this means an inversion of the notion's traditional role, as proximate or legal cause is more typically used to impose liability in appropriate cases rather than in a jurisgenerative role. For example, '[t]he words 'legal cause' are used […] to denote fact that the causal sequence by which the actor's tortious conduct has

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[98] *See supra* note 81.

[99] W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS § 43 (5th ed. 1988).

[100] Courts sometimes struggle to distinguish causation in fact and proximate cause. *See* Jane Stapleton, *Legal Cause: Cause-in-Fact and the Scope of Liability for Consequences*, 54 VAND. L. REV. 941, 945 (2001)

[101] The term 'causation in fact' is somewhat of a misnomer. Cause is not, strictly speaking, a 'fact'; it is a relationship between two events. *See* Wex S. Malone, *Ruminations on Cause-in-Fact*, 9 STAN. L. REV. 60, 61 (1956)

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resulted in an invasion of some legally protected interest of another is such that the law holds the actor responsible for such harm unless there is some defense to liability'. [102]

Where the notion of IP proximate cause may be particularly useful is in its *target*, for it considers whether the conduct is 'a substantial factor in bringing about' the outcome.[103] Proximate cause is, *au fond*, a normative determination with built-in flexibility and steeped in temporal and other contextual constraints such as normalcy. Hence, it has great dynamicity. As United States Chief Justice Roberts noted in his dissent in *CSX*, the notion of proximate cause supplies the vocabulary for answering questions such as 'whether there was a superseding or intervening cause'. [104] Tort law recognizes that 'external influences' may be considered as 'superseding causes'.[105] From a normative perspective, 'superseding' may be interpreted as meaning *more relevant*. The chapter argues that courts *can and should* use that sieve in IP cases involving sapient AI machines.[106] The difficulty to solve in close cases will be due to a *break in the legal causation chain* between humans and the outcome (what looks like a copyrightable work or patentable invention). This break will be due to an *intervening cause*, namely the AI machine's autonomous contribution.

In their (normative) application of proximacy to the cause of a contribution to a literary or artistic work or an invention, there are two errors that courts are likely to make. The first error would be to (over)reward (or hold accountable in case the work produced is infringing a third party copyright, for example) humans so far removed from the AI machine's operation as to be 'far out', to use the US Supreme Court's language.[107] In extreme cases, for example, the only meaningful human control over the machine might be a 'kill switch'. [108] The second, related

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[102] *See* RESTATEMENT (SECOND) OF TORTS § 9 (1965).

[103] *id*., Cmt (a).

[104] CSX Transp., Inc. v. McBride, 564 U.S. 685, at 719.

[105] *See* Weston Kowert, *The Foreseeability of Human-Artificial Intelligence Interactions*, 96 TEX. L. REV. 181, 184 (2017); and Matthew U. Scherer, *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies*, 29 HARV. J.L. & TECH. 353, 365-66 (2016).

[106] More rarely so in intentional tort cases. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM §33 Comment e. (2010).

[107] CSX Transp., note 117 *supra*, at 704.

[108] *See* Thomas Arnold and Matthias Scheutz, *The 'Big Red Button' Is Too Late: An Alternative Model For The Ethical Evaluation of AI Systems*, 20 ETHICS & INFOR. TECH., 59, 60 (2018)

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potential error is to consider that *someone must* be rewarded or held responsible. It is possible that no human can be causally (factually and legally) linked to the outcome.

There are well-established intellectual property doctrines that can serve as vehicles to operationalize 'IP proximate causation'. In copyright law, courts could use originality. The US Copyright Act grants protection only to *original* works of authorship.[109] This notion of originality is a worldwide standard, even though it is not spelled out explicitly in international treaties.[110] The U.S. Supreme Court has held that originality is required by the Constitution, which allows Congress to protect the 'Writings' of 'Authors'.[111] It found that it was 'unmistakably clear' that the terms 'authors' and 'writings' in the US Constitution presuppose a degree of originality.[112] Originality, in turn, requires a minimal degree of 'creativity', a 'creative spark'.[113]

Courts should define originality as requiring that a 'human spark' be causally related to the output. This is the approach taken by the European Parliament in considering that 'works autonomously produced by artificial agents and robots might not be eligible for copyright protection, in order to observe the principle of originality, which is linked to a natural person, and since the concept of 'intellectual creation' addresses the author's personality'.[114] In patent law, courts could use the notion of inventorship along similar lines and redefine it to achieve the aim of separating human and machine, by focusing on human contributions, if any, to the conception of the invention.[115]

<a>7. Looking Ahead

[109] 17 U.S.C. § 102(a).

[110] *See* Daniel Gervais and Elizabeth Judge, *Of Silos and Constellations: Comparing Notions of Originality in Copyright Law,* 27:2 CARDOZO ARTS & ENT. L. J. 375-408 (2009); and Daniel Gervais, *Feist Goes Global: A Comparative Analysis of the Notion of Originality in Copyright Law*, 49:4 J. COPYRIGHT. SOC.Y OF THE USA 949-981(2002).

[111] U.S. CONST. art. I, § 8, cl. 8.

[112] Feist Publications, 499 U.S. 340, 346 (1991).

[113] *id.*

[114] Resolution, supra note 111, at ¶15.

[115] *See supra* note 81.

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The developments of AI towards progressive cyborgization may lead to situation when human creators with enhanced mental abilities compete with unenhanced creators and inventors. Those possible developments far transcend the scope of this chapter and indeed the field of intellectual property itself, but the chapter's analytical path could perhaps be of use also in that context.

Without looking too far into possible futures, we may in short order be submerged under a flow of machine-made literary and artistic works and new inventions. To use a term favoured by Kurzweil and others, the pace could be such that we may face a 'singularity' of artificial creativity and innovation, displacing many human creators and inventors from the marketplace.[116] Why would a record label pay a songwriter if a machine can produce successful commercial hits? Why would a pharmaceutical company hire postdocs if machines can do the work? As adumbrated in the Introduction, it is impossible to predict with accuracy whether and if so, for how long, human authors and inventors will or will not survive as a significant source of cultural production and innovation in the medium to long run. In the short run, however, it is worth asking whether intellectual property policy should try to keep a place for human creativity and inventiveness. Doctrinally at least, if we want to, we can. The harder question is the normative one.

Perhaps we should give in as a species and welcome machine creators and inventors, and even accelerate that process by giving IP rights to machine productions. One way or the other, that is a debate we must have, and the chapter is a contribution to that debate. If we refuse to take the position that the focus of IP law is human creativity and innovation, *what will be left for us to do?* Who will be the great creators of tomorrow who will help us understand and shape our world if machines are the artists, novelists and journalists? Who will come up with the pioneer discoveries if machines are the inventors? What happens when the machines are the engineers, songwriters and lawyers? Then again, as the Borg collectively say when they are about to assimilate you, perhaps 'resistance is futile'.[117]

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[116] *See* Nick Bostrom, *What Happens When Our Computers Get Smarter Than We Are? Singularity* (May 7, 2015), online: https://www.singularityweblog.com/nick-bostrom-ted/

[117] The Borg are a fictional species in Star Trek. They aim to conquer beings from various species (including some humans) and turn them into 'drones' (what one might call cyborgs) by adding technology to their bodies. The assimilated beings become part of the Borg 'collective'. *See* https://intl.startrek.com/database_article/borg (last accessed Apr. 24, 2021).

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<a> 8. Conclusion

Is machine 'intelligence the last invention that humanity will ever need to make', as Nick Bostrom suggested?[118] Is our species 'going to mortally struggle with this problem'?[119] It is not often that a new species comes along that can challenge humans on the terrain that has ensured our dominion over other creatures and machines, namely our 'higher mental faculties'.[120] Come to think of it, it is actually the first time. How the system of laws and institutions humans have put in place to ensure a more or less orderly unfolding of the human story will respond is a question that must be asked, and answered.[121]

A key chapter in that story is whether, and if so how, intellectual property will focus on trying to maintain a role for humans in creative expression and inventiveness. This chapter has provided paths that can be followed, together or separately, to at least some of the answers. In doing so, it has claimed that the 'cause' of human progress is a good cause *per se*: the law should aim to foster human progress, not just technological change. [122] Change and progress are not synonyms. Change is a difference between two points A and B on a timeline while progress is an improvement at point B.[123] Change happens; progress not necessarily. Naturally, not everyone will agree on what constitutes 'progress', but this chapter assertion is that *human* self-fulfillment and realization through art and science *is* progress, and it consequently suggests that the law should aim to foster those goals.[124] In this, the chapter stands (with humility) on the shoulders of many giants, from Plato's Laws to Aristotle Nicomachean Ethics to Spinoza's *conatus*.

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[118] *See* Bostrom, *supra* note 116.

[119] JAMES BARRAT, OUR FINAL INVENTION: ARTIFICIAL INTELLIGENCE AND THE END OF THE HUMAN ERA 5 (2013).

[120] One could argue that this point should be framed as a matter of culture, in that not all cultures around the world would agree with that statement as many indigenous peoples, among others, do not see humans as having a natural dominion over nature and other species. That is also a matter beyond the scope of this chapter.

[121] On the need for a transnational regulatory path, *see* Daniel Gervais, *Towards an Effective Transnational Regulation of AI,* 36 AI & SOCIETY (2021)

[122] *See generally* Gervais, *supra* note 11.

[123] *See id*. at 11.

[124] *See id.* at 11-19.

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The more we rely on machines to perform creative and innovative tasks that are singularly human and important for us as a source of progress--from news reporting, to music and fiction, to inventions in all fields of technology--the more we may shrink the space available for our individual and collective self-realization. To use a simple explanatory metaphor, as we use our creative and inventive 'muscles' less and less, they will shrink. Is that what is meant by 'Progress of Science and Useful Arts'?

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