

December 15, 2019

Director of the U.S. Patent and Trademark Office  
P.O. Box 1450  
Alexandria VA 22313

**RE: REQUEST FOR COMMENTS ON INTELLECTUAL PROPERTY PROTECTION  
FOR ARTIFICIAL INTELLIGENCE INNOVATION**

To the United States Patent and Trademark Office:

My name is Ryan Abbott, I am Professor and Chair of Law and Health Sciences at the University of Surrey in the United Kingdom, and Adjunct Assistant Professor of Medicine at the David Geffen School of Medicine at UCLA. Relevant to these comments, I am a U.S. attorney licensed in California and New York, and a solicitor (non-practicing) in England and Wales.

I would like to thank the USPTO and Director Iancu for their interest in this subject and for this opportunity to comment on AI innovation.

While the broader topic of AI innovation raises a myriad of important issues, I will restrict my comments here to AI-generated works or “computer-generated works” (CGW) in the context of copyright law, which I will define as a “copyrightable work generated by an AI in circumstances such that the AI, if a natural person, would be an author.” I will also address the US Copyright Office’s “Human Authorship Requirement.” U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 306 (3d ed. 2017).

I would also like to direct the USPTO to comments I provided earlier this year in response to the Office’s request for comments on patenting artificial intelligence inventions. Those comments have been submitted to Regulations.gov with comment tracking number: [1k3-9d57-123a](#). While the earlier comments focus on patent law issues associated with AI innovation, they also have relevance to copyright. Additionally, I attach to the present comments an academic article with focus on copyright issues: Ryan Abbott, *Artificial Intelligence, Big Data and Intellectual Property: Protecting Computer-Generated Works in the United Kingdom*, In RESEARCH HANDBOOK ON INTELLECTUAL PROPERTY AND DIGITAL TECHNOLOGIES (Tanya Aplin ed., Forthcoming January 2020) (“Abbott 2020”).

The following comments directly address at least Questions 1, 5, and 13, namely:

1. Should a work produced by an AI algorithm or process, without the involvement of a natural person contributing expression to the resulting work, qualify as a work of authorship protectable under U.S. copyright law? Why or why not?

5. Should an entity or entities other than a natural person, or company to which a natural person assigns a copyrighted work, be able to own the copyright on the AI work? For example: Should a company who trains the artificial intelligence process that creates the work be able to be an owner?

13. Are there any relevant policies or practices from intellectual property agencies or legal systems in other countries that may help inform USPTO's policies and practices regarding intellectual property rights (other than those related to patent rights)?

## I. Arguments in Support of Protections for CGWs

### Subsistence

The Office should register copyrights for CGWs because doing so would further the underlying goals of copyright law, including the constitutional rationale for copyright protection, and because there is no binding authority that prohibits copyright for CGWs.

The U.S. Constitution explicitly provides an economic rationale for copyright protection. Namely, that Congress shall have the 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.” UNITED STATES CONSTITUTION, ARTICLE I, SECTION 8, CLAUSE 8. This refers to copyright acting as a financial incentive to generate expressive works.

Copyright can promote the creation of works by allowing copyright owners to keep others from making, using, copying and selling protected works without their permission. Without copyright, it might not be possible to exclude third parties from, say, downloading music or artwork for free. Thus, copyright can increase the financial value of works by allowing copyright holders to charge a premium for their intellectual property. In turn, the increased value of works incentivizes their creation.

In addition to serving as an economic incentive, copyright is also justified on the basis of natural or moral rights, such as the right of attribution, the integrity of an author’s work, and Lockean theories.

Allowing copyright for CGWs would further all of these economic and moral objectives. In terms of economic rights, even though AI is not responsive to financial incentives, the individuals and businesses who own and develop AI are. Allowing copyright for CGWs would increase the value of “creative AIs” that are capable of generating CGWs, which would thereby incentivize their development. This would reward effort upstream from the stage of creative activity and ultimately result in even more expressive works. In addition, it would prevent a perverse situation where an AI is more effective at generating creative output than a person in

certain situations, but a party is forced to avoid using AI because only directly human output can attract copyright protection.

In terms of moral rights, acknowledging AI as an author would safeguard moral rights because it would prevent people from receiving undeserved acknowledgement. Taking credit for an AI's work would not be unfair to a machine, but it would diminish the accomplishments of people who have created without using inventive AI. In addition, acknowledging AI as authors would acknowledge AI developers who can take credit for the accomplishments of their creations.

### Ownership

An AI should clearly not own copyright. Among other reasons, machines do not have legal personality and cannot own property.

In the event that copyright protection is provided for CGWs, the default owner of copyright should be the owner of the AI that has generated the work. This best achieves the goals of copyright law because it makes a creative AI more valuable to its owner and thus most promotes the development of creative AIs. This would also be consistent with current principles of property ownership, such that the owners of chattel (including machines) are able to exploit their property, and it would not interfere with the transfer of personal property in the form of creative AIs.

Such an arrangement would not be without precedent, particularly with respect to copyright ownership where the Works Made for Hire doctrine allows an employer to be considered an author and to own copyright. 17 U.S.C. § 201(b) (2016). Indeed, in the U.S., non-human, artificial persons such as companies can already be authors under this doctrine.

### International Analogs

Providing copyright protection for CGWs would not be without precedent. The United Kingdom was the first jurisdiction to explicitly provide for copyright protection of CGWs. The Copyright, Designs and Patents Act 1998 ("CDPA") is the primary legislation for copyright law and it makes special provision for CGWs with different rules for authorship and copyright duration. These works are defined as those "generated by a computer in circumstances such that there is no human author of the work[s]." Copyright, Designs and Patents Act 1988, §178.

For CGW works, the CDPA provides that, "[i]n the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangement necessary for the creation of the work are undertaken." Copyright, Designs and Patents Act 1988, §9 (3). Since the enactment of the CDPA, jurisdictions such as Ireland, India and New Zealand have followed the United Kingdom's lead in providing copyright protection for CGWs.

## II. Problems with the Human Authorship Requirement

### Policy Objections

The Human Authorship Requirement discourages the use and development of creative AI. As a result of the Copyright Office’s policies, CGWs in the United States now automatically enter the public domain and cannot receive copyright protection. As a result, even when an AI would be more efficient than a person, a person may need to be used to create a new work in order for copyright protection to subsist. This is a problematic state of affairs that will become even more inefficient once creative AI is able to routinely outperform people at certain creative acts. Advanced AI may result in significant and widespread social benefits assuming appropriate legal frameworks exist.

In addition, the Human Authorship Requirement is likely to lead to a state of affairs in which people inaccurately claim authorship for work done by machines. Anyone in control of an AI that has generated a CGW with value can register the work simply by listing themselves as an author. Indeed, it has previously been reported that intellectual property filings have not disclosed the fact creative works were CGWs. Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 54 B. C. L. Rev. 1079–1126 (2016). This policy encourages applicants to act dishonestly to capture the value of CGWs. It also undermines the value of human authorship by allowing individuals to inaccurately claim they are authors.

#### Lack of Authority for the Human Authorship Requirement

I am aware of no U.S. statute that specifically addresses CGWs and copyright, or that explicitly requires an author to be a natural person. Indeed, as discussed earlier, non-human entities may be authors under, *inter alia*, the Works Made for Hire doctrine.

The Human Authorship Requirement cites to dicta from over a hundred years ago to support the assertion that a human being has to create a work. Specifically, it cites to the 1879 Trade-Mark Cases, 100 U.S. 82, 94 (1879), as well as to the 1886 case of *Burrow-Giles v. Sarony*, 11 U.S. 53, 58 (1884), in support of the Human Authorship Policy based on their references to “the creative powers of the mind” and “intellectual conceptions”. However, these cases did not consider whether AI could legally generate works eligible for copyright protection. Indeed, in the late 19<sup>th</sup> century, AI did not exist in any meaningful sense. The cameras of the time were tools that were incapable of automating human creativity.

Today, it has now been well documented that machines are able to autonomously generate creative works (Abbott, 2020). It is not at all clear that there is a mechanistic difference between how people and machines engage in creative acts that justifies different legal rules, and there is certainly not a functional difference that justifies different legal rules. Because copyright law is primarily functional in nature and concerned with the generation of new works, it should be indifferent to whether people or machines are generating these works so long as copyright law achieves its objective of promoting the useful arts.

The Copyright Office is currently relying upon non-binding judicial opinions from the Gilded Age to answer the question of whether CGWs can be protected. If CWGs are to be prohibited, this should only be on the basis of sound public policy after serious consideration. To the extent that the cases cited in support of the Human Authorship Requirement have anything useful to

offer with respect to CGWs, the relevant dicta is that just as the terms “Writings” have been construed flexibly in interpreting the Patent and Copyright Clause, so too should the term “Authors” be afforded the flexibility needed to effectuate constitutional purposes.

### **Conclusion**

Advances in AI pose new challenges to intellectual property systems designed to incentive and protect acts of human creativity. These developments will require us to not only reconsider how existing blackletter law can accommodate new technological developments, but also the normative foundations of our intellectual property systems.

The guiding principle for the USPTO should be what rules will best achieve the underlying goals of copyright law. Namely, how can copyright law best incentivize expressive works and protect the rights of authors. With respect to AI, USPTO should be concerned with the functionality of machines and their consequentialist benefits. What legal rules will result in the greatest social benefit from technologies like AI? At the end of the day, the primary purpose of the copyright system is to promote creative activity, whether it comes from a machine or a person.

It is important the U.S. adopt policies that allow copyright on AI-generated works. This will encourage development of creative AI, ultimately resulting in new socially beneficial works. Even if creative AI currently plays a relatively small role in the creative economy, this is very likely to change as a result of continued advances in AI. I submit that the best way to appropriately encourage this, to ensure the U.S. remains a globally competitive nation, and to protect the moral rights of authors is to list an AI as an author where it functionally automates creative work and for any ownership rights in copyright for AI-generated works to vest in an AI’s owner.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read "Ryan Abbott".

Ryan Abbott, MD, JD, MTOM

# ARTIFICIAL INTELLIGENCE, BIG DATA AND INTELLECTUAL PROPERTY: PROTECTING COMPUTER-GENERATED WORKS IN THE UNITED KINGDOM

RYAN ABBOTT\*

**Abstract:** Big data and its use by artificial intelligence (AI) is changing the way intellectual property is developed and granted. For decades, machines have been autonomously generating works which have traditionally been eligible for copyright and patent protection. Now, the growing sophistication of AI and the prevalence of big data is positioned to transform computer-generated works (CGWs) into major contributors to the creative and inventive economies. However, intellectual property law is poorly prepared for this eventuality. The UK is one of the few nations, and perhaps the only EU member state, to explicitly provide copyright protection for CGWs. It is silent on patent protection for CGWs.

This chapter makes several contributions to the literature. First, it provides an up-to-date review of UK, EU and international law. Second, it argues that patentability of CGWs is a matter of first impression in the UK, but that CGWs should be eligible for patent protection as a matter of policy. Finally, it argues that the definition of CGWs should be amended to reflect the fact that a computer can be an author or inventor in a joint work with a person.

Keywords: computer-generated works, artificial intelligence law, big data and intellectual property, international law, patents

## I. INTRODUCTION

Big data and its use by artificial intelligence (AI) is changing the way intellectual property is developed and granted. For decades, machines have been autonomously generating works which have traditionally been eligible for copyright and patent protection.<sup>1</sup> For instance, in the US, the first “computer-generated work” (CGW) was submitted for copyright registration prior to 1965. The US Patent and Trademark Office (USPTO) has granted patents for inventions autonomously generated by computers as early as 1998. Terms such as “computers” and “machines” are used in this chapter interchangeably to refer to computer programs or software rather than to physical devices or hardware. As AI continues to grow exponentially more sophisticated and powerful, and the amount of data available to these machines keeps pace, CGWs should become a major contributor to the creative and inventive economies.<sup>2</sup>

This chapter considers the phenomenon of CGWs from a UK, EU and international law perspective. There is little law on the subject. UK law explicitly provides for copyright protection of CGWs, and in this respect, it is an outlier in the EU and internationally. However, UK law is silent on patent protection. No UK, EU or international law explicitly prohibits protection for

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CGWs, but rarely are such works explicitly protected. Legal instruments and judicial language related to both copyright and patents frequently refer to authors and inventors as natural persons, or restrict authorship or inventorship to natural persons, but this is most likely in response to the prospect of corporate authorship and inventorship. Such language does not appear to be the result of seriously considering CGWs and should not prohibit IPRs as a matter of policy.

This chapter begins by describing the phenomenon of CGWs and then reviewing the relevant law. It seeks to resolve the following questions: Are computers autonomously creating or inventing or merely aiding human authors and inventors? How will inventive machines alter research and development? Can a CGW receive copyright or patent protection? Can a person qualify as an author or inventor for a machine's output? Who would own IPRs associated with a CGW? These and other questions can be answered by referring to the fundamental policy rationales for IPRs, and by analogy to instances of human authorship and invention.

The chapter argues that patentability of CGWs is a matter of first impression in the UK, but that CGWs should be eligible for patent protection. This would incentivize the development of inventive machines, which will ultimately result in more innovation. Acknowledging machines as inventors would also safeguard moral rights, because it would prevent people from receiving undeserved acknowledgement.

The chapter also proposes that the standard for CGWs should be amended—for copyright as well as patent. Rather than treating a CGW as a work “generated by a computer in circumstances such that there is no human author of the work”, a CGW should be a work “generated by a computer in circumstances such that the computer, if a natural person, would be an author.” Similarly, for patents, CGW should be a work “generated by a computer in circumstances such that the computer, if a natural person, would be an inventor.” This would take into account the fact that people and machines often work collaboratively, and that even with the involvement of a person a machine can contribute as an author or inventor in its own right.

Finally, this chapter argues there is a need for an internationally harmonized approach to CGWs. Most jurisdictions in the EU, and worldwide, have yet to decide how to regulate CGWs. Failure to internationally harmonize may disadvantage countries which permit IPRs for CGWs, and advantage those which do not.

## II. CREATIVE COMPUTERS AND INVENTIVE MACHINES

### *The Growing Sophistication of AI*

Much has been written about the increasing capacity of AI to engage in knowledge-work. Indeed, hardly a day goes by without a news article describing some new feat achieved by AI, whether it is IBM's AI system *DeepBlue* beating Garry Kasparov at Chess, IBM's *Watson* winning a game of Jeopardy, or Google's *DeepMind* defeating a Go world champion in 2016. *DeepMind*'s Go victory was unexpected at the time because of the sheer complexity of the game, which has more potential Go board configurations than there are atoms in the Universe. AI systems are playing games to demonstrate their capabilities and to train, but they are also being applied to solve practical problems. *Watson*, for example, is being used to find new uses for existing drugs—an activity that has traditionally been fertile grounds for generating patentable inventions.

Computer knowledge-work can be thought of on a spectrum. On the one end, computers may function as simple tools that assist human authors and inventors, much the way that a pen or a wrench can help someone to write or invent. Works generated in this fashion have been referred to as “works created using a computer”, and likely account for the vast majority of human-machine

collaboration. While it could not be seriously argued that Microsoft Word should be a co-author of this chapter, it did contribute to the chapter's creation. At times, Word corrects spelling, automatically formats, and even suggests the use of certain words.

The term "intermediate works" has been used to refer to more substantive contributions made by computers to creative works where a person qualifies as an author or inventor. It may be difficult to precisely distinguish between an intermediate work and a work created using a computer. Word probably could not contribute to an intermediate work, but a variety of publicly available software programs can. For instance, "Band-in-a-Box" allows a user to choose chords and styles, and the program then automatically generates a "complete professional-quality arrangement of piano, bass, drums, guitar, and strings or horns."<sup>3</sup> Other programs can make similarly substantive contributions to different types of creative works, such as novels and films. In some instances of intermediate works, it may be the case that the computer would qualify as a joint author or inventor, if it were a natural person.

At the other end of the spectrum, computers generate works under circumstances in which no human author or inventor can be identified. These are often referred to as CGWs or "works created by a computer". While not widely appreciated, computers have been creating CGWs for decades. As an interesting example of the interplay between copyright and patent, in 2003, technologist Raymond Kurzweil, now a Director of Engineering at Google, was granted a patent on a computer program that could autonomously generate creative writings—the "Cybernetic Poet." Incidentally, Mr. Kurzweil now predicts that machines will have human levels of intelligence in about a decade.

The argument has been made that a human author or inventor exists for any CGW, in the sense that, "behind every good robot is a good person."<sup>4</sup> It is true that a programmer (or *many* programmers and developers) has to create computer software, and in some cases it may make sense to impute authorship or inventorship to a programmer—particularly if a programmer develops an algorithm specifically to solve a particular problem or to generate a particular output. In these cases a programmer might have a significant contribution to a machine's specific output. However, it may also be the case that a programmer creates an algorithm with no expectation or knowledge of the problems it will go on to solve. Some AI systems such as neural networks can behave unpredictably, such that their original programmers may not understand precisely how they function.<sup>5</sup> Some computer systems, such as those based on genetic programming, may even be able to alter their own code. By analogy to human inventorship, an inventor's teachers, mentors and even parents do not qualify as inventors on their patents, at least, not without directly contributing to the conception of a specific invention.

Attributing authorship or inventorship to a computer *user*, rather than a programmer, is also problematic. It may sometimes be the case that a user makes a significant contribution to a computer's output, or that formulating instructions to a computer requires significant skill. However, it may also be the case that a user simply asks a computer to solve a problem, and the computer proceeds to independently generate an answer. In the future, it may even be the case that the computer is able to identify that its output is eligible for copyright or patent protection. In such cases, it seems difficult to argue that the user is an author or inventor. Again, by analogy to human works, simply instructing another person to solve a problem does not *usually* qualify for authorship or inventorship.

Thus, in at least some instances, computers are generating works traditionally entitled to copyright and patent protection under circumstances in which no natural person qualifies as an author or inventor according to traditional criteria. In practice, it may be difficult to distinguish

between works created using a computer, intermediate works, and works created by a computer. However, this is not unlike making sense of human authorship and inventorship for joint works where individuals make diverse contributions.

### *Where's the CGW?*

Given these technological advances, one would be forgiven for asking—where are the CGWs? Why are there not routinely lawsuits over CGWs? How have countries managed without legal standards for CGWs?

It may be that the creative AI revolution has yet to arrive. CGWs may be few and far between, or lack commercial value. When Scott French programmed a computer to write a novel in the style of a famous author in 1993, the resulting work was described by one critic as, “a mitigated disaster”.<sup>6</sup> Likewise, with regard to inventions, computers may rarely be inventing, or these outputs may lack significant utility.

It may also be that computers *are* creating CGWs, but that this is not being disclosed. There are good reasons to think this may be the case. In the US, for example, CGWs are not entitled to copyright protection. In 1965, the US Copyright Office reported it received several applications for CGWs. Given the exponential improvements in computer science, one would thus expect a similarly exponential increase in CGWs submitted for copyright protection from 1965 until the present. However, at least as early as 1973, the US Copyright Office elected to deny protection for CGWs.<sup>7</sup> As a result, anyone in possession of a potentially valuable CGW would disqualify protection for the work by revealing its origins. A computer user wishing to obtain protection for a CGW may thus end up identifying himself or herself as the author. Similarly, in the UK, it is not clear that CGWs are entitled to patent protection. Computer users may thus elect to identify themselves as inventors for CGWs. Indeed, some of the earliest applicants for patents on CGWs were advised by their attorneys to report themselves as inventors.<sup>8</sup>

Failing to disclose the machine's role in a CGW may also seem an appealing option because it is unlikely to be challenged. For instance, in the UK, CGWs are protected by copyright without registration, and the UK Intellectual Property Office (IPO) will not dispute a patent applicant's reported inventorship unless this is challenged by a third-party. The issue of authorship or inventorship of a CGW may not arise until litigation, and even that is unlikely. When human authors and inventors have a disagreement about relative contributions, there will generally be one or more parties with an adverse legal interest. However, if a user takes credit for a computer's invention, the computer is not in a position to protest. A legal dispute will probably only occur in cases where an alleged infringing party wants to dispute copyright or patent protection can subsist in a CGW, and somehow becomes aware that a computer was involved in generating the work.

This situation with respect to CGWs is a problematic state of affairs. It is important that authorship and inventorship be accurately attributed, both to optimize the use of copyright and patents as economic incentives, and to preserve the moral rights of natural persons. Establishing an author or inventor's identity is important because whether the work qualifies for protection in the UK may depend on the author's national status. It also identifies the first owner of copyright or patent, may base the term of copyright protection on the author's death, and determines whether there are moral and rental rights belonging to an author. In whatever manner nations elect to protect CGWs, including by providing no protection, appropriate identification of the origin of CGWs is necessary for IPRs to function effectively as economic rights. Even with regard to moral rights, failure to designate a computer as an author or inventor may result in individuals taking credit for

works they have not personally generated. This may undermine the value of human authorship and inventorship.

Determining computer authorship and inventorship may be a complex endeavor. However, that is already the case with natural persons. For instance, despite the romantic conception of inventors as lone prodigies tinkering in their garages and experiencing flashes of genius, the vast majority of invention comes from industry and academic work where multi-person collaborations are the norm. Inventorship disputes are becoming more common,<sup>9</sup> and determining inventorship in collaborative work is “one of the muddiest concepts in the muddy metaphysics of the patent law”.<sup>10</sup>

### III. LEGAL STANDARDS

Intellectual property in the UK is primarily governed at the national level, subject to compliance with certain EU requirements and international treaties.

#### *United Kingdom Standards for Computer-Generated Works*

The Copyright, Designs and Patents Act 1998 (“CDPA”) is the primary legislation for copyright law.<sup>11</sup> Copyright is an intellectual property right which subsists in certain creative works such as books, music and movies. It gives its owner the exclusive right to exploit the underlying subject matter for a fixed number of years, generally 70 years plus the life of the author, subject to certain exceptions such as fair dealing. Generally, the author of a work is the person who creates it, and the author is the default copyright owner. A notable exception is that an employer will be the default owner if a work is “made by” an employee in the course of employment. In some instances, an “author” can be a body incorporated in the UK, such as a limited company.<sup>12</sup> Special authorship rules apply to “entrepreneurial” or “media” works—sound recordings, films, broadcasts and typographical works—that are produced rather than created, whereby legal entities are accepted as authors.

The CDPA makes special provision for CGWs with different rules for authorship and copyright duration. These works are defined as those “generated by a computer in circumstances such that there is no human author of the work[s].” CDPA §178. For these works, the CDPA provides that, “[i]n the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the arrangement necessary for the creation of the work are undertaken.” CDPA §9(3). Of note, this protection only extends to literary, dramatic, musical and artistic works and not to media works, although a similar system to §9(3) also applies with regard to design rights.<sup>13</sup> For CGWs, the term of the copyright is fifty years from the end of the calendar year in which the work was made.<sup>14</sup>

At least two cases considered CGWs under the Copyright Act 1956, the statutory regime prior to the CDPA.<sup>15</sup> This statute had no provisions for CGWs.<sup>16</sup> In *Express Newspapers plc v Liverpool Daily Post & Echo* [1985] FSR 306, the plaintiff newspaper *Daily Express* conducted a ‘Millionaire of the Month’ competition. It distributed cards with a five-letter code, and the public could check these cards against a daily newspaper grid, generated by a computer, to see if they won a prize. The defendant newspaper copied these grids, and was subsequently sued for copyright infringement. One argument advanced by the defendant was that because the grids were produced with the aid of a computer, they had no human author and thus could not be protected by copyright. Whitford J rejected this argument, stating, “[t]he computer was no more than the tool by which the varying grids of five-letter sequences were produced to the instructions, via the computer programs, of [the programmer]. It is as unrealistic [to suggest the programmer was not the author]

as it would be to suggest that, if you write your work with a pen, it is the pen which is the author of the work rather than the person who drives the pen.” *Id.* Whitford J also noted “that a great deal of skill and indeed, a good deal of labour went into the production of the grid and the two separate sequences of five letters”. *Id.*

Prior to this case, in 1977, Whitford J had chaired the “Whitford Report” which found of computer-generated works, “the correct approach is to look on the computer as a mere tool in much the same way as a slide rule or even, in a simple sense, a paint brush. A very sophisticated tool it may be, with considerable powers to extend man’s capabilities to create new works, but a tool nevertheless.”<sup>17</sup> The Whitford Report concluded that both the computer programmer and the person who originated data to provide the computer should be authors of any resultant CGW. In response to the Whitford Report, the Government issued the *Green Paper* report. Among other things, this report argued that the computer user, as potentially distinct from the programmer and originator of data, should generally also be an author.<sup>18</sup> In 1986, the Government published a White Paper, *Intellectual Property and Innovation*, which argued, “[t]he responses to the 1981 Green Paper have shown, however, that circumstances vary so much in practice that a general solution will not be fair in all cases. It appears that no practical problems arise from the absence of specific authorship provisions in this area. *The Government has therefore concluded that no specific provisions should be made to determine this question...* If no human skill and effort has been expended then no work warranting copyright protection has been created.”<sup>19</sup>

After this White Paper, the Copyright Committee of the British Computer Society (BCS) submitted a proposal to the Government arguing that CGWs should be protected as a distinct type of work. “The BCS proposes the creation of a new class of copyright protected works. The copyright owner or ‘maker’ should be defined as the person by whom the arrangements necessary for the making of that computer output or computer-generated work, are undertaken.”<sup>20</sup> This language was essentially adopted in the CDPA. The BCS’s proposed language was modeled after provisions for film authorship under the Copyright Act 1956. Despite the BCS’s protestation that sound recordings, films, cable programmes and published editions were already being generated by computer, the CDPA did not extend protections to this subject matter for CGWs.

Since the CDPA’s enactment, the authorship of CGWs was considered in *Nova Productions Ltd v Mazooma Games Ltd*.<sup>21</sup> In this case, the parties were competing manufacturers of electronic pool games. Nova claimed copyright in its graphics and the frames generated by software from those graphics and displayed to users during gameplay. Kitchin J (as he then was) regarded the frames which the software generated based on user actions to be CGWs, even though the component graphics of the frames were designed by a person. Kitchin J further held that the author of the CGW in this case was the company director responsible for designing the game—the person who designed the appearance of the various elements displayed, devised the rules and logic for frame generation, and wrote the program, and not the game player, who “...contributed no skill or labour of an artistic kind”. It should be noted there was limited consideration of §9(3) in this case because the subsistence and ownership of the works was not contested.

In sum, while judicial experience with CGW copyright is limited, it is clear that copyright protection is available. The “author” of a CGW work is the person by whom the arrangements necessary for the creation of the work are undertaken. In light of the relative absence of case law related to authorship of CGWs, cases that have investigated authorship for films may be instructive. Under the CDPA, a film’s producer and principal director are together deemed an author. A producer, “in relation to a sound recording or a film, means the person by whom the arrangements necessary for the making of the sound recording or film are undertaken...” CDPA

§178. Identifying a producer may be a fact intensive inquiry.<sup>22</sup> Cases have found it is relevant who instigated the making of the film, who paid for the making of the film, whether a film would not have existed but for the input of a person, whether more than one person may be a producer, and the extent of creative contributions.<sup>23</sup> Although jurisprudence in related areas may provide guidance, there is a degree of novelty to determining authorship of CGWs. It may not be clear in all cases whether the person who makes necessary arrangements is a computer's owner, user, or programmer.

#### *United Kingdom Standards for Patenting Computer-Generated Works*

By contrast to copyright, there is no statutory provision governing patents for CGWs, and there appear to have been no cases on the subject. The Patents Act 1977 ("PA") is the primary legislation for patent law. The PA protects inventions which are new, involve an inventive step, and are capable of industrial application. Patents grant their owners the exclusive right to make, use, sell and import an invention for a limited term, generally 20 years from the date an application is filed, subject to certain exceptions.

While nothing in the PA explicitly deals with CGWs, on numerous occasions it references natural persons. For example, the PA requires the identity of individual inventors to be disclosed, and inventors have the right to be mentioned in an application or a patent. It also provides benefits to inventors in some circumstances in which an employer has received outstanding benefit from an invention. The PA states that, "inventor... in relation to an invention means the actual deviser of the invention..." PA §7(3). The term "deviser" is not defined in the PA, but judicial language also frequently refers to inventors as persons and refers to concepts such as "mental activity" being necessary for invention.<sup>24</sup>

#### *European Union Standards for Computer-Generated Works*

The European Single Market seeks to guarantee the free movement of goods, capital, services and labour within the European Union. However, IPRs such as copyright and patents can create barriers to free trade. IPRs are largely national in origin, and not transferrable across borders or mutually recognized per se. In the interest of promoting trade, the EU has attempted to centralize and harmonize national IP laws. This has been aided by case law from the Court of Justice of the European Union (CJEU), the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), which is discussed in the next section, and various EU directives.

Early CJEU cases established the doctrine of exhaustion and the specific subject matter doctrine. This allowed recognition of national IPRs, but limited the application of IPRs where they would limit free movement of goods. The EU is a party to TRIPS, which has harmonized to a great extent IPRs within the EU. Since TRIPS, various EU directives, such as the Computer Program Directive and the Database Directive, have increasingly harmonized national IP laws where differences existed in terms of substance or duration of rights.<sup>25</sup> Further efforts at harmonization have resulted in a unique EU trademark system, and various *sui generis* rights such as EU level plant variety rights. Today, there is relative comprehensive harmonization of some forms of IP such as trademarks, and relative greater discrepancy with copyright. (Elsmore, 2012).

There is no equivalent to the CDPA §9(3) in other EU continental jurisdictions.<sup>26</sup> Worldwide, the UK is one of only a handful of countries that explicitly permits copyright for CGWs. Other nations that provide protection, such as Ireland, New Zealand and India, were influenced by the UK's example—their statutory instruments contain similar language to CDPA §9(3).<sup>27</sup>

EU member states may not have laws specifically permitting or refusing copyright protection for CGWs, but many have laws that restrict authorship to natural persons. For example, Spanish copyright law states that the author of a work is the natural person who creates it.<sup>28</sup> Under French law, only natural persons who create works may be considered authors, and the rights to a work vest in the author regardless of any contract.<sup>29</sup> For collective works, a legal entity can exercise rights but is not classified as the author. Various other national instruments contain language that alludes to authorship as being a human activity. At a European level, the benchmark for originality is an “author’s own intellectual creation.” This concept was first introduced through legislation—the Software, Term and Database Directives—and then developed by the CJEU.<sup>30</sup> For example, in 2011, the CJEU held that, “copyright is liable to apply only in relation to a subject-matter, such as a photograph, which is original in the sense that it is its author’s own intellectual creation... the author of a portrait photograph can stamp the work created with his ‘personal touch’.”<sup>31</sup> This and similar language seems to imply an author is a natural person. CGWs are not explicitly discussed in any European directives.

For patents, as with the PA, the European Patent Convention (EPC) requires the identity of inventors to be disclosed in patent applications and issued patents,<sup>32</sup> although it is left to contracting states to resolve who is an inventor and other entitlement issues. The EPC is a multilateral treaty, separate from the EU and with different membership, which created the European Patent Organisation (EPO) and a system for granting “European patents.” A European patent is not a centrally enforceable patent or a unitary right. Rather, the EPC provides a harmonized procedure for unified prosecution and opposition, on the basis of which a European patent may be nationally granted in any of the 38 EPO countries. By contrast, the European patent with unitary effect (EPUE), or the unitary patent, is a new type of European patent that would be valid in participating member states of the EU. This would involve a single patent and ownership, as well as a single court (the Unified Patent Court), and uniform protection. The *Agreement on a Unified Patent Court* establishes the unitary patent system. Participation is open to any member state of the EU, but not other parties to the EPC. Negotiations for the unitary patent have been ongoing since the 1970s. At present, this agreement will enter into force after it is ratified by Germany.

### *International Standards for Computer-Generated Works*

Two of the most important international agreements governing copyright and patent law are the Berne Convention and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). For example, the Berne Convention required countries to offer the same level of copyright protection to nationals of other parties to the convention. It also introduced the idea that copyright protection is not contingent on formalities such as registration, though member states are free to require ‘fixation’. The most substantive international IP agreement is TRIPS, which established global standards for copyright and patent protection. The UK and all EU Member States are required to adhere to the mandatory requirements in TRIPS. These requirements were modeled after the IP laws in developed nations such as the United Kingdom, United States and Japan, so TRIPS required relatively few changes to the UK’s IP laws when it came into effect on 1 January 1996.<sup>33</sup>

Nothing in these, or any other binding international instrument, explicitly authorizes, or prohibits, protections for CGWs. The Berne Convention, for instance, states the Union is created, “for the protection of the rights of authors in their literary and artistic works.”<sup>34</sup> However, the Convention does not define “author.”<sup>35</sup> The Berne Convention Guide states that this is due to the

fact that, “national laws diverge widely, some recognizing only natural persons as authors, while others treat certain legal entities as copyright owners.”<sup>36</sup>

The World Intellectual Property Organization (WIPO) did consider protections of “computer-produced works” in discussions of a possible Model Copyright Law.<sup>37</sup> It defined a computer-produced work as one generated by a computer where identification of authors is impossible because of the indirect nature of individual contributions. The original owner of the moral and economic rights in such a work would be either the entity “by whom or by which the arrangements necessary for the creation of the work are undertaken,” or the entity “at the initiative and under the responsibility of whom or of which the work is created and disclosed.” WIPO’s Committee of Experts eventually concluded further study was needed, and the model law was never adopted.

### *United States Standards for Computer-Generated Works*

No statute governs the subject of CGWs in the US, and no cases have seriously considered copyright or patent protection for CGWs. However, the US Copyright Office has a policy prohibiting copyright for any non-human work—what it now refers to as its “human authorship requirement.” The US Patent and Trademark Office (USPTO) does not have any stated policy regarding CGWs and patents. In 1986, Professor Pamela Samuelson wrote, “[a]s yet there has been no judicial decision allocating rights in computer-generated works. It can, however, only be a matter of time before courts are forced to resolve the issue.”<sup>38</sup> That prediction proved optimistic.

One recent US case came close to raising the issue. *Naruto v. Slater* involved a series of pictures that a crested macaque took of itself. These “Monkey Selfies” were subsequently commercialized by the camera’s owner, David Slater, who asserted he owned the copyright to the photographs. People for the Ethical Treatment of Animals (PETA) subsequently sued Mr. Slater, alleging that the macaque, Naruto, was the copyright owner, and that Mr. Slater had infringed Naruto’s copyright.

In January 2016, US District Judge William Orrick III dismissed the case on the grounds that Naruto lacked standing to sue. The judge also deferred to the USPTO’s interpretation that the macaque was not an “author” within the meaning of the Copyright Act. He considered PETA’s argument that the USPTO policy is antithetical to the “public interest in animal art”, but ultimately ruled “that is an argument that should be made to Congress and the President, not to me.”<sup>39</sup> PETA appealed the decision to the Ninth Circuit Court of Appeals, and shortly after oral arguments, the parties reached a settlement in which Mr. Slater agreed to donate 25% of any future revenues from the monkey selfies to charities. Despite the settlement, however, the Ninth Circuit dismissed the case to create precedent. The Court held that animals only have statutory standing if an Act of Congress plainly states animals have statutory standing, and so animals are unable to sue under the Copyright Act because the law does not expressly authorize animals to file copyright infringement claims. In doing so, the court avoided weighing in on the merits of non-human authorship.

Outside of CGWs, US copyright law has a mechanism for authorship of artificial persons. “In the case of a work made for hire, the employer for whom the work was prepared is considered the author for purposes.” 17 U.S.C. § 201(b) (2011). Functionally, the same outcome may occur in the UK, but while the UK permits employers to own works, ownership is distinct from authorship for so-called “author works”—literary, dramatic, musical or artistic works—the same works protected by CDPA §9(3). Even in EU countries where only natural persons may be authors, a focus on “author’s rights” does not preclude authors from transferring certain rights to employers,

and some jurisdictions will imply the existence of an agreement to do so. Ultimately, then, the same economic outcome may occur for works made in the course of employment in the US, UK and in EU civil law jurisdictions, but the terminology may differ. Some civil law jurisdictions may also retain additional, inalienable rights for authors.

#### IV. PROTECTING COMPUTER GENERATED WORKS

##### *Policy*

Various rationales are given for IPRs, but broadly speaking, they can function as economic incentives and they are justified on the basis of natural rights. The notion of IPRs as an economic right, particularly for patents, dominates the Anglo-American system. In the US, for example, the Constitution explicitly endorses an innovation incentive rationale for IPRs, by granting Congress the power “[t]o promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.”<sup>40</sup>

Patents can incentivize innovation.<sup>41</sup> This is based on the theory that information goods are typically non-excludable and non-rivalrous, so lack of protection will lead to underproduction. By granting a limited monopoly in the form of a patent, this allows inventors to enjoy greater financial benefits from discoveries and encourages invention. In addition, patents can promote the commercialization of inventions. For instance, new drug approvals often take years, and the pharmaceutical industry claims that getting new drugs approved costs billions of pounds. Once a drug is approved, it may be easy for a competitor to copy the drug and avoid the costs of initial approval. Patents may thus encourage an originator pharmaceutical company to spend the necessary resources on approval, because after the drug is approved they can charge monopoly prices until patents expire. Patents, whether incentivizing research or commercialization, are thus one solution to the “freerider” problem. Finally, patents can promote information disclosure. Patents are issued to inventors in exchange for disclosing to the public how to make an invention. Without patents, inventors might rely on confidential information to prevent copying, and never publicly disclose how to make an invention. This happened, for example, with the drug “Premarin” which was first made by Wyeth and now is made by Pfizer. No generics company has been able to replicate this drug since its first regulatory approval in 1942. Perhaps most famously, Coca-Cola has kept its recipe for its iconic beverage confidential for over a century.

By contrast, the civil law systems of continental Europe may place more emphasis than the UK on moral rights, which are viewed as independently protectable and separate from economic rights. Moral rights protect an author’s personality and the integrity of a work, and are considered “personal, perpetually inalienable and unassignable.”<sup>42</sup> Moral rights also accommodate “personality” rights based, for instance, on theories by Kant and Hegel that people express their “wills” and develop as persons through their interactions with external objects. This, for instance, is accomplished by giving authors the right to control certain uses of their works, even after assigning economic rights. Personality theorists argue that authors and inventors are inherently at risk of having their ideas stolen or altered in objectionable ways. Thus, IPRs are justified to prevent misappropriation or modification of objects through which authors express themselves. IPRs also accommodate Lockean theories of first occupancy, the idea that the person who owns a particular thing should be the person who ‘gets there first’, as well as labour theory, the idea that ownership is derived from mixing labour with unowned or commonly held property, and that appropriating these products would be unjust. These ideals are reflected in patent law, for instance, by giving

inventorship rights to the first inventor to file for a patent, and giving inventorship rights to individuals who find new uses for natural products.

But IPRs can also have significant costs. They restrict competition (particularly in the case of patents) and free speech (particularly in the case of copyright), and they can inhibit innovation, collaboration, and open communities. To the extent that IPRs are justified, it is because they are thought to have more benefits than costs. However, with IPRs, more is not always better. For instance, software patents have been criticized for being unnecessary as an incentive, while at the same time creating “patent thickets” that make work in the software industry challenging.<sup>43</sup> For this reason, the EPC states that “programs for computers” are not patentable, but the EPO will grant patents for “computer-implemented inventions” as long as they have a technical effect.

### *Whether to Patent and to whom?*

Having examined UK, EU and international laws on copyright and patent protection for CGWs, or the absence thereof, let us return to the question of whether the UK should provide patent protection for CGWs. A number of academic commentators have argued that CGWs should become public property.<sup>44</sup> If CGWs should instead be eligible for patent protection, who should be the inventor and owner of a CGW?

This chapter proposes that CGWs should be eligible for patent protection. The innovation incentive function of patents does not change based on whether a computer or a person invents. It is true that a computer does not respond to financial incentives, but the entities who develop inventive machines do. Providing patent protection for the output of autonomous machines makes autonomous machines more valuable, and what better way to incentivize innovation than to incentivize the development of inventive machines? This would reward activity upstream from the act of invention. To the extent that patents are incentivizing commercialization and disclosure of information, there is no change in this function as between a human and CGW. Also, if patent protection is not available for inventive AI output, then businesses may not use inventive AI, even in future instances where AI will be more effective than a person.

If CGWs are prohibited from receiving patents, it may be possible for a natural person to claim inventorship of a CGW even where that person was not involved in the development or operation of a computer. Namely, a person could argue they “devised” the invention by virtue of recognizing the relevance of a machine’s output. Indeed, discovery of an unrecognized problem may give rise to patentable subject-matter (“problem-inventions”).<sup>45</sup> Similarly, discovery of an unrecognized *solution* can be patentable. In some cases, recognition of the inventive nature of a computer’s output may require significant skill, but in others, the nature of inventive output may be obvious. In the future, it may even be the case that a computer can identify its own output as patentable, and format it for a patent application.

If CGWs are to be protected, how then should inventorship and ownership be determined? Distinguishing inventorship and ownership may not functionally impact economic rights, but it does implicate moral rights. At present, *de jure* or *de facto*, individuals are claiming inventorship of CGWs under circumstances in which they have not functioned as inventors. This is fundamentally unfair, and it weakens moral justifications for patents by allowing individuals to take credit for the work of inventive machines. It is not unfair to computers who have no interest in being acknowledged, but it is unfair to other human inventors because it devalues their accomplishments by altering, and diminishing, the meaning of inventorship. This could equate the hard work of creative geniuses with those simply asking a computer to solve a problem. It would be particularly problematic once inventive machines come to generate a substantial portion, or

even the majority of inventions.<sup>46</sup> By contrast, acknowledging computers as inventors would also acknowledge the work of computer programmers. While they may not have directly contributed to an invention, they may take credit for the success of their machines. This is similar to the way in which a supervisor may take pride in the success of a PhD student, without taking direct credit for their future writings and inventions.

If CGWs are to be protected, and a computer is to be acknowledged as an inventor, who should own the CGW? Certainly, computers should not own patents. Computers are non-sentient, cannot own property, and are themselves owned as property. Colin Davies has suggested the computer should hold IP rights and transfer these under contract.<sup>47</sup> He notes this would require machine “responsibility,” which might require a deposit in a computer’s name to satisfy adverse judgments or an insurance scheme. More simply, ownership may directly vest in a computer’s user, programmer, or owner. In many instances, these may be the same entity, but they may also be distinct parties. The best policy or ideal solution would be to have ownership vest in the party that results in the most effective economic outcome, and also results in a standard that is practical to implement.<sup>48</sup>

The computer’s owner should be the default owner of any CGW it produces. This is most consistent with current ownership norms surrounding personal property (including both computers and patents).<sup>49</sup> It should also most effectively incentivize innovation because it will motivate owners to share access to their software. If the computer’s user is the default owner of a CGW, this may instead result in computer owners restricting access. Computer programmers do not need to own future CGWs because they will capture the increased value of an inventive machine upon selling it. Also, having ownership default to programmers would interfere with the transfer of a machine, and it would be logistically problematic for developers to monitor machines they no longer own. The case for having computer owners also have ownership of CGWs reveals another reason why computers should be acknowledged as inventors. If computers cannot be inventors and instead the first natural person to recognize a computer’s invention becomes the inventor, this would give CGWs to computer users rather than owners. There is already precedent for assigning ownership in IPRs to an owner distinct from an author or inventors, such as with works for hire, joint authorship, films, etc.

This default was just be a starting point—computer users, owners and developers would be free to contract to different outcomes.

### *Computer-generated works—competition or collaboration?*

The current definition of CGWs fails to take into account the fact that computers independently should qualify for authorship and inventorship, even when contributing to jointly authored works with natural persons. Computers may be inventors even of intermediate works. As such, the definition of CGWs should be amended from work “generated by a computer in circumstances such that there is no human author of the work”, to work “generated by a computer in circumstances such that the computer, if a natural person, would meet authorship requirements.” This would more accurately take into account contributions by machines, and allow economic incentives to work more efficiently.

The downside of this approach may be that it would be difficult for computer owners to know when their machines have generated CGWs. Users might benefit from failing to disclose CGWs to computer owners and then claiming they invented a CGW. However, users may still choose to disclose CGWs so that they could negotiate for clear title and, alternately, to avoid liability. To the extent that users and owners are distinct entities and users are licensing computers

for purposes generating CGWs, users may choose to negotiate *a priori* for ownership of CGWs with computer owners.

Determining human inventorship is already a tricky business in collaborative works. It may be even more difficult for collaborative works involving a computer. There are a variety of ways for computers to invent, some of which involve more human intervention than others. For example, a programmer may design a computer program specifically to solve a particular problem, and the solution may be the patentable invention. In such an instance, the programmer might have a greater claim to inventorship, resulting in joint inventorship with a computer. Again, this is not unlike current inventorship criteria, where a variety of individuals can play greater or lesser roles in invention. However, the current definition of CGWs in the CDPA does not accommodate this reality for copyright, as it fails to take into account that a computer can jointly author a work with a person.

### *International Harmonization*

Finally, there is a need for a harmonized approach to CGWs. If the UK grants copyright and patent protections for CGWs, it has to provide nationals of other EU member states and parties to TRIPS with the same rights. However, if these other parties fail to allow for CGWs in their own domestic laws, UK nationals may not receive reciprocal protections.<sup>50</sup> Few EU member states have dealt with CGWs.<sup>51</sup> Inventive machine owners might thus be unable to obtain IPRs outside the UK. In fact, disclosing a machine author or inventor in a UK application might prejudice IPRs in other jurisdictions. At least for an interim period, UK entities would be advised to identify a natural person as an author or inventor where possible to avoid an inequitable economic outcome.

Future treatment of CGWs within the EU might be dealt with by an EU directive or regulation, although Brexit may remove the UK from the direct effect of changes to EU law. Regardless of Brexit, UK nationals still should benefit under the national treatment rule of TRIPS from changes to EU law that ascribe machine authorship and inventorship for CGWs. CGWs might also be dealt with by a future multinational agreement. However, harmonization exercises at the international level tend to proceed at a glacial pace.

### *Concluding Thoughts*

In October 2017, the Kingdom of Saudi Arabia announced it was granting citizenship to a humanoid robot, Sophia, manufactured by Hanson Robotics. It is unclear whether this announcement was merely intended for publicity, or whether the nation has actually granted Sophia citizenship. In any event, if Sophia is a Saudi citizen, because Saudi Arabia is a party to TRIPS, other WTO members may be obliged to provide for IPRs for Sophia's CGWs. Although, other countries may argue that Berne and TRIPS refer to *authors and inventors* who are nationals, but that machines cannot be authors and inventors regardless of 'nationality'. In any event, while granting legal personhood to a machine may be one way to try and avoid disparate treatment of CGWs at the international level, there are other reasons to disfavor such an approach.

The law is overdue for establishing clear standards for protection of CGWs. As AI continues to improve, such works will become increasingly important. Efficiently structured copyright and patent laws can help maximize the value of CGWs, and protect the moral rights of human authors and inventors.<sup>52</sup> However, for IPRs to function effectively, it is important that right holders and potential infringers have a reasonable degree of certainty about the scope and limits of protection.

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- <sup>1</sup> See, Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 54 B. C. L. Rev. 1079–1126 (2016).
- <sup>2</sup> See, Ryan Abbott, *Everything is Obvious*, 66 UCLA. L. Rev. 2 (2019).
- <sup>3</sup> See, e.g., Band-in-a-Box, PG Music, <http://www.pgmusic.com>.
- <sup>4</sup> Arthur Miller, *Copyright Protection for Computer Programs, Databases, and Computer Generated Works: Is Anything New Since CONTU?* 106 Harvard Law Review 977–1073 (1993).
- <sup>5</sup> Abbott, Ryan, *The Reasonable Computer: Disrupting the Paradigm of Tort Liability*, 86 Geo. Wash. L. Rev. 1 (2018) (discussing unexplainability in the context of AI).
- <sup>6</sup> Patricia Holt, *Sunday Review*, S.F.CHRON., Aug. 15, 1993, B4; see, generally, Grimmelmann, J. *There's No Such Thing As A Computer-Authored Work*, 39 Columbia Journal of Law & the Arts 403, 408 (2016).
- <sup>7</sup> U.S. COPYRIGHT OFFICE, COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES (FIRST) §2.8.3 (1st ed. 1973).
- <sup>8</sup> Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 54 B. C. L. Rev. 1079–1126 (2016).
- <sup>9</sup> IDA Ltd and others v University of Southampton and others [2006] EWCA Civ 145; Abbott, Ryan, Jeremy Lack and David Perkins. *Managing Disputes in the Life Sciences*. *Nature Biotechnology*, 36, 697 (2018).
- <sup>10</sup> *Mueller Brass Co. v Reading Industries Inc.* 176 USPQ 361 (1972).
- <sup>11</sup> The CDPA permits copyright for “(a) original literary, dramatic, musical or artistic works, (b) sound recordings, films [or broadcasts], and (c) the typographical arrangement of published editions.” CDPA 1988, § 1 (internal footnote and emphasis omitted).
- <sup>12</sup> Copyright, Designs and Patents Act, 1988 §154.
- <sup>13</sup> Copyright, Designs and Patents Act, 1988 §214.
- <sup>14</sup> Copyright, Designs and Patents Act, 1988 §12(7).
- <sup>15</sup> In the case of *Cummins v. Bond* in 1927, a court was asked to adjudicate copyright in a work allegedly written by a journalist while acting as a spiritual medium. *Cummins v. Bond*, 1 Ch. 167 (1927). The court was not willing to decide that “authorship and copyright rest with someone already domiciled on the other side of the inevitable river.” *Id.* at 173. The rights to the work had to vest in a terrestrial being.
- <sup>16</sup> A similar outcome occurred in the case of *The Jockey Club v Rahim* (unreported) 22 July 1983, which concerned computers generating lists of runners and riders for horse races.
- <sup>17</sup> Whitford Committee on Copyright Designs and Performers Protection (Cmnd 6732 HMSO 1977), para 514.
- <sup>18</sup> Reform of the Law Relating to Copyright, Designs and Performer's Protection, A Consultative Document 58 (Cmnd 8302 HMSO 1981).
- <sup>19</sup> Intellectual Property and Innovation (Cmnd 9712; HMSO, Ch 9, paras 9.6–8).
- <sup>20</sup> Robert Hart, *Copyright and computer generated works*, 40 Aslib Proceedings 173, 173–181 (1988).
- <sup>21</sup> *Nova Productions Ltd v Mazooma Games Ltd* [2006] RPC 379. CGWs were also briefly considered in *Bamgboye v Reed* [2004] EMLR 5, 73 [38], Williamson J wrote that §9(3) “is dealing with the case where one is looking at a piece of music which, in fact, is composed of computerised sounds.”
- <sup>22</sup> See, e.g., *Beggars Banquet* [1993] EMLR 349.
- <sup>23</sup> Jani McCutcheon, *Curing the authorless void: Protecting computer-generated works following*

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*icetv and phone directories*. 37 Melbourne University Law Review 46 (2013).

<sup>24</sup> See, e.g., *Yeda Research and Development Co Ltd v Rhone-Poulenc Rorer International Holdings Inc* [2007] UKHL 43, [2008] RPC 1 quoting Laddie J. in *University of Southampton's Applications* [2005] R.P.C. 11, [39] (“The inventor is defined in s.7(3) as ‘the actual deviser of the invention’. The word ‘actual’ denotes a contrast with a deemed or pretended deviser of the invention; it means, as Laddie J. said in *University of Southampton's Applications* [2005] R.P.C. 11, [39], the natural person who ‘came up with the inventive concept.’”)

<sup>25</sup> Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs; Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases.

<sup>26</sup> Andres Guadamuz, *Do androids dream of electric copyright? Comparative analysis of originality in artificial intelligence generated works*, *Intellectual Property Quarterly* 169 (2017).

<sup>27</sup> Copyright, Designs and Patents Act, 1988, c. 48, § 9(3) (U.K.); Copyright Act of 1994, § 5 (N.Z.); Copyright and Related Rights Act 2000, Part I, § 2 (Act. No. 28/2000) (Ir.).

<sup>28</sup> Ley 22/11 sobre la Propiedad Intelectual de 1987.

<sup>29</sup> C. IP. Art. L111-1 (2003).

<sup>30</sup> Case C-5/08 *Infopaq International A/S v Danske Dagblades Forening* [2009] ECR I-06569.

<sup>31</sup> *Eva-Maria Painer v. Standard VerlagsGmbH and ors*, Case C-145/10 [2011] ECDR (13) 297, 324, [AG121]. In that case, Advocate-General Trstenjak interpreted EU directives related to this language to mean that, “‘only human creations are ... protected’, although these can ‘include those for which the person employs a technical aid, such as a camera’.” *Id.*

<sup>32</sup> EPC R. 19 (Designation of the inventor).

<sup>33</sup> 94/800/EC Council Decision (of 22 December 1994). See, generally, Matthew James Elsmore, *Comparing regulatory treatment of intellectual property at WTO and EU level*, in *LIBERALISING TRADE IN THE EU AND THE WTO: A LEGAL COMPARISON* 412–439 (Sanford E. Gaines, et al., eds., 2012).

<sup>34</sup> BERNE CONVENTION FOR THE PROTECTION OF LITERARY AND ARTISTIC 1971 ART. I.

<sup>35</sup> Cf. SAM RICKETSON AND JANE C. GINSBURG, *INTERNATIONAL COPYRIGHT AND NEIGHBORING RIGHTS* (2 VOLUMES): *THE BERNE CONVENTION AND BEYOND* (2<sup>nd</sup> Ed. 2006) (arguing the reference to ‘makers’ of cinematographic works is the exception rather than the rule, and that ‘author’ referring to natural persons would be most consistent with the moral rights provisions and durations of protection being based on the life of an author).

<sup>36</sup> WORLD INTELLECTUAL PROPERTY ORGANIZATION, *GUIDE TO THE BERNE CONVENTION II* (1978).

<sup>37</sup> See INTERNATIONAL BUREAU OF WIPO, *PREPARATORY DOCUMENT, DRAFT MODEL ON COPYRIGHT* at 258-59 (No. CD/MPC/III/2, Mar. 30, IggO).

<sup>38</sup> Pamela Samuelson, *Allocating ownership rights in computer-generated works*. 47 U. Pitt. Law Review 1185, 1190 (1985).

<sup>39</sup> *Naruto v. David John Slater et al*, No. 16-15469 (9<sup>th</sup> Cir. 2018).

<sup>40</sup> UNITED STATES CONSTITUTION, ARTICLE I, SECTION 8, CLAUSE 8 (emphasis added).

<sup>41</sup> WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW*. Cambridge, MA: Belknap Press (2003).

<sup>42</sup> Martin A. Roeder, *The Doctrine of Moral Right: A Study in the Law of Artists, Authors and Creators*, 53 Harv. L. Rev. 554, 557 (1940). See, also, Graham Dutfield, *Collective Invention and Patent Law Individualism: Origins and Functions of the Inventor's Right of Attribution*. 5 The WIPO Journal 25, 27 (2013).

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- <sup>43</sup> Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303 (2013).
- <sup>44</sup> See, e.g., Ralph Clifford, *Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up?* 71 Tul. L. Rev. 1675 (1997).
- <sup>45</sup> See, e.g., T 0002/83 (Simethicone Tablet) of 15.3.1984 (EPO Board of Appeal).
- <sup>46</sup> See, Abbott, R. Everything is Obvious, 66 UCLA. L. Rev. 2 (2019).
- <sup>47</sup> Colin Davies, *An evolutionary step in intellectual property rights - Artificial intelligence and intellectual property*. 27 Computer Law and Security Review 601, 615 (2011).
- <sup>48</sup> Ryan Abbott, *Hal the Inventor: Big Data and its Use by Artificial Intelligence*, in BIG DATA IS NOT A MONOLITH (Hamid Ekbia, et al., eds.) (2016).
- <sup>49</sup> Cf Schuster, W. Michael, 'A Coasean Analysis of Ownership of Patents for Inventions Created by Artificial Intelligence', 75 *Washington and Lee Law Review* (forthcoming 2018), <<https://ssrn.com/abstract=3132753>>. (arguing for user default ownership).
- <sup>50</sup> Robert Hart, *Copyright and computer generated works*, 40 Aslib Proceedings 173, 173–181 (1988).
- <sup>51</sup> Mark Perry & Thomas Margoni, *From music tracks to Google maps: Who owns computer-generated works?* 26 Computer Law and Security Review 621, 621–629 (2010).
- <sup>52</sup> Ryan Abbott & Bret Bogenschneider, *Should Robots Pay Taxes? Tax Policy in the Age of Automation*, 12 Harv. L. & Pol. Rev. 145 (2018).