

Convergence, Complexity and Uncertainty

Artificial Intelligence and Intellectual Property Protection

Bryan Mercurio and Ronald Yu*

I INTRODUCTION

Artificial intelligence (AI) is integral to many systems we use today – from the recommendation engines on entertainment platforms to facial recognition software on mobile phones to systems driving progress on the future of autonomous vehicles. What was once thought of as science fiction – an AI creating copyrightable content, registerable designs or potentially patentable inventions – or even creating non-existent but realistic-looking persons¹ – has morphed into reality.²

AI is also changing the nature of the process of buying goods and services on e-commerce platforms in a way that has important implications for commerce and market competition. For example, AI assistants, search engines, customer service bots and online marketplaces play an important role in shaping the consumer decision-making process. The manner in which a consumer interacts with the online marketplace through AI may result in the presentation of only a limited number of brands to a consumer or other alterations to the way that consumers view and make product selections.³

Presently, a non-human cannot in most jurisdictions be named as an inventor for something it invented or enjoy copyright rights for the creation of works. With this background, it is not difficult to see how AI sits uneasily in the construct of the intellectual property (IP) system. The question of AI and IP is both contemporary and

* This article was produced as part of a project funded by the Hong Kong Policy Innovation and Co-ordination Office's Public Policy Research Funding Scheme for a project entitled *Regulating Cross Border Data: A Public Policy Framework for Hong Kong* (Project No. 2019.A4.064.19D)

¹ M Zhang, "This AI Creates Photo-Realistic Faces of People Who Don't Exist" (Petapixel, 17 November 2017), <https://perma.cc/HUH8-JXHQ>.

² For example, a Paris-based collective called "Obvious" created the work "Portrait of Edmond de Belamy" that sold at auction for \$423,500 in October 2018, using Generative Adversarial Networks. See J Newman and SM Gibson, "Blurring the Lines: When AI Creates Art, Is It Copyrightable?" (Patent Lawyer Blog, 13 May 2020), <https://perma.cc/UMR5-QSQA>.

³ WIPO Secretariat, "Revised Issues Paper on Intellectual Property Policy and Artificial Intelligence", WIPO/IP/AI/2/GE/20/1 REV, <https://perma.cc/9PDM-DY35>.

pressing. In fact, the issue has been deemed so important and urgent that the World Intellectual Property Office (WIPO) held a “Conversation on IP and AI” event in September 2019, followed by a public consultation in which it received over 250 submissions, a consultation paper,⁴ an event in February 2020 on “Copyright in the Age of Artificial Intelligence”⁵ and a second “Conversation on IP and AI” in July 2020.

Some of the urgency behind this activity lies in the fragmentation of norms stemming from a lack of international guidance. The matter is made even more urgent by the notoriety surrounding the recent rejection of the granting of patents by patent offices in the USA, UK and Europe to an AI named DABUS (which stands for “Device autonomously bootstrapping uniform sensibility”), who the owner claims invented “food container” and a “device and method for attracting enhanced attention” autonomously without any form of human intervention.⁶

The time is thus ripe to address the profound role the IP system has in AI, not only because it can protect but also serve to block access to key AI technologies (for example, by patent holders preventing others from using patented technologies). This chapter first defines the concept before evaluating the state of play in regards to AI and patents, trade secrets and copyright. In so doing, the chapter raises substantive issues relating to AI which challenge the norms and standards of the IP system. Next, the chapter evaluates issues concerning IP in the data used by an AI system. Finally, the chapter briefly touches on the profound question of the purpose of IP, and the consequences of AI as an IP holder.

II DIFFICULT TO DEVISE AND DEFINE

Before even thinking of how to address issues relating to AI and IP, it is necessary to understand some of the more esoteric aspects of IP and how these could affect policy decisions regarding AI inventions. In order to do so, however, it is necessary to first agree on certain definitions. This was likely one of the first set of challenges that WIPO encountered when launching its consultation. Defining AI for legal purposes is not straightforward, given the wide range of ideas and opinions as to what constitutes “AI”. To avoid any lengthy debates, this chapter will simply adopt the definitions WIPO used in its consultation paper:

- AI is a discipline of computer science that is aimed at developing machines and systems that can carry out tasks considered to require human intelligence, with

⁴ See “Artificial Intelligence and Intellectual Property Policy” (World Intellectual Property Organization (WIPO)), <https://perma.cc/587U-WN49>. The Consultation Paper was subsequently heavily revised in May 2020 on the basis of comments and further reflection.

⁵ See “Copyright in the Age of Artificial Intelligence” (Copyright.gov, 5 February 2020), <https://perma.cc/LKB8-7VEG>.

⁶ See “AI ‘DABUS’ Autonomous Inventor, But Not Official” (Meyer-Dulheur MD Legal Patentanwalte Partg MBB, 17 February 2020), <https://perma.cc/57CV-SYSH>; K Baretto, “DABUS MACHINE: The Harbinger to Debates on Artificial Intelligence as an ‘Inventor’ under Patent Law” (RGNUL Student Research Review, 22 February 2020), <https://perma.cc/9EWW-TKJP>.

limited or no human intervention. AI generally equates to “narrow AI” which is techniques and applications programmed to perform individual tasks. Machine learning and deep learning are two subsets of AI.⁷

- “AI-generated” and “generated autonomously by AI” are terms that are used interchangeably and refer to the generation of an output by AI without human intervention. This is to be distinguished from “AI-assisted” outputs that are generated with material human intervention and/or direction.⁸

While these definitions are sufficient for our purposes, it should be noted that defining what constitutes an AI-generated invention or creation is far more difficult than it appears at first glance, given both the wide continuum between AI that was created autonomously⁹ and with some human input (which itself may have been augmented, for example with artificial creativity augmentation¹⁰ or other AI). The full set of arguments as to what is or is not an AI-generated invention is beyond the scope of this chapter,¹¹ but suffice to say that the definition of AI is perhaps not completely finalized and static.

III ARTIFICIAL INTELLIGENCE AS AN INTELLECTUAL PROPERTY HOLDER

With AI defined, we can now proceed to examine the questions of:

- whether AI-generated inventions, creations or designs can be granted IP protection;
- how such inventions, creations and designs should be treated in legislation or by governmental agencies; and
- whether the law should require that a human being be named as an inventor or author or whether it should permit an AI application to be named as the inventor (which naturally raises the question of whether an AI could have legal personhood).

Of course, a large part of the problem here is that current laws never envisaged a situation where AI systems could create and invent on their own, with a minimal nexus with a human being. In such a circumstance, a human could not technically

⁷ Deep learning is regarded by some as a subset of machine learning. See, for example, “Uninformed Search Algorithms” (Javatpoint), <https://perma.cc/64NU-AKM4>.

⁸ WIPO Secretariat, WIPO Conversation on Intellectual Property (IP) and Artificial Intelligence (AI), Second Session, Revised Issues Paper on Intellectual Property and Artificial Intelligence, WIPO/IP/AI/2/G/GE/20/1 REV, 21 May 2020.

⁹ It should be noted that there is a human connection in fully autonomous systems and as long as computers rely on instructions defined by a human as to how to solve a problem, the separation between human and non-human (algorithmic) ingenuity is, in itself, artificial.

¹⁰ On this topic, see N-M Aliman and L Kester, “Artificial Creativity Augmentation”, paper delivered at AGI-20 Conference, 25 June 2020, <https://perma.cc/SR2Z-UMEK>.

¹¹ Those wishing to explore a more robust discussion on this subject should read the excellent paper by D Kim, “AI-Generated Inventions’: Time to Get the Record Straight?”, 69 GRUR International 443.

be listed as author or inventor. Yet current laws in most jurisdictions also prevent the AI from being named an author or inventor, and thus AI inventions are left in a lacuna without legal protection, which returns us to the question of whether AI-generated content, inventions and the like warrant IP protection. If AI inventions and creations are allowed IP protection, should there be new systems of examination (for patents) or protection (for copyright) for such works? Finally, if AI inventions and creations are denied IP protection, would this incentivize organizations and individuals to conceal the involvement of AI, and if AI were involved, how could it even be detected? On top of these, there are questions specifically related to patents, trade secrets and copyrights which will be addressed in subsections A to D.¹²

A Patents and Trade Secrets

At first glance, obtaining patent protection for an AI-generated invention appears straightforward; such an invention would be patentable if it meets the definition as set out by Article 27.1 of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement and domestic legislation:

patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application . . . and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.

Thus, in order to qualify for protection, an invention must meet the following conditions:

- novelty – meaning it is not part of the state of the art (as defined by the relevant patent law);
- inventiveness (or non-obviousness); and
- utility (or industrial applicability) – which means, among other things, that it is capable of actually working in the real world (e.g. an invisibility cloak, similar to what one might see in *Star Trek* or *Harry Potter*, would not meet this test).

These conditions distinguish an invention from a mere discovery of, say, a naturally occurring phenomenon or equation.¹³ Thus, discovering that a wave coming from the earth's core that interferes with satellite broadcasts is useful, but not

¹² Other important questions regarding the ramifications of inventorship and ownership would have on related issues such as infringement, liability or dispute resolution – or even how, if an AI were an inventor, it could enter into contracts – are beyond the ambit of this chapter. On the latter, see A Chan, “Can an AI Be an Inventor? Not Yet” (*MIT Technology Review*, 8 January 2020), <https://perma.cc/JNU8-EYLJ>.

¹³ See, for example, *Diamond v Chakrabarty* 447 U.S. 303 (1980); *J.E.M. Ag Supply v. Pioneer Hi-Bred Int'l* (USSC (2001)).

patentable, whereas inventing a device which filters the interference would be a patentable invention.

Inventiveness (and novelty) are judged from the standard of a person skilled in the art (i.e. the “skilled person”) standard.¹⁴ The skilled person is a legal fiction of a person who knows everything about a particular field yet is not creative or imaginative. While the standard of the skilled person differs across jurisdictions,¹⁵ Laddie, J. discussed the nature of the skilled (but non-inventive) person in the art in the case of Pfizer Ltd.’s patent:

This is not a real person. He is a legal creation. He is supposed to offer an objective test He is deemed to have looked at and read publicly available documents and to know of public uses in the prior art. He understands all languages and dialects. He never misses the obvious nor stumbles on the inventive. He has no private idiosyncratic preferences or dislikes. He never thinks laterally. He differs from all real people in one or more of these characteristics. A real worker in the field may never look at the piece of prior art – for example he may never look at the contents of a particular public library – or he may be put off because it is in a language he does not know. But the notional addressee is taken to have done so.¹⁶

AI potentially challenges the standard of inventiveness in three ways. First, many AI systems work by sifting through vast amounts of data to find patterns, which some liken to the process of discovery, which is problematic as it is generally accepted that utilizing something that already exists in nature is a “discovery”, and therefore not patentable.¹⁷ Second, as an AI has far greater capacity to analyse vast amounts of data trained with specific data from designated fields of art than any human, such an AI not only will more easily find inventions obvious but, if taken to its logical extreme, it could not only become a skilled person but might also find all inventions obvious.¹⁸ Third, as AI is increasingly employed in research and development (R&D), there is the potential to raise the standard of inventiveness of developers and those skilled in the art. What these potential issues mean is that in order to accommodate AI, there may have to be a re-think of the inventiveness standard – this will be difficult and lead to many unintended consequences. For example, raising the bar for inventiveness

¹⁴ In the USA the skilled person is known as “A person having ordinary skill in the art” (PHOSITA).

¹⁵ N Khanna and J Gulati, “Knowledge/Skill Standards of a ‘Person Skilled in Art’: A Concern Less” (2018) 17 *John Marshall Review of Intellectual Property Law* 588.

¹⁶ *The Asia File Products Sdn Bhd v. Brilliant Achievement Sdn Bhd & 2 Ors*, MTKL GS No. 05 (IP)-22-47 (2010), citing [2001] FSR 201.

¹⁷ For further analysis, see R Yu, “Should an Invention Created by Machine Learning Be Patentable?” (WIPO Public Consultation on AI and IP Policy – Submissions, 15 December 2019), <https://perma.cc/AV9W-XPC5>.

¹⁸ R Abbott, *The Reasonable Robot: Artificial Intelligence and the Law* (Cambridge, Cambridge University Press, 2020), at 93. The concern that the “skilled person” should need to be raised in light of AI or that inventive AI might even represent the skilled person has been raised in recent literature. See R Abbott, “Everything Is Obvious” (2018) 66 *UCLA Law Review* 2.

would ensure information and discoveries are not locked away but may make it harder for ordinary human inventors to acquire a patent.¹⁹

In addition to the three standards of patentability, a patent application must also provide for sufficient disclosure of the invention to enable a skilled person to reproduce the invention.²⁰ This is in keeping with the patent system's other goal to promote social and technical advancement and increase public welfare through the disclosure of inventions to the public for the benefit of the public at large. AI-related issues pose a significant challenge to the system in this regard – simply stated, what does one need to disclose when dealing with an AI-generated invention? The answer is not as simple as one might think given that the outcomes of an AI invention might change depending on the input data and/or the algorithms.²¹ Additional questions involve unique complexities and will lead to divergences of opinion, such as: must algorithms used by the AI be disclosed as part of a patent application by an AI? Should data used by the AI also be disclosed as well, and if so, how much data? Does the human expertise used to select and curate the data and train the algorithm be disclosed, and if so, to what extent? Requiring strict standards which demand inventors to supply greater detail and precise information may mean inventors simply bypass the patent system in favour of maintaining the invention as a trade secret. This in turn may not be to society's benefit. In short, the difficulties with enablement/disclosure should not be underestimated given the potential size of the data sets involved.²²

Finally, the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement allows (but does not require) members to create exceptions to patentability, such as inventions “necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment”,²³ and diagnostic, therapeutic and surgical methods for the treatment of humans or animals as well as plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than

¹⁹ J Wu, “High Patent Quality Standards Have Caused U.S. to Lose Technological Advantages” (IP Watchdog, 8 August 2017), <https://perma.cc/T52C-YMSN>.

²⁰ See *Biogen v. Medeva* [1997] RPC, at 1.

²¹ On the issue of explainability, see AD Selbst and S Barocas, “The Intuitive Appeal of Explainable Machines” (2018) 87 *Fordham Law Review* 1085.

²² As a reference, Amazon gathers data on every one of its customers while they use the site including what they buy, what they look at, their shipping addresses and whether they leave reviews/feedback. Amazon's Buyer Fraud Service system collects more than 2,000 real-time and historical data points for each order and uses machine learning algorithms to detect and prevent those with a high probability of being fraudulent. Multiply these by the millions of orders Amazon processes daily and one gets some idea of the amount of data the company collects on a daily basis. See “Amazon: Using Big Data to Understand Customers” (Nbernard Marr & Co.), <https://perma.cc/7RAV-3RM5>; and Amazon, “Amazon.com Buyer Fraud Service Gains Scalability, Cuts Costs in Half Using AWS”, <https://perma.cc/SDD2-GTEL>.

²³ TRIPS, Article 27.2.

non-biological and microbiological processes.²⁴ While these lines may appear straightforward, the reality is not quite so simple and distinctions can be blurred.²⁵

Compounding the issue is the fact that exceptions from patentability are defined at the regional and national level. In regard to AI, this raises issues involving software and business methods. These forms of invention are excluded from patentability in some nations, meaning that software or computer program-related inventions may be patentable in one jurisdiction but not in another.²⁶ The result of disunity could be more forum shopping whereby organizations, inventors or creators actively seek jurisdictions whose laws are more favourably disposed to protecting their inventions or creations, in this case created or generated by AI. Moreover, this connects to the issue of broader societal benefits resulting from inventions; if AI applications or algorithms are excluded from patentability, developers and organizations would essentially have no choice but to keep such AI as a trade secret, thereby undermining the goal of the patent system to disseminate technical knowledge.

To date, applications for patent protection when the inventor is named as an AI system have been rejected. For instance, the UK Intellectual Property Office (UKIPO), European Patent Office (EPO) and US Patent and Trademark Office (USPTO) all recently denied applications for patents that named an AI, called DABUS, as the inventor in December 2019, January 2020 and April 2020, respectively. These applications, for a warning light and food container, were made on behalf of Stephen Thaler, CEO of Imagination Engines, by the Artificial Inventor Project.²⁷ In rejecting the application, the UKIPO hearing officer decided that the UK Patents Act 1977 requires an invention by a natural person.²⁸ The EPO likewise rejected the applications on procedural grounds as an application for a European patent must designate an inventor and “state the family name, given names and full address of the inventor”. In so holding, the EPO found this requirement was consistent with a “clear legislative understanding that the inventor is a natural person” and consistent with EPO and national decisions.²⁹ Similarly, the USPTO held that the US patent statutes preclude interpretation of “inventor” to cover

²⁴ Ibid., at Article 27.3. Members must, however, provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof.

²⁵ Compare, for instance, the Canadian Supreme Court decisions in *Harvard v. Canada* [2002 SCC 76] and *Monsanto Canada Inc. v. Schmeiser* [2004] 1 S.C.R. 902, 2004 SCC 34.

²⁶ For example, Art. 52 of the European Patent Convention states that computer programs are not patentable *per se*, but in the USA no specific exclusion of software from patentable subject matter exists.

²⁷ As noted earlier, Stephen Thaler claims that the AI created the inventions autonomously and without human intervention.

²⁸ See Intellectual Property Office, BL O/741/19, 4 December 2019, <https://perma.cc/HK2V-6XFB>.

²⁹ See Grounds for the EPO decision of 27 January 2020 on EP 18 275 163, <https://perma.cc/T3NS-S2CV>; Grounds for the EPO decision of 27 January 2020 on EP 18 275 174, <https://perma.cc/6KTW-PL3C> (“The designation of an inventor is mandatory as it bears a series of legal consequences, notably to ensure that the designated inventor is the legitimate one and that he or she can benefit from rights linked to this status. To exercise these rights, the inventor must have a legal personality that AI systems or machines do not enjoy”).

machines because “the plain reading” of words such as “whoever”, “himself”, “herself” and “individual”, as well as the requirement that an inventor executes an oath, is as a “person”. The USPTO also cited US case law which holds that inventors cannot be states or corporations.³⁰

This leaves trade secrets as the more likely avenue for protection of AI inventions. Trade secrets protect information that is secret, of commercial value, imparted in a situation of confidentiality and subject to reasonable efforts to protect its secrecy. In some ways, trade secrets better suit the companies which develop AI as such inventions do not require registration and can last indefinitely, provided they are kept secret.³¹ Moreover, given the fast pace of development and difficulty in reverse engineering AI systems, companies are in fact increasingly relying on trade secrets to protect investments and developments in AI. AI companies also rely on trade secrets to protect their valuable algorithms given their inability to acquire patent protection for algorithms and reluctance to disclose the algorithm in a patent application,³² and because copyright law protects expression and not the underlying idea behind an algorithm, effectively rendering copyright unsuitable for protecting the functional aspects of algorithms.³³

While one cannot register a trade secret – doing so would itself alert others to its presence and provide for public disclosure – there are systems in place to prove the existence of a trade secret without disclosing the secret. An example of this is WIPO Proof, which provides tamper-proof evidence of the existence of a trade secret by providing a data- and time-stamped digital fingerprint of a digital file containing the trade secret and a repository of these fingerprints (which WIPO refers to as tokens).³⁴

B Copyright

The TRIPS Agreement (Article 9.2) states that copyright attaches to original works which are “expressions and not to ideas, procedures, methods of operation or

³⁰ The USPTO also noted this was consistent with the approach to inventorship in the USPTO’s Manual of Patent Examining Procedure. See M Hervey, “USPTO Denies Patent Application for Invention by AI” (Gowling WLG, 4 May 2020), <https://perma.cc/96XJ-S4HW>.

³¹ For background, see JC Frome, “Machines as the New Oompa-Loompas: Trade Secrecy, the Cloud, Machine Learning, and Automation” (2019) 94 *New York University Law Review* 706.

³² Companies go to great lengths to protect algorithms, not only with physical security and legal means such as non-disclosure agreements but also with technological methods – for example, frequent changes to algorithms. In 2018 Google reportedly made 3,234 changes to its search algorithms (see “Google Algorithm Update History” (Moz), <https://perma.cc/6Y5-H2DB>). There are, however, some efforts underway to erode companies’ reliance on trade secrets to protect, for example, algorithms. For example, at the time of writing, India proposed rules to require tech companies like Google, Amazon and Facebook to provide source code and algorithms. See R Montti, “Google Might Have to Give Algorithm Access to India” (*Search Engine Journal*, 6 July 2020), <https://perma.cc/ZJ53-87KH>.

³³ This is often referred to as the idea–expression distinction (or dichotomy) which limits the scope of copyright protection by differentiating an idea from the expression or manifestation of that idea. Unlike patents, which may confer proprietary rights in relation to general ideas and concepts per se when construed as methods, copyright does not confer such rights.

³⁴ “WIPO PROOF – Trusted Digital Evidence” (WIPO), <https://perma.cc/5HDF-GSRJ>.

mathematical concepts as such.” In the context of software, this makes clear that expressions are protected, whereas the underlying ideas in the software or computer programs – that is, the AI algorithms and other processes – would not be eligible for protection.

Originality (which is different from the novelty standard in patent law which requires that the invention not be part of the prior art) – the aspect of a created or invented work that makes it new or novel, and thereby distinguishes it from reproductions, clones, forgeries or derivative works³⁵ – remains a basic prerequisite in copyright law.³⁶ The question in regards to our inquiry is whether an AI-generated work can be regarded as original. The Berne Convention references “authors”,³⁷ which may not be determinative but perhaps lends itself to the conclusion that there must be a human involved in the process. Indeed, courts in several countries have interpreted originality as requiring a fairly significant degree of human ingenuity. For instance, in the famous case of *Naruto v. Slater*, the 9th Circuit Court in the USA held that “[t]o qualify as a work of ‘authorship’ a work must be created by a human being”.³⁸ In that case, it was not enough for a photographer to place cameras in strategic locations and tempt the animals to pick up the camera and take pictures. Likewise, in *Aeohs Pty Ltd v. Ucorp Pty Ltd* the Full Federal Court of Australia found that data sheets created by a computer program (a simple data-collecting mechanism) were not subject to copyright because there was not a sufficiently involved human author.³⁹

These judgments indicate that copyright over computer programs and software will generally vest with whoever created the source code of that software. Likewise, content generated by “AI-like” software which performs functions based on programmed rules but without exhibiting true intelligence or originality, for example a “smart-home” device that can dim lights or check the weather forecast on command, would likely remain the copyright of the author of the program’s code or the person making the input. The same would likely apply for programs used as part of an artistic or technical process but which are ultimately controlled by human choices.

³⁵ “Originality in Copyright” (US Legal), <https://perma.cc/4NH7-XD9W>.

³⁶ J Dratler and SM McJohn, *Intellectual Property Law: Commercial, Creative and Industrial Property* (vol. 1, New York, Law Journal Press, 2006), at 5–71.

³⁷ The Berne Convention deals with the protection of works and the rights of their authors. Its first paragraph states: “The countries of the Union, being equally animated by the desire to protect, in as effective and uniform a manner as possible, the rights of authors in their literary and artistic works.” See “Berne Convention (1971 Paris Act plus Appendix), Berne Convention for the Protection of Literary and Artistic Works”, <https://perma.cc/6WWA-8QqJ>.

³⁸ *Naruto v. Slater*, No. 16-15469 (9th Cir. 2018), where the US 9th Circuit Court affirmed the district court’s dismissal of copyright infringement claims brought by the People for the Ethical Treatment of Animals (PETA), which filed suit as a friend to Naruto the crested black macaque, alleging copyright infringement over selfies he took on a wildlife photographer’s unattended camera.

³⁹ *Aeohs Pty Ltd v. Ucorp Pty Ltd* (2012) 201 FCR 173 (Full Federal Court).

That being the case, while the creator of the AI program would retain copyright over original source code, that individual may have no rights to original work created by the software that they did not envision or program. Thus, for instance, while the source code of an AI program designed to create original music or generate business recommendations would be subject to copyright, the decisions and work generated by that AI may not be copyrightable if there is not a sufficient level of human input. The more distant the human involvement from the ultimate original work (as the AI continues to evolve), the less likely it would be that copyright would attach to the individual.

Whereas the US Copyright Office and others apply a “human authorship policy” that prohibits copyright protection of works that are not generated by a human author,⁴⁰ not all jurisdictions concur with this interpretation. For instance, UK law acknowledges the possibility that works could be “computer-generated”⁴¹ and provides that the author of a computer-generated work is deemed to be the person “by whom the arrangements necessary for the creation of the work are undertaken”.⁴² Interestingly, China may also be heading towards protection for AI as a court decision in Guangzhou in January 2020 awarded RMB1500 in damages for infringing a financial article written by Tencent’s robot Dreamwriter without authorization: “the article’s form of expression conforms to the requirements of written work and the content showed the selection, analysis and judgment of relevant stock market information and data … the article’s structure was reasonable, the logic was clear and it had a certain originality”.⁴³ What remains unclear in jurisdictions which hold that AI-generated work can enjoy copyright protection is, among other things, whether such protection extends to other related copyright rights such as sound recordings, broadcasts, performances or adaptations. This is an important question, but as of yet undecided and untested.

Yet another interesting question is whether copyright law ought to be used to regulate deep fakes – the generation of simulated likenesses of persons and their attributes, such as their appearance or voice.⁴⁴ Deep fakes raise complicated copyright questions such as whether deep fakes created by information that may be copyright protected should benefit from copyright, and if they should, to whom the copyright in the deep fake should belong; and whether the person whose likenesses

⁴⁰ R Abbott, “The Artificial Inventor Project” (*WIPO Magazine*, December 2019), <https://perma.cc/AZR4-N86Y>.

⁴¹ Defined as “generated by computer in circumstances such that there is no human author of the work” (*Copyright Designs and Patents Act 1988* (UK) Sec. 178).

⁴² *Copyright Designs and Patents Act 1988* (UK) Sec. 9(3).

⁴³ See A Guadamuz, “Impact of Artificial Intelligence on IP Policy”, <https://perma.cc/7RPS-GEW9>.

⁴⁴ Such systems have improved dramatically in the last few years. See A Liszewski, “Disney’s Developed Movie-Quality Face-Swapping Technology That Promises to Change Filmmaking” (*Gizmodo*, 29 June 2020), <https://gizmodo.com/disneys-developed-movie-quality-face-swapping-technology-1844202003>.

and performances are used in the deep fake ought to receive compensation, and if so, how this could be done.

More fundamentally, other questions involving the term of protection and liability of the copyright owner will also need to be addressed. In terms of the former, many copyright laws provide specific periods of time during which the work and the rights arising thereof are legally protected that are usually determined in reference to the lifetime of the work's author, and exceptionally the work's first publication or transmission. The life of the author cannot be used when AI is the author, given the theoretically indefinite lifespan of the system,⁴⁵ but consensus has not yet emerged on the appropriate length of protection. In regards to liability, unlike an original work written by a person, some AI systems store their information in a form that cannot easily be read by humans or reverse engineered. Given this, it may be impossible to discover why a system made a particular decision or produced a particular output. In such cases, liability will likely attach to the person or entity that controls or directs the actions of the AI. This is difficult, however, and may not always be apparent where one party has created the AI and another has decided what data to put into it or what questions to ask it. In the interim, the practical reality is that business entities will need to ensure that there are contractual indemnities in place for any actions of the AI that infringe copyright work.⁴⁶

C Intellectual Property in the Data

A thorough discussion of AI and IP cannot ignore the important issue of data, as there may be IP in the data and there certainly is IP in the systems that manage and handle data. Developers rely on vast troves of data in the initial training of AI systems as well as for personalization, product improvement or localization (i.e. adapting AI systems to work in a variety of different local conditions). Considerable resources must be spent finding suitable training data, correcting training errors or ensuring the data has not been corrupted (for example, by a cyberattack).

Yet IP protections for data are limited save for some *sui generis* legislation and the limited protection offered by copyright law for databases as collections.⁴⁷ In the USA, for example, databases may be protected by copyright law not as such but as compilations which are defined as a "collection and assembling of preexisting

⁴⁵ G Gurkaynak et al., "Questions of Intellectual Property in the Artificial Intelligence Realm" (2018) 3 *The Robotics Law Journal* 9.

⁴⁶ Similarly, businesses will also need to ensure they know the source of the data used in the AI system to avoid infringing third parties' IP rights or misusing confidential information.

⁴⁷ Databases may be protected by copyright and under *sui generis* legislation; see, for example, the EU Database Directive which defines a database as "a collection of works, data or other independent materials arranged in a systematic or methodical way and capable of being individually accessed by electronic or other means". The definition of database is sufficiently wide to include collections of material on the website. However, use of data by an AI has yet to be judicially tested and *sui generis* database rights are territorial. See G Smith, *Internet Law and Regulation* (5th ed., London, Sweet & Maxwell, 2020), at 2–110.

materials or of data that are selected in such a way that the resulting work as a whole constitutes an original work of authorship".⁴⁸ Such protection is of limited value, however, as the US Supreme Court held that a compilation of facts is copyrightable *only* if the selection or arrangement "possesses at least some minimal degree of creativity".⁴⁹ Pre-existing materials or data included in the database therefore may be protected by copyright, or may be unprotectable facts or ideas.⁵⁰ In contrast, Europe grants copyright protection to databases which, as such, by reason of the selection or arrangement of their contents, constitute the "author's own intellectual creation". However, additional *sui generis* protection afforded under the Database Directive⁵¹ is granted to reward the substantial investment of the database maker in creating the database and prevent free-riding on somebody else's investment in creating the database, and exists in parallel to the copyright protection on the structure of the database.⁵²

That there is weak IP protection for data and no system of property rights raises numerous questions regarding the equity of current setups among AI companies that take freely provided data from individuals, then use this data to create products that those same individuals are charged to use.⁵³ This situation is analogous to the one lesser-developed countries experienced decades ago when they complained that developed countries had appropriated their traditional knowledge (TK)⁵⁴ without adequate compensation, thereby exacerbating the wealth gap between developed and developing countries.⁵⁵ TK does not enjoy IP protection, though *sui generis* legislation in some countries does grant protection. But unlike the international north-south divide that characterized the TK debates decades ago, the current debate on remuneration to data providers is both international and intra-national

⁴⁸ 17. U.S.C. § 101.

⁴⁹ *Feist Publications, Inc. v. Rural Telephone Service Co.*, 499 U.S. 340 (1991).

⁵⁰ A fundamental principle of intellectual property law is that no one should be given a monopoly on facts, ideas or other building blocks of knowledge, thought or communication. See JE Cohen and WM Martin, "Intellectual Property Rights in Data", in DJ Richards, BR Allenby and WD Compton (eds), *Information Systems and the Environment* (Washington, DC, National Academy Press, 2001), at 51.

⁵¹ Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases.

⁵² J Debussche and J César, "Big Data and Issues and Opportunities: Intellectual Property Rights" (Bird & Bird, March 2019), <https://perma.cc/8S5Z-NVMQ>.

⁵³ A Yang, "Make Tech Companies Pay You for Your Data" (*Los Angeles Times*, 27 June 2020), <https://perma.cc/H7MD-MS7C>.

⁵⁴ According to WIPO, TK is a living body of knowledge passed on from generation to generation within a community. It often forms part of a people's cultural and spiritual identity. See "Traditional Knowledge", <https://perma.cc/69VC-VHMX>.

⁵⁵ A comprehensive review of IP and TK is beyond the scope of this chapter, but for additional information see T Cottier and M Paniuzzo, "Legal Perspectives on Traditional Knowledge: The Case for Intellectual Property Protection" (2004) 7 *Journal of International Economic Law* 371; G Dutfield, "Protecting Traditional Knowledge: Pathways to the Future" (2006) ICTSD Issue Paper No. 16; and S Ragavan, "Protection of Traditional Knowledge" (2001) 2 *Minnesota Intellectual Property Review* 1.

(though the challenge now could be characterized as a struggle between the tech giants who have both the data and the technological infrastructure and those companies who do not possess such assets).

Granting property rights in the data raises a host of challenging issues, which are raised but not analysed here, including adequate compensation for use, restriction on use (and whether prevention of data transfer without compensation falls afoul of obligations undertaken in free trade agreements) and whether and the extent to which property rights in data hinder innovation. Another IP-related aspect to data worth considering is that there is IP in the form of know-how (or other trade secrets) in the use of data for AI. Because of the growing liability concerns and other issues associated with faulty AI systems,⁵⁶ organizations employing AI systems will need to become more careful about the implementations of such systems, and will need to ensure the quality of the data used to train and update such systems to ensure that the data is appropriate for the task at hand, that it was not tampered with and that it is accurate (the last point is a problem given that the sources of data companies rely upon for, say, digital marketing may be suspect).⁵⁷ Thus there is IP in the curation of data – to ensure the data has been validated, is appropriate for the purpose at hand and has not been tampered with – as well as IP in the creation of AI applications and deployment of AI technologies (that may be protected by IP rights or block their use by others' IP rights). The importance of these IP-related data issues will only grow in relevance, yet current levels of protection are limited and it is uncertain whether greater levels of protection would lead to clearer outcomes or enhanced levels of innovation.

D *The Profound Question*

IP refers to creations of the mind⁵⁸ used in commerce, and the IP system is designed to encourage creation and invention and reward creators and inventors through IP rights. As per Stephen Thaler's claim that an AI is capable of autonomously creating a patentable invention (DABUS) without any human intervention, the most fundamental question which requires resolution is whether AI's lack of corporeal

⁵⁶ For example, a faulty facial recognition match led to a man's arrest for a crime he did not commit. K Hill, "Wrongfully Accused by an Algorithm" (*New York Times*, 25 June 2020), <https://perma.cc/2zBC-87T3>.

⁵⁷ For example, much of the data used by digital marketers to profile users was actually created by AI bots and not human users. See A Fou, "Are Marketers Wasting Money on Adtech Myths?" (*Forbes*, 4 June 2020), <https://perma.cc/4JAo-MEDB>.

⁵⁸ Interestingly, the question of what constitutes a "mind" has not arisen in recent discussions of AI and IP. Does "mind" refer to a single monolithic mind which characterizes human and most AI systems, a symbiosis of human minds and AI, a hive mind or swarm intelligence? This is beyond the ambit of this chapter, but for more information see L Rosenberg, "The Rise of the Human Hive Mind, Disruption Hub" (Disruption Hub, 28 June 2017), <https://perma.cc/8L72-5CTL>; and G Beni and J Wang, "Swarm Intelligence in Cellular Robotic Systems", in P Dario, G Sandini and P Aebischer (eds), *Robots and Biological Systems: Towards a New Bionics?* (Berlin, Springer, 1993), at 703–712.

existence is sufficient to deny it IP rights. This conundrum forces us to confront a related question – is the IP system, which until now has been intimately associated with the human creative and inventive spirit with its respect and reward for the encouragement of human innovation and creativity – more about advancing creative and technological progress or upholding human rights?

Dr Francis Gurry, immediate past Director General of WIPO, noted that “intellectual property is key to economic development”,⁵⁹ and studies have shown that IP rights benefit developing as well as developed nations.⁶⁰ There have always been developmental and commercial aspects to IP, even with the fundamental objective of the patent system being to encourage investment of human and financial resources and risk taking in generating inventions that may positively contribute to the welfare of a society, promote creations, distinguish the origin of goods and services and prevent consumer confusion.⁶¹ Even national constitutions promote IP; for example, the American Constitution’s Patent and Copyright Clause states that “[The Congress shall have power] to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries”;⁶² AI could undoubtedly increase the pace of innovation and creation.

There is potential benefit to the signalling value of protecting the IP of AI-generated creations and inventions, including that jurisdictions which permit the registration of IP rights to an AI for its inventions or creations would be seen as pro-innovation and perhaps attract more development, investment and employment opportunities. Likewise, a lack of IP protection for AI-generated inventions might discourage companies from investing in AI technologies and prevent breakthroughs in important areas like drug discovery.⁶³

What is certain is that a lack of protection will lead to greater use of trade secrets, which could serve to further retard innovation and knowledge dissemination. While limiting the use of trade secrecy could potentially mitigate this potential problem, attempts to do so could violate obligations undertaken in free trade agreements⁶⁴ and

⁵⁹ “Intellectual Property Key to Economic Development” (Zimbabwe Situation, 5 November 2019), <https://perma.cc/M3QT-CXY5>.

⁶⁰ JM Barnett, “Patent Tigers: The New Geography of Global Innovation” (2017) 2 *Criterion Journal on Innovation* 429. For a more nuanced view, see B Mercurio, “Reconceptualising the Debate on Intellectual Property Rights and Economic Development” (2010) 3 *The Law and Development Review* 65.

⁶¹ WIPO Secretariat, note 3 above.

⁶² US Constitution, Article I Section 8, Clause 8.

⁶³ See Chan, note 12 above.

⁶⁴ The Intellectual Property Chapter of the recently negotiated United States-Mexico-Canada Agreement (USMCA), also referred to as the “new NAFTA”, contains the most comprehensive treatment of trade secrets in any free trade agreement, with provisions against the misappropriation of trade secrets, the possibility for criminal and civil procedures, penalties and remedies, prohibitions against impeding licensing of trade secrets, judicial procedures to prevent disclosure of trade secrets during the litigation process and penalties against government officials for the unauthorized disclosure of trade secrets. See USMCA, Section I (Article 20.69–20.77).

would definitely meet fierce resistance by tech giants and other AI companies dependent on the protection of confidential algorithms and other information for business pursuits. Moreover, countries considering weakening trade secrecy laws would do well to remember India's past attempt to emasculate trade secrecy – when India attempted to force Coca-Cola to release its secret recipe under its Foreign Exchange Regulation Act of 1973, Coca-Cola refused and simply left the country.⁶⁵

But the question remains unanswered whether prioritizing innovation and creation over people is fair or wise. As AI continues to increase in sophistication, society may be unwilling to sacrifice individual rights at the altar of innovation. Industry promises to protect the rights of marginalized groups and individuals, but such promises often ultimately ring hollow as history has shown that such self-regulation can be woefully inadequate at protecting people, particularly those in marginalized communities who are frequently targeted by manipulation campaigns.⁶⁶ Furthermore, in times of global economic crisis the priority may be coping with the significant socio-economic challenges brought about by the COVID-19 health crisis.⁶⁷

In sum, there are countless legal, technical and policy arguments for and against ownership of IP by an AI in the areas of patents, copyrights, design rights and trade secrets, as well as questions regarding property rights in the data or whether to establish a *sui generis* system for original content, and posing one question in one area can generate many others elsewhere. At one level, there is no practical need to let an AI become an IP holder. After all, one could simply name a human in an application the way some companies designate their chief engineer in patent applications, even though the actual inventors were other employees; or it has been suggested that the system could treat AI as we would treat a pet, arguing that pets have intelligence and a certain level of autonomy but not legal personhood. Similarly, the AI operator legitimately controls, confines and possesses the AI during conception and thus ownership of the AI invention should be held by the AI operator, their employer (work-of-hire) or successor.⁶⁸ While the latter approach allows for easy identification of the origin of the invention and a true entity entitled to the exclusive right, it does not suffer from problems of wrongful credibility (i.e. truthfully showing the involvement of an AI, and avoiding divisive discussions of

⁶⁵ See K Obermeier, "When India Kicked Out Coca-Cola, Local Sodas Thrived, Some Still Reign Today" (*Atlas Obscura*, 15 February 2019), <https://perma.cc/ESM8-R5A4>. Curiously, India may be attempting to do so again by requiring foreign tech companies to disclose their algorithms. See R Montti, "Google Might Have to Give Algorithm Access to India" (*Search Engine Journal*, 6 July 2020), <https://perma.cc/DJ4V-NF5B>.

⁶⁶ AccessNow, "Human Rights in the Age of Artificial Intelligence" (2018), <https://perma.cc/MC4L-CMJL>.

⁶⁷ The economic situation in Spain, for example, has deteriorated to the point that the country has already taken steps to implement universal basic income. See K Ng, "Spain Approves National Minimum Income Scheme" (*Independent*, 29 May 2020), <https://perma.cc/Y82L-HP8F>.

⁶⁸ ZW Lin, "Finding a Way Forward: Analyzing Approaches to Artificial Intelligence Inventorship" (*IP Watchdog*, 20 June 2020), <https://perma.cc/Q9XE-K7RK>.

legal personhood⁶⁹). This model, however, may not work or may seem unfair where human intervention is minimal.

The final challenge to address is how the question of IP rights affects business investment. Some have claimed that the USA's more permissive software patenting regime than Europe is a primary reason why more software development took place in America.⁷⁰ This may be overblown, as the USA did not see an outflow of investment, innovation or talent following the effective raising of standards after the US Supreme Court's decision in *Alice Corp. v. CLS Bank International*, where the court avoided giving a clear definition of the expression "software patent" and held that "merely requiring generic computer implementation fails to transform [an] abstract idea into a patent-eligible invention".⁷¹ Similarly, the 2018 report on the impact of the Database Directive⁷² made no mention of any great new flows of technological investment into the European Union as a result of the Directive.

IV CONCLUSION

How the IP system deals with AI is far more complicated and involved than it might initially appear because there are many difficult matters that are at once esoteric and, in some cases, profoundly consequential, plus a mixture of technical, legal, data-related, social and societal issues to juggle. Even the question of how to deal with disclosure in a patent application involving an AI-generated invention is complex – and that is only one of many such problems. AI and IP bring together many technological, legal, data and societal policy questions in a complex, messy convergence that is not easy to untangle. In short, AI makes for an uneasy fit with the existing structures and norms of the IP regime. Thus, developers of AI would be well advised to secure the benefits of their investment and mitigate IP risks associated with AI by contract. Developers would be well advised to select an appropriate jurisdiction for the development of AI, contractually define such matters as the ownership of IP and inventions akin to IP, and assign and break down all foreseeable risks created by AI via insurance clauses or other mechanisms.

⁶⁹ This is something the European Union discovered when it examined the issue of legal personality for robots. See J Delcker, "Europe Divided Over Robot 'Personhood'" (*Politico*, 13 April 2018), <https://perma.cc/Y2DA-JHEC>.

⁷⁰ See "Which Countries Allow Software Patents?" (Patsnap, 25 January 2017), <https://perma.cc/K6L3-3AVB>; M Guntersdorfer, "Software Patent Law: United States and Europe Compared", <https://perma.cc/X9C3-ZNYD>; and E Robert Yoches et al., "How Will Patent Reform Affect the Software and Internet Industries?" (2011), <https://perma.cc/B2FF-RJSY>.

⁷¹ *Alice Corp. v. CLS Bank International*, 573 U.S. 208 (2014). In 2019 the USPTO issued new guidelines to applicants with software-related patent applications that increased the burden on applicants to provide a more robust disclosure for computer-related claims. See further M Henry-Nickie, K Frimpong, HS Friday, "Trends in the Information Technology Sector" (Brookings Institute, 29 March 2019), <https://perma.cc/8HG8-79Aq>.

⁷² European Commission, Evaluation of Directive 96/9/EC on the legal protection of databases, Brussels 25.4.2018.