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Oxford Intellectual Property Research Centre

Submission
for

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'Open Consultation on Artificial Intelligence and Intellectual Property: Call for Views'
https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views

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IPO Artificial Intelligence and Intellectual Property: call for views Copyright and Related Rights

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1. **Do you agree with the above description of how AI may use copyright works and databases, when infringement takes place and which exceptions apply? Are there other technical and legal aspects that need to be considered?**

Note: The Oxford Intellectual Property Research Centre has not yet adopted a stance Questions 2 & 4-9, and reserves answers on those questions until further notice.

(a) Copyright Infringement.

This submission argues that infringement ought not be limited to AI outputs and disputes the characterisation of AI use of copyrighted materials as analogous to memory in the human brain. Though copyright law does not police memory for persons,[1] AI cannot be treated analogously to the human brain due to insufficient understanding on how AI generates outputs: the 'black box' problem. For instance, it is unclear whether machine learning immediately deletes temporary copies of data inputs once training sessions conclude.

Extending infringement beyond outputs need not result in over-expansive copyright scope if an AI user can demonstrate how AI uses copyrighted material. If it can be shown that an AI user carries out an implementation that does not retain copies, such activities would constitute the making of transient copies and are not infringing.[2] However, the 'black box' problem means that delimiting AI infringement to outputs alone is unjustifiable at this point in time until more is understood about AI processes.

Another way to enable the use of copyright works by AI in processes would be to treat this as an adaptation of an idea which does not amount to copyright infringement. For example, in *Jones v London Borough of Tower Hamlets* [2001] RPC 23, it was held that mere adaptation of an architect's idea lacked sufficient derivation to constitute copying. Moreover, while it remains difficult to characterise AI as a 'mind', this conceptualisation is consistent with the idea expression dichotomy in copyright law.

(b) Copyright Exceptions.

The economic significance of how AI uses copyrighted materials would likely render most exceptions unavailable, with the potential to threaten AI development.

However, the quotation exception may have a significant reach to enable AI developers to use copyrighted works analogously to the US 'fair use' exception. Introduced in 2014, s30(1ZA) CDPA 1988 applies to fair dealing of works for the purposes of 'criticism, a review or otherwise'.[3] Quotation applies to any kind of work,[4] and may cover an entire work.[5]

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[1] *Davies v Wolverhampton Wanderers Football Club* [2019] EWHC 1252 (Ch) citing Mr Justice Leggatt in *Gestmin SGPS SA v Credit Suisse (UK) Ltd and another* [2013] EWHC 3560 (Comm) at [16-22].
[2] Copyright, Designs & Patents Act 1988 s28A; Directive (EU) 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society [2001] OJ L167/10 Article 5(1), Recitals 31, 33.
[3] Copyright and Rights in Performances (Quotation and Parody) Regulations 2014 (SI 2014/2356), regs. 3, 5 and the Copyright and Rights in Performances (Research, Education, Libraries and Archives) Regulations 2014 (SI 2014/1372), reg. 4
[4] C-476/17 *Pelham v Hütter*, [2019], [68].
[5] *Pelham v* (n 4) [71]; C-516/17*Spiegel Online* [2019], [78].

Machine learning activities may be accommodated within quotation. This generally involves the use of data sets of many works at different stages of development. Data set A may be used at training phase 1 (photographic materials), training phase 2 using data set B (text-based materials). That same AI may generate an output from a third data set, set C (text-based and photographic materials). What appears to be an extensive use of copyrighted materials in this case may amount to fair dealing: s30(1ZA)(b), if there is sufficient acknowledgement: s30(1ZA)(d) for a work already publicly available: s30(1ZA)(a). The fair dealing test depends on whether such use is judged to be the extent required for the purpose: s30(1ZA)(c). At present, understanding what extent is required for the purpose of machine learning may best by answered through consultations with experts in AI technology.

3. Is there a need to clarify existing exceptions, to create new ones, or to promote licensing, in order to support the use of copyright works by AI systems? any evidence to justify this.

(a) Quotation: Uncertain Scope.
Clarification is needed on the quotation exception so as to encourage ethical AI development, given this would involve access to and use of large, high quality datasets which are often copyrighted.

The first unclear point about section 30(1ZA) is whether the inclusion of 'otherwise' expands the purposes for which section 30(1ZA) applies. Section 30(1ZA) implements Article 5(3)(d) of the Information Society Directive on 'quotations for purposes such as criticism or review'.[6] Uncertainty remains as to whether section 30(1ZA) can be read broader than the two purposes laid out by the Directive. Aplin and Bently argue quotation may be a sort of 'global, mandatory fair use' open to any purpose when read in the light of Article 10(1) of the Berne Convention.[7] Notably, Article 10(1) is written with imperative language, and has been recognised as mandatory by leading commentaries on the Convention.[8] Quotation has yet to be applied in this manner by a court, though the potentially broad application of this reading may incorporate many uses of copyrighted materials in AI implementation.

Even if quotation can be interpreted in this manner, clarification is needed on what is meant by 'making available' to the public for the purposes of quotation. Ricketson and Ginsburg argue that 'made available' under Article 10(1) of the Berne Convention describes many activities that present the work publicly, not merely publication with authorial consent.[9] Similarly, Hudson expounds policy considerations which could back up this reading of s30(1ZA), meaning 'not unlawfully' rather than 'with authorial permission'.[10] This may be particularly important for AI with online applications.

Moreover, there is evidence that the expansiveness of the quotation exception has not met a negative reception by copyright users. As part of a longitudinal study on the use of copyright exceptions, Dr Hudson interviewed cultural institutions in common law jurisdictions.[11] In the UK, quotation has been readily used, and interviewees described it in similar terms to US interviewees on 'fair use'. This included comments indicating to user confidence as to the meaning of, and the applicability of quotation in a range of circumstances.[12] Quotation may functionally act as a limited 'fair use' style exception available to AI developers.

(b) Licensing.

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[6] Information Society Directive (n 2).
[7] Tanya Aplin and Lionel Bently, 'Displacing the Dominance of the Three-Step Test: The Role of Global, Mandatory Fair Use' in W. Ng, H. Sun and S. Bal Ganesh (eds), *Comparative Aspects of Limitations and Exceptions in Copyright Law* (Cambridge University Press 2018);
[8] Tanya Aplin and Lionel Bently, *Global Mandatory Fair Use: The Nature and Scope of the Right to Quote Copyright Works* (Cambridge University Press 2020) 29-31.
[9] Sam Ricketson and Jane Ginsburg, *International Copyright and Neighbouring Rights: The Berne Convention and Beyond* (vol 1 2nd edn OUP 2006) para 13.41.
[10] Emily Hudson, *Drafting Copyright Exceptions* (Cambridge University Press 2020) 283-284.
[11] ibid.
[12] Hudson (n 10) 280-283.

Correspondingly, international collective licensing platforms ought to bolster support for authors to ensure proper remuneration is not overcome by the administrative burden of licensing copyright for AI. AI consumes vast amounts of data from various sources, and is often developed globally. This makes identification of the relevant copyright-holders time-consuming and expensive, while licensing arrangements on an individual basis would not be cost-effective. To ensure authors receive remuneration for the use of their works, it is proposed that AI technology be deployed by collective licensing agencies to arrange large-scale, centralised licensing of copyrighted works for AI development where copyright exceptions do not apply.

Centralised licensing of copyrighted works in AI development may also have positive effects on AI innovation. It may prevent market barriers to smaller companies and start-ups who cannot afford the same licensing costs or access to legal counsel that larger corporations can.[13] Relatedly, this means that AI developers who cannot afford to pay do not resort to historical, or freely available data which sometimes can result in smaller data sets which codify biases in AI outputs.[14]

[13] Benjamin Sobel, "Artificial Intelligence's Fair Use Crisis", (2017) 41 Colum JL & Arts 45.
[14] ibid.

IPO Artificial Intelligence and Intellectual Property: call for views Trade Marks

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1. If AI technology becomes a primary purchaser of products, what impact could this have on trade mark law?

The impact of this development on trade mark law will depend on exactly how the AI is used in the purchasing context. AI technology is currently used in the purchasing process both as a virtual assistant and in creating product recommendation systems. The use of AI in these ways involve significant human input. If AI becomes a primary purchaser of products with little human input, however, this may lead to changes in the normative underpinnings of trade mark law, as axioms about the purpose of trade marks vis-à-vis the behaviour of human consumers becomes less applicable.

Where AI technology becomes the primary purchaser of products, these purchasing decisions will likely be data driven rather than emotive. The value of trade marks as rich symbols of meaning, and their advertising function, might be reduced as AI technology starts to play a greater role in purchasing decisions.[1] Individuals could set AI assistants to buy the cheapest available goods, with little regard for the source of the product. A purchasing decision made only on the metric of price and subject to certain quality requirements (e.g. product features), rather than source or brand, lessens the importance of the essential function of marks as an indicator of origin. While many consumers already make purchasing decisions on the basis of price rather than brand,[2] this may become a more widespread practice as AI becomes more prevalent. It is, however, unlikely that purchasing decisions made by AI assistants will be based solely on price and quality for all consumers, given the success of machine learning in personalising service offerings to boost consumer relationships with brands.[3]

The use of AI technologies as primary shoppers may not mean the death of brands. AI technologies are fully capable of being used to learn about a consumer's values, affective preferences, and brand preferences, basing product recommendations not only on price but also a shopper's past purchases, such as AI systems already in use, including Amazon's product recommendation system.[4] A consumer's online activities, which may include their social media engagement, is inevitably informed by the brands they engage with online. Where AI

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[1] Jennifer Davis, 'The Value of Trade Marks: Economic Assets and Cultural Icons' in Y Gendreau (ed), *Intellectual Property: Bridging Aesthetics and Economics* (Themis, University of Montreal 2006)
[2] Especially for consumers living in more rural areas where there is less selection available for equivalent products, and those living in lower-income brackets.
[3] Adam West, John Clifford, David Atkinson, '"Alexa, Build Me a Brand" An Investigation into the Impact of Artificial Intelligence on Branding' (2018) 9 The Business and Management Review, 321, 327
[4] See for example Anh Tan, 'Artificial Intelligence in Ecommerce Case Amazon' (Thesis, Centria University of Applied Sciences), 25 - 27

technologies are designed to become intimately acquainted with consumer's values and preferences, the role of a brand may remain a central aspect of AI-assisted online purchasing.[5]

More generally, AI technology is less likely to be confused by use of similar marks on similar goods due to its ability to access and interpret vast amounts of contextual information. Even if an AI technology was "confused" on one occasion,[6] it is unlikely to make the same mistake again.[7] It is also important to recognise that AI might be misled if the information it relies on is misleading.[8] Alternatively, this may mean that while there may not be confusion in the purchasing context, issues with regard to post-sale confusion may become more prevalent.

If AI technology develops so that it purchases and ships goods to consumers without any human interaction, while there may have been no confusion at the point of sale, downstream, the person receiving the purchase may still be confused as to the origin of the goods bearing the mark.[9] The doctrine of post-sale confusion may therefore be more frequently invoked in disputes, leading to doctrinal development in this area. Whilst many scholars have argued that findings of infringement where there is no confusion in the purchasing context has led to trade mark law being extended far beyond its *raison d'être*,[10] new uses for AI technologies may justify the expansion of trade mark law in this way in order to increase protection for those who will ultimately consume the products purchased by AI.

2. Are there, or could there be, any difficulties with applying the existing legal concepts in trade mark law to AI technology?

The most obvious difficulty in applying existing legal concepts in trade mark law to AI technology is with regard to the "average consumer" which has always conceived of a *human consumer.*[11] This issue is discussed more fully in relation to question 3.

Other trade mark doctrines, such as initial interest confusion, may be affected and engaged by the use of AI technology. For instance, initial interest confusion claims may inhibit, or modify, how AI technologies provide consumers with recommendations, if we assume consumers will somehow read recommendations for alternatives as confusing. An alternate approach, as has been the case in the United States with regard to initial interest confusions claims regarding online search results,[12] is to recognise that consumers play a more engaged role in assessing the context of third-party use of a mark given the limitations of the trade mark regime. For example, they are unlikely to presume that a list of alternative wrist watches suggested by the online marketplace AI are somehow versions of the (unavailable) watch they originally searched for. While some consumers may see the results of a search with reference to a trade mark to be affiliated or sponsored by the relevant mark holder, the majority of informed

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[5] Adam West, John Clifford, David Atkinson (n 3)
[6] We suggest the concept of "confusion" itself, rather than inaccuracy, is at its core a human attribute as AI technology cannot experience uncertainty in the same way that natural persons do. While it is outside the scope of this submission to discuss this further, it is illustrative of how trade mark law doctrine has been developed with an understanding of the human consumer in mind.
[7] Michael Grynberg, 'AI and the "Death of Trademark"' (2019) 108 Ky LJ 199, 205
[8] Douglas Heaven, 'Why deep-learning AIs are so easy to fool' (2019) 574 Nature 163-166
[9] Lee Curtis and Rachel Platts, 'AI Is Coming and It Will Change Trade Mark Law' (2017) 271 Managing Intell Prop 9, 11
[10] Mark A. Lemley and Mark McKenna, 'Irrelevant Confusion' (2010) 62 Stanford L Rev 413
[11] See n 2
[12] Michael Gynberg (n 7), 226 – 227; Multi Time Mach, Inc, 804 F3d

consumers would understand that the results are simply similar alternative products if they do not bear the trade marked term in their listing.[13]

Similarly, other doctrines premised on non-confusing mental links or association, such as some dilution claims, may be implicated by AI technologies providing recommendations in ways that are not yet clear. The use of AI technologies posing recommendations does not necessarily create any *difficulties* applying these legal concepts, but given how they may intersect may affect the doctrinal development of these trade mark law doctrines, and associated concepts.

The nature, and existence, of the trade mark registry underpins many trade mark law doctrines. As AI technology becomes more prevalent, one of the first areas being impacted is the trade mark register.[14] A primary way in which this impact is occurring is by the use of AI technology by registries and individual applicants in determining whether potential conflicts exist.[15] To date, AI technology is being used to assist human actors in determining potential conflicts rather than performing the analysis independently. In some instances, however, overcautious AI technology will still lead to false positives and exacerbate issues regarding register clutter.[16] For example, AI technologies may be more likely than human examiners to find semantic similarity, and may assess similarity of goods on the basis of Nice classification number rather than the nature of the goods themselves. AI technologies are additionally more liable to ignore additional elements incorporated into the broader multifactor likelihood of confusion test such as evidence of market conditions and the construction of the average consumer of the goods in question.[17] This may lead to new applicants being discouraged, or prevented, from applying for new marks on the basis of potential conflicts.[18]

3. Does AI affect the concept of the "average consumer" in measuring likelihood of confusion?

In terms of the average human consumer, we will be living in a blended "bricks and clicks" environment for the foreseeable future, and purchasing will remain both online and offline. While there will be an increasing role for AI technologies in the online purchasing environment, any "average consumer" concept modified by AI ought to be restricted to the online shopping space.

As discussed above, AI technology is being used by registries to determine conflicts between marks. Using solely, or predominately, AI technology to analyse potential conflicts will be seen as a desirable and attractive option to some, as it is an economical and efficient way to identify potential conflicting marks. If AI technology is adopted in this capacity, it may

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[13] Michael Gynberg (n 7), 226 – 227

[14] Difficulties are, therefore, raised not only in applying existing legal concepts to AI technology, but also in AI technology applying the existing legal concepts and this may impact upon the functioning of the register and in turn, the legal regime.

[15] Dev S Gangjee, 'Eye, Robot: Artificial Intelligence and Trade Mark Registers' (October 10, 2019) Forthcoming in N Bruun, G Dinwoodie, M Levin & A Ohly (eds), *Transition and Coherence in Intellectual Property Law*, (Cambridge University Press, 2020) <https://ssrn.com/abstract=3467627> accessed 14 Nov 2020 see also Anke Moerland and Vieites Novaes de Freitas, Conrado, 'Artificial Intelligence and Trade Mark Assessment' in R Hilty, K-C Liu & J-A Lee (eds), *Artificial Intelligence & Intellectual Property* (Oxford University Press 2021), Chapter 13 < https://ssrn.com/abstract=3683807> accessed 29 Nov 2020

[16] Gangjee (n 15), 11

[17] ibid, 11 – 12

[18] This is problematic in light of recent findings that certain markets are already experiencing an over-cluttering and depletion of effective marks. See Barton Beebe and Jeanne C Fromer 'Are We Running Out of Trademarks? An Empirical Study of Trademark depletion and Congestion' (2018) 131 Harv L Rev 945

eventually lead to registries bypassing the normative metric of the average consumer completely as AI technology struggles to take into account broader factors within the likelihood confusion test, including issues of reputation and the construction of the hypothetical average consumer of the relevant goods.[19]

When considering the similarity of two marks, registries and courts compare the marks from the perspective of the "average consumer" of the relevant goods of services for which the marks have been registered or applied for. Even if the "average consumer" concept is not completely bypassed as a result of the use of AI technology by registries, this concept is premised on assumptions about consumption practices and consumer psychology that do not apply to AI technology.

The nature of AI technologies is inconsistent with several of the core assumptions underlying the metric of the "average consumer." The "average consumer" is deemed to be reasonably well informed, circumspect, and observant and does not often have the chance to make direct comparisons between marks, instead relying on imperfect recollection, with levels of attention varying according to the category of goods in question. In relation to specialist, technical or expensive goods, the "average consumer" is deemed to have a higher level of attention and is therefore considered less likely to be confused. AI technology, in contrast, has the opportunity to compare marks side by side and has access to various databases to provide contextual information relevant to preventing confusion.[20] AI technology is more than reasonably observant and circumspect, with levels of attention varying depending on the nature of the goods. However, it may be the case that levels of human involvement in the purchasing context may vary depending on the monetary value of the goods involved. Furthermore, the use of AI technology in making purchasing decisions may require certain aspects of the analysis of the perception of the "average consumer" to be given more importance than others. For instance, with use of virtual assistants to make purchases, consumers often provide verbal commands and receive verbal responses from the AI, phonetic similarity may be of more importance and arguably may need to be given more weighting than visual and conceptual similarities when analysing similarity due to the issues of "slurring."[21] Whilst the use of AI technology may require modifications to the concept of the "average consumers," these must be restricted to the online shopping space, given that for the foreseeable future many transactions will still take place offline.

4. What is the impact of AI on the drafting of section 10 of the TMA? Can AI "use in the course of business" a sign which may be confusingly similar or identical to a trade mark?

AI technology is liable to be used in many different ways, some of which may result in the use of a sign in the course of business and this may lead to AI technology infringing a registered trade mark.

[19] Gangjee (n 15) 12, 14
[20] Michael Gynberg (n 7), 211
[21] Lee Curtis and Rachel Platts, 'Alexa, What's the Impact of AI on Trademark Law' (2019) 281 Managing Intell Prop 43

The use of AI technologies may be analogous to cases involving other basic forms of AI such as *Google France*,[22] *Lush v Amazon* [23] and *L'oreal v Ebay*.[24] Whether AI is using a sign in the course of business may depend, in part, on the relationship between the AI technology provider and the store through which the product is sold. If the AI provider and the advertiser are one and the same, as was the case in relation to Amazon's search engine in *Lush v Amazon,* the search results and any operational elements such as drop down menus featuring suggested searches, will be part of a commercial communication and therefore use of a sign in the course of business.[25] More sophisticated AI technology used in generating product recommendations, or in assisting purchases may therefore also use a sign which may be confusingly similar or identical to a trade mark in the course of business.

In line with *Google France*, in instances where the AI technology is simply acting as a service provider in storing and using the mark for the purposes of advertising a product for sale on behalf of a third party, the AI would not be using the mark in the course of business (but the provider/owner of the AI may become liable for the infringement in line with Article 14 Directive 2000/31 once they have been put on notice of an infringing use).[26]

5. Can the actions of AI infringe a trade mark?

As discussed above, whether AI can infringe a trade mark will depend on the role the AI is playing in the purchasing process. Following earlier case law, whether AI technology has infringed a trade mark may depend on the form in which online searches for products are presented to customers, rather than how AI processes the trade mark internally.

6. If AI can cause trade mark infringement, does this change who could be liable? Should it be the owner, the operator, the programmer, the trainer, the provider of training data, or some other party?

The introduction of AI technology should not change the general application of trade mark law that assigns liability in accordance with the normative framework that seeks to ensure that trade marks are used in a healthy, competitive and transparent market. Therefore, following the previous case law discussed in response to Question 4, liability will depend of the relevant circumstances of the case including who the AI belongs to and how the AI is being used in the purchasing process, as well as whether providers and owners have adequately responded to notices of infringement.

[22] Joined cases C-236/08 to C-238/08 *Google France, Google Inc. v Louis Vuitton Malletier* [2010] ECR I-02417
[23] *Cosmetic Warriors and Lush v Amazon.co.uk and Amazon EU SARL* [2014] EWHC 181 (Ch)
[24] C-324/0 *L'Oréal SA and Others v eBay International AG and Others* [2011] ECR I-06011
[25] ibid, para 57
[26] *Google France* (n 22), paras 58 and 120

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Open consultation: 'Artificial intelligence and intellectual property: call for views'

'Impact of artificial intelligence on UK trade secret law'

Questions

1. Is trade secret protection important for the AI sector? Does the nature of AI technologies and business influence your answer?

Yes, trade secret protection is very important for the AI sector.

However, the answer to this question is also determined by the nature of the relevant information and data subject to trade secret protection. As Nicola Searle explained: '(…) it is generally agreed that patents are more often used for product innovations, (…) while trade secrets are for process innovations.'[2] This is the case because they are per se not patentable.[3] It depends, therefore, on what the specific information in the context of AI actually is. Certain processes in AI, for example the functioning of algorithms, can be protected only through trade secret law.[4] Regarding AI-related products, on the other hand, it depends whether they are patentable. Even if this is so, both patent and trade secret protection are available.[5]

2. Does the nature of AI pose any problems if UK trade secret protection is required? Does UK trade secret law give adequate protection to aspects of AI technology where no other intellectual property rights are available?

[1] Parts of these answers draw on insights from doctoral research on trade secrets currently being undertaken at the University of Oxford.

[2] Nicola Searle, 'The Process May (or May Not) Be the Product: Trade Secrets and COVID Research' (*The IPKat*, 3 August 2020) <https://ipkitten.blogspot.com/2020/08/the-process-may-or-may-not-be-product.html> accessed 18 November 2020. See also International Trade Centre UNCTAD/WTO and World Intellectual Property Organization, *Secrets of Intellectual Property: A Guide for Small and Medium-Sized Exporters* (ITC/WIPO 2003) 66 <https://www.wipo.int/edocs/pubdocs/en/intproperty/itc_p163/wipo_pub_itc_p163.pdf> accessed 29 November 2020. cf also W Nicholson II Price, 'Expired Patents, Trade Secrets, and Stymied Competition' (2017) 92 Notre Dame L Rev 1611, 1618.

[3] International Trade Centre UNCTAD/WTO and World Intellectual Property Organization (n 2) 66.

[4] International Trade Centre UNCTAD/WTO and World Intellectual Property Organization (n 2) 63; Meghan J Ryan, 'Secret Algorithms, IP Rights, and the Public Interest' Nevada Law Journal (forthcoming).

[5] International Trade Centre UNCTAD/WTO and World Intellectual Property Organization (n 2) 66.

The nature of AI can cause problems in the context of trade secret protection if it concerns inventions raising ethical questions, or relating to fundamental rights, for example, the use of algorithms in judicial contexts[6] or the role of AI in armed conflicts.[7]

As noted in the introduction to the trade secret section, trade secrets in the UK are protected through the Law of Confidence and through statutory law.[8] Especially the Trade Secrets Regulations of 2018, which transposed the EU Trade Secrets Directive 2016/943[9] into national law,[10] are relatively detailed.

Essential in this regard is the broad scope of the concept of trade secrets. A wide range of information or data can be regarded as a trade secret,[11] especially as trade secret law is at times seen as having a 'gap filling' function,[12] where other forms of IP do not apply.[13] AI-related information is, therefore, protected by trade secret law, as long as it satisfies the criteria of being a trade secret.

The broad scope of trade secret protection might be regarded as problematic if it concerns specific information relating to AI which should be open to the public, because, for example, it touches upon ethical questions.[14] In order to respond to such developments, the scope of trade secret law would need to be narrowed, also, for example, through limitations and exceptions.

However, from a more practical point of view, it has to be noted that trade secret protection cannot simply be prohibited by a legal act. If an inventor decides to keep information secret, he or she is free to do so as a matter of fact. Nevertheless, the legislator can make protection through trade secret law less attractive for inventors, for example, were possible limitations on trade secret law restrict enforcement measures in case of a violation of the information in question.

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[6] See, Ryan (n 4).

[7] See, for example, for further discussion on this aspect, in: United Nations Office for Disarmament Affairs, the Stanley Center and the Stimson Center, 'The Militarization of Artificial Intelligence' <https://front.un-arm.org/wp-content/uploads/2020/06/Stanley-Stimson-UNODA-2020-TheMilitarization-ArtificialIntelligence.pdf> accessed 18 November 2020.

[8] UK Intellectual Property Office, 'Impact of Artificial Intelligence on UK Trade Secret Law' <https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views/impact-of-artificial-intelligence-on-uk-trade-secret-law> accessed 29 November 2020.

[9] Directive (EU) 2016/943 of the European Parliament and of the Council of 8 June 2016 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure [2016] OJ L 157/1.

[10] Explanatory Note to the Trade Secrets (Enforcement, etc.) Regulations 2018.

[11] See, for example, with regard to US law, the enumeration in the Economic Espionage Act § 1839(3): 'the term "trade secret" means all forms and types of financial, business, scientific, technical, economic, or engineering information, including patterns, plans, compilations, program devices, formulas, designs, prototypes, methods, techniques, processes, procedures, programs, or codes, whether tangible or intangible, and whether or how stored, compiled, or memorialized physically, electronically, graphically, photographically, or in writing […]'. See also International Trade Centre UNCTAD/WTO and World Intellectual Property Organization (n 2) 63.

[12] Robert G Bone, 'The (Still) Shaky Foundations of Trade Secret Law' (2014) 92 Tex L Rev 1803, 1812–1813.

[13] ibid. This is especially the case in comparison with patent law, as every patent can (also) be a trade secret, but not vice versa.

[14] Text to n 6 and n 7.

In addition, it is not only the broad definition of trade secrets that can cause difficulties, but also the absence of an appropriate definition of AI.[15] There ought to be discussion as to whether the current definition favoured by the Government could be formulated in a more precise way.

3. What are the advantages and disadvantages of using trade secrets in the AI sector? Could information that is not shared inhibit AI development?

Opting for trade secret protection in the context of AI is advantageous as it is neither time-consuming nor necessarily cost-intensive.[16] It is especially advantageous in the early stages, when an invention in this field might not yet be ready to be patented, as it can give the trade secret holders more time to develop the invention further.

A weakness of trade secret protection is that, in general, information cannot be shared with third persons,[17] although this might be necessary or desirable as regards the public interest. Moreover, a disadvantage is that inventions protected by trade secret law cannot be further developed by competitors, so that this might, in the result, hinder innovation.[18]

4. Do trade secrets cause problems for the ethical oversight of AI inventions?

As pointed out above, the scope of trade secret law is very broad and, therefore, covers a wide variety of information.[19] This means that also information which may be ethically questionable, and which should (therefore) be made public, might be protected as a trade secret, so that such relevant information is not disclosed.[20]

Therefore, the balancing of openness and secrecy, which should be reflected in legal policy, becomes crucial. It is, as has been stated above, possible for the legislator to formulate limitations on, or exceptions to, trade secret protection for AI if this is seen as necessary for ethical (or other compelling policy) reasons, so that, in case of a violation of the information in question, no legal redress would be available to the holder of the trade secret.[21] However, as explained above, a factual decision to keep information secret cannot as such be prevented by way of a legislative rule.[22]

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[15] See even the remark in the Consultation description: 'There is no single agreed definition of artificial intelligence.' <https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views> accessed 18 November 2020.

[16] The trade secret exists from the moment the holder decides to keep the relevant information confidential and, depending on the value of the information, the protection measures can be kept rather simple. However, the phenomenon of excessive trade secret protection has to be considered as well. cf also International Trade Centre UNCTAD/WTO and World Intellectual Property Organization (n 2) 64, 66.

[17] cf in this context the definition in Article 39(2) TRIPS.

[18] In this context, see in general the discussion about the role of innovation in trade secret law, for example among others, Michael P Simpson, 'The Future of Innovation: Trade Secrets, Property Rights, and Protectionism - An Age-Old Tale' (2004) 70 Brook L Rev 1121.

[19] See answer to question 2 above and n 11.

[20] Text to n 6 and n 7.

[21] See answer to question 2 above.

[22] ibid.

5. Additional comments

With regard to new legislation in the field of AI, it is advisable to focus on the adoption of statutory measures rather than less binding legal rules (such as self-regulatory codes of conducts, or similar), as statutory law has certain advantages here. For instance, AI is a field where the development of new technologies happens not only rapidly, but also potentially with unforeseen negative consequences.[23] Statutory law is capable of setting boundaries to such developments (or establishing institutions and procedures for doing so) where this is regarded necessary.

Furthermore, the absence of statutory rules can lead to uncertainty and inconsistently applied standards which should be avoided in such important areas. Law, as the central tool of public policy in a democratic society, exists in order to set (legal) standards for socio-economic and technical developments.[24] Especially in an increasingly digitalized world, and in the face of constant technical progress, the influence of technological developments on everyday life expands, and thus needs intensified attention from the national legislator.[25]

However, in the context of preparing new legislation, the international dimensions of AI in a globalized world need to be considered as well. This is particularly so given, for example, the expanded potential for the transnational use of data.

[23] Ryan (n 4).
[24] cf David S Levine, 'Secrecy and Unaccountability: Trade Secrets in Our Public Infrastructure' (2007) 59 Fla L Rev 135.
[25] Ryan (n 4). See also Levine (n 24).

IPO Artificial Intelligence and Intellectual Property: Call for Views Patents

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1. What role can/does the patent system play in encouraging the development and use of AI technologies?

Statistics on published AI patents indicate a positive relationship between AI innovation and the patent system. The last decade has seen a fourfold increase in published AI patent applications globally.[1] Moreover, 88% of patents first filed in the UK are protected abroad.[2]

Yet, these statistics may reveal more about AI innovation than the impact of the patent system on AI inventors. Historically, patents have not been deemed essential to software innovation.[3] As information goods, most R&D expense lies in the fixed costs of software development, while copying is cheap.[4] It remains open whether patents are a powerful *ex ante* incentive to develop AI altogether.

There is, however, room for concern that patents may stifle AI innovation. Software patents are known for intensive litigation.[5] Software is prone to 'patent thickets'.[6] Careful scrutiny of the subject matter exclusion and novelty requirements for AI may avoid grant of 'junk' patents.[7] Moreover, access to AI technologies with broad applicability is imperative. For example, deep learning is a crucial research tool.[8] Thus, appropriate incentives for the multiple stages of software innovation must be maintained.[9]

1. Can current AI systems devise inventions? Particularly:

(a) to what extent is AI a tool for human inventors to use?

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[1] UKIPO, 'Artificial Intelligence A worldwide overview of AI patents and patenting by the UK AI sector', <https://files.lbr.cloud/public/2019-10/import-AI-patent-overview.pdf> Accessed Sept 28, 2020.
[2] ibid, 30.
[3] William Landes and Richard Posner, *The Economic Structure of Intellectual Property Law* (Harvard University Press 2003), 312; Edwin Mansfield, 'Patents and Innovation: An Empirical Study' (1986) 32 Man Sci 2, 173, 180.
[4] Wendy Seltzer, 'Software Patents and/Or Software Development' (2013) 78 Brook L Rev 929, 946.
[5] David J Kappos, 'Investing in America's Future through Innovation: How the Debate over the Smart Phone Patent Wars (Re)Raises Issues at the Foundation of Long-Term Incentive Systems' (2013) 16 Stan Tech L Rev 485.
[6] Mark Lemley and Carl Shapiro, 'Patent Holdup and Royalty Stacking' (2007) 85 Texas L Rev 1991.
[7] Patents Act 1977 s1(2)(a); s2.
[8] Iain Cockburn et al, 'The Impact of Artificial Intelligence on Innovation An Exploratory Analysis" in *The Economics of Artificial Intelligence: An Agenda,* Ajay Agrawal, (eds) Joshua Gans, and Avi Goldfarb (University of Chicago Press 2019).
[9] Suzane Scotchmer, 'Standing on the Shoulders of Giants: Cumulative Research and the Patent Law' (1991) 5(1) J Econ Perspect 29.

AI is a tool developed by humans for humans to use. Academic literature and policymakers largely overestimate how AI inventions come into existence, and what they may do without human intervention. Current AI systems are developed *by* humans, *for* humans. There is no magic wand that automatically creates AI systems. Even technical experts state that automatic programming, where computers complete tasks without being instructed 'how' to do so via high level-language programming, is "unrealistic, at least in the foreseeable future".[10] In an open letter, AI and robotics experts likewise claim that,

> "From a technical perspective, this statement offers many bias based on an overvaluation of the actual capabilities of even the most advanced robots, a superficial understanding of unpredictability and self-learning capacities and, a robot perception distorted by Science-Fiction and a few recent sensational press announcements".[11]

Current AI is thus the result of genetic programming wherein human inventors create the system with human usage in mind.

(b) could the AI developer, the user of the AI, or the person who constructs the datasets on which AI is trained, claim inventorship?

There is a difference between claiming ownership and obtaining patent protection for the AI itself and its output. The type of AI system and its underpinning algorithms play a role in whether inventorship poses a barrier. AI systems predominantly comprise predictive algorithms. Machine learning, a method in which computers execute tasks autonomously without human intervention, typically aids this process.[12] There are two main categories of machine learning algorithms: supervised and unsupervised. Unsupervised learning algorithms unearth hidden patterns from unlabelled datasets, "as the aim is for the system to group data that is similar,"[13] and consists primarily of clustering and association rule learning algorithms.[14] Supervised learning algorithms, on the other hand, detect structures from labelled data, which is "tagged data",[15] and are trained on this data to form algorithmic models which may be applied to "unseen data" to detect future correlations.[16]

Unsupervised algorithms, where a human plays less of a role, as is the case for neural networks, may at first blush be more difficult to patent as their input develops without consistent human intervention, transforming it into a system not fully created by a natural person. On the other hand, the human is responsible for constructing the original network and therefore contributes to the invention. Without this involvement, there would be no invention, so neural networks themselves are arguably not precluded from patentability on the basis of the inventorship criterion. The same applies to supervised algorithms which entail even more human

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[10] Michael O'Neill and Lee Spector, "Automatic Programming: The Open Issue?" (2020) 21 Genetic Programming and Evolvable Machines 251, 252.
[11] Robotics, 'Open Letter to the European Commission Artificial Intelligence and Robotics' <http://www.robotics-openletter.eu> Accessed Oct. 30, 2020.
[12] WIPO, Technology Trends 2019: Artificial Intelligence, 3.0IGO, 146 <https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf> Accessed Oct. 10, 2020.
[13] Datatilsynet, 'AI and Privacy Report' (2018) at 8-9, <https://www.datatilsynet.no/globalassets/global/english/ai-and-privacy.pdf> Accessed Nov. 10, 2020.
[14] Cristoph Michael Flath and Nikolai Stein, 'Towards a Data Science Toolbox for Industrial Analytics Applications' (2018) 94 CII 17-18.
[15] Datatilsynet (n 13) 8.
[16] Mehryar Mohri, Afshin Rostamiziadeh and Ameet Talwalkar, *Foundations of Machine Learning* (MIT Press 2018) 1-2.

involvement. Indeed, as Lauber-Rönsberg notes, certain AI systems are only "a tool of a human inventor".[17] The AI is thus constructed by a developer, who writes and layers algorithms and then trains said algorithms on data in order to create a system. The developer may therefore claim inventorship over the AI system.

(c) are there situations when a human inventor cannot be identified?

There should be no situation where the original human inventor of an AI system itself cannot be identified because they are created by humans. As Kim states,

> "artificial neural networks and evolutionary algorithms – essentially require detailed instructions that determine how the relation between inputs and outputs is derived through computation. Accordingly, it is argued that, as long as computers rely on instructions defined by a human as to how solve a problem, the separation between human and non-human (algorithmic) ingenuity is, in itself, artificial".[18]

This also applies to recent examples of AI-aided inventions, such as 'The Next Rembrandt' project and the Creativity Machine. The AI algorithm behind 'The Next Rembrandt project' produced a Rembrandt painting that was strikingly similar to the original.[19] But this AI algorithm required 16 months of work in order to be put into effect. The project website states that, to distill the artistic DNA of Rembrandt, an extensive database of his paintings was built and analyzed, pixel by pixel".[20] Moreover, they,

> "examined the entire collection of Rembrandt's work, studying the contents of his paintings pixel by pixel. To get this data, we analyzed a broad range of materials like high resolution 3D scans and digital files, which were upscaled by deep learning algorithms to maximize resolution and quality. This extensive database was then used as the foundation for creating The Next Rembrandt".[21]

The painting would not thus exist without the developers collecting and analysing the paintings, and building a database which the algorithm could use in order to produce a painting. This clearly shows that humans inventors can be identified for AI-aided projects. The same applies for the Creativity Machine, which consists of a neural network that may inter alia generate music and problem-solving. The Machine discovered an improved, novel tooth-brushing technique which was later sold as the 'Oral-B CrossAction' brush.[22] Stephan Thaler is notably listed as the rightsholder for the Creativity Machine patent.[23] This is because Thaler invented the Creativity Machine by designing its objectives and parameters, as well as choosing the information in which the Machine based its 'decision'.[24] Because current AI requires and

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[17] Anne Lauber-Rönsberg and Sven Hetmank, 'The Concept of Authorship and Inventorship under Pressure: Does Artificial Intelligence Shift Paradigms?' (2019) 14 JIPLP 570, 571.
[18] Daria Kim, 'AI-Generated Inventions: Time to Get the Record Straight?' (2020) 69(5) GRUR International 443, 443.
[19] ING, 'The Next Rembrandt' <https://www.nextrembrandt.com> Accessed Nov. 20, 2020.
[20] ibid.
[21] ibid.
[22] Robert Plotkin, *Genie in the Machine: How Computer-Automated Inventing is Revolutionizing Law and Business* (Stanford University Press, 2009) 51-54.
[23] Patent No. US5659666A for 'Device for the autonomous generation of useful information' <https://patents.google.com/patent/US5659666> accessed 20 Nov, 2020.
[24] Ana Ramalho, 'Patentability of AI-Generated Inventions: Is a Reform of the Patent System Needed?' (February 15, 2018) 1, 4, Available at SSRN: https://ssrn.com/abstract=3168703 or http://dx.doi.org/10.2139/ssrn.3168703

would not exist without human involvement, there are as of yet no situations where a human inventor cannot identified. This may, however, change should AI systems become more autonomous, as discussed in further detail in question 8.

2. **Should patent law allow AI to be identified as the sole or joint inventor?**

See answer to question 6.

3. **If AI cannot be credited as inventor, will this discourage future inventions being protected by patents? Would this impact on innovation developed using AI? Would there be an impact if inventions were kept confidential rather than made public through the patent system?**

It is unlikely that patentees will prefer trade secret protection if AI cannot be credited as inventor because accreditation as 'inventor' often attracts more procedural than substantive significance.

It is dubious that accreditation as inventor is an incentive in and of itself. Abbott argues that that AI inventorship would encourage AI development, and failing that, the natural person using the AI to invent would be encouraged by an accreditation of AI as inventor.[25] Yet, software innovation is cumulative.[26] Software development is often an incremental process of improvements by many people.[27] It seems doubtful that the current boom in AI innovation would be different. Moreover, Abbott's argument relies on a notion of innovation as driven by the individual inventor – an increasingly critiqued idea.[28] It is therefore unlikely that the inability to name AI as inventor will discourage patent applications when most inventors (as a matter of common language) go unnamed.

The recent Thaler[29] outcome may challenge the culture and philosophy of AI inventors. Mr Thaler argued there was a moral case against crediting a natural person as inventor to AI-generated invention, as this devalues the significance of human inventorship.[30] As AI develops increasing similarity to human intelligence, court refusal to recognise AI as inventive may be perceived as regressive by AI developers.

Ultimately, it must be noted that Smith J was emphatic that DABUS may be inventive as a factual matter, but that DABUS was not an inventor within the Patents Act 1977 because DABUS is not a person:

> "I should stress that nothing in this analysis should be taken to suggest that DABUS is not itself. capable of an inventive concept… Nevertheless, I conclude that DABUS is not, and cannot be, an inventor within the meaning of the 1977 Act, simply because DABUS is not a person."[31]

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[25] Ryan Abbott, 'I Think, Therefore I Invent: Creative Computers and the Future of Patent Law' (2016) 57 BC L Rev 1079, 1103-1104.
[26] Lemley and Shapiro (n 6).
[27] ibid.
[28] Mark Lemley, 'The Myth of the Sole Inventor' (2012) 110 Mich L Rev 709.
[29] *Stephen L Thaler v The Comptroller-General of Patents, Designs And Trade Marks* [2020] EWHC 2412 (Pat).
[30] ibid, [46].
[31] ibid.

4. Is there a moral case for recognising AI as an inventor in a patent?

There is not a moral case to recognise AI as an inventor in a patent because, as per the answers to questions 2 and 8, current AI systems are a reflection of human labour and are not truly autonomous.

5. If AI was named as sole or joint inventor of a patented invention, who or what should be entitled to own the patent?

I. AI as sole inventor.

If designated as a sole inventor, AI would lack entitlement to own a patent because it is not a "person" under section 7 of the Patents Act 1977. Under section 7(3), the inventor is the "actual deviser of an invention", and has the first right to own the patent under section 7(2)(a). This does not specify that the inventor be a natural person or a legal person, and there is no authority on this point.[32] In *Thaler*, the argument that AI should qualify as an inventor if meeting inventorship criteria equivalent to that of natural persons was rejected. Justice Smith ruled that AI is not a "person" under the act and cannot apply solely or jointly for a patent as inventor as it lacks legal personality and is not a natural person.[33]

A patent can be granted to an AI inventor in practice, though this application would fail to meet the procedural criteria for patent grant. The UKIPO presumes that the applicant inventor is entitled to patent ownership: section 7(4) of the Patents Act 1977. However, failure to meet this procedural requirement would leave the patent open to grounds for revocation under s72(1)(b) of the Patents Act 1977.

Justice Smith's interpretation of 'persons' provides a convincing justification as to why AI cannot and should not be entitled to own a patent. Entitlement to patent ownership is inextricably linked to inventorship under section 7(2)(a) – an entitlement to 'persons' within the meaning of the Patents Act 1977. This interpretation is consistent with historical legislation on patent ownership as for 'persons'.

AI should not be inventor as a legal person. Some commentators argue that AI exhibits characteristics equivalent to the intelligence of natural persons, justifying legal personhood for AI.[34] Significantly, it is not clear that legal personhood is dependent on being a natural person, or that this could justify the legal personhood of AI. A persuasive point on this question, the European Parliament has recently censured the idea of legal personhood of AI for the purposes of intellectual property law.[35]

II. AI as joint inventor.

While Justice Smith ruled out the possibility of AI as joint-inventor,[36] this ruling sits uncomfortably with proper interpretation of section 7 of the Patents Act 1977. It is possible to qualify as a sole inventor under section 7(1) or joint inventor under section 7(3) without

[32] *Stephen Thaler* (n 29), [45].
[33] ibid [34-35].
[34] Colin Davies, 'An Evolutionary Step in Intellectual Property Rights — Artificial intelligence and intellectual property' (2011) 27 Comput Law Secur Rev 601.
[35] European Parliament, Draft Report on Intellectual Property Rights for the Development of Artificial Intelligence Technologies (2020/2015(INI)) [10].
[36] *Stephen Thaler* (n 29) [35].

automatically being the patent owner. These analyses are separate.[37] While it is presumed that applicants are patent owners unless indicated contrary under section 7, this is often not the case; i.e. joint-inventors, employee inventors.

If AI and a natural person are named joint-inventors, the patent application should be amended, but should not be open to revocation under section 72(1)(b). While AI may have done much of the work that implements the idea, inventorship will invariably attach to a natural person because this attaches to the "heart" of the invention.[38] An inventor's contribution is "to the formulation of the inventive concept".[39] In *Yeda,* Lord Hoffmann's explanation below is of particular relevance to the way in which AI is said to 'invent':

> "Deciding upon inventorship will therefore involve assessing the evidence adduced by the parties as to the nature of the inventive concept and who contributed to it… *Inventors themselves will often not know exactly where it lies."*[40]

Therefore, as inventor, the natural person has the first right to own the patent and AI acts as a tool.

6. Does current law or practice cause problems for the grant of patents for AI inventions in the UK?

There is a difference in obtaining patent protection for the AI produced output and the AI system itself. Each is reviewed respectively.

I. AI-Aided Output

A key challenge to the grant of AI technologies is that the patent system is reliant on invention as a human-driven feat. In practical terms, this means that patent law may be ill-equipped to respond to the scale and rapidity of AI-driven invention.

As a general purpose technology (GPT), AI will revolutionise innovation across society at a rate no patent system has faced before. GPTs are defined by pervasive spread to sectors, continuous improvement, and innovation spawning: i.e. the idea that GPTs make the invention of new products easier.[41] GPT innovation is complex due to GPT "innovation complementarities" with the sectors in which they are deployed. This means that a lack of incentives in one sector can create an indirect externality which leads to a system-wide reduction in R&D.[42] Hence, coordination between the GPT and application sectors is imperative for innovation and ought to play into IP considerations for AI.

The challenge this poses to the patenting AI poses a correlative challenge to the UK Intellectual Property Office. AI may soon surpass the capabilities of human inventors, or of the patent system. This may range from AI-generated patent applications which overload the administerial capacity of the patent office, to AI-developed strategies for defensive litigation

[37] *Rhone-Poulenc v Yeda Research* [2007] UKHL 43; [2008] RPC 1.
[38] *IDA Ltd v University of Southampton* [2006] EWCA Civ 145; [2006] RPC 21.
[39] *University of Southampton's Applications* [2005] RPC 22.
[40] *Rhone-Poulenc v Yeda* (no 37), [20].
[41] Timothy Bresnahan and Manuel Trajtenberg 'General Purpose Technologies: Engines of Growth?' (1995) J 65(1) Econom. 83- 108.
[42] ibid.

and patent thickets.[43] There is already concern that the automation of the invention process in itself will lead to patent thickets.[44]

II. The AI System Itself

The AI system itself may either be patented as part of the method claims of a computer program application or separately as computer-implemented inventions (CIIs). It is improbable that they obtain protection if filed as the former, and increasingly likely if filed as CIIs.

a) Computer Programs

Although Article 27(1) of TRIPS allows patents "for any inventions, whether products or processes, in all fields of technology", Article 52(2) of the EPC excludes mathematical methods and computers programs from patentability. However, the EPO has issued more than 30,000 software patents since 1978[45] despite excluding computer programs from patentability. In 2019, the EPO President also stated that computer program claims are *not* excluded from patentability.[46]

But algorithms are still unlikely to obtain patent protection as part of the computer program they belong too. The TBA has handled few computer program cases, but those decided demonstrate that the patentability of computer programs predominantly depends upon technical character.[47] The type of program and its underlying algorithms therefore determines patentability.[48] The predictive algorithms and models relevant to this study are not directed at enhancing a computer's inner functionality as envisioned by the TBA,[49] but at expediting user experiences and internal business operations, as well as facilitating applications on the internet, not inside a computer. Consequently, these predictive algorithms fail to satisfy the technical standards envisioned by the TBA.

b) Computer-Implemented Inventions

Algorithms are more likely to be patented as CIIs. CIIs attract tight scrutiny by the TBA when it comes to their technical character.[50] But the TBA has found that certain algorithms executed to perform functions on data and databases have technical character.[51] The updated 2019 EPO Guidelines for Examination likewise confirm that machine learning algorithms such as neural networks serving a technical purpose are patentable.[52]

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[43] Lemley and Shapiro (n 6).
[44] Sinan Utku and Alain Strowel, 'Recent Developments Regarding the Patentability of Computer Implemented Inventions within the EU and the US: Part 1—Introduction and the Legal Problem of Patenting Computer-Implemented Inventions' (2017) 39(2) E.I.P.R. 73.
[45] European Commission, Proposal for a Directive on the Patentability of Computer-Implemented Inventions – Frequently Asked Questions, MEMO/02/32 20 February 2002, <http://europa.eu/rapid/press-release_MEMO-02-32_en.htm?locale=en>.
[46] EPO President's Reference/Patentability of Programs for Computers, G 3/08 (12 May 2010) 11.2.5.
[47] T 935/97, (Computer Program II/IBM) of 4.2.1999; T 1173/97, (Computer Program I/IBM) of 1.7.1998; Stefan V. Steinbrener, 'Patentable Subject Matter Under Article 52(2) and (3) EPC: a White list of Positive Cases from the EPO Boards of Appeal – Part 1' (2018) 13 JIPLP 13, 13-15.
[48] Stefan V. Steinbrener, 'Patentable Subject Matter Under Article 52(2) and (3) EPC: a Whitelist of Positive Cases from the EPO Boards of Appeal – Part 2' (2018) 13 JIPLP 103, 103-105.
[49] T 424/03, (Clipboard Formats I/MICROSOFT) of 23.02.2006, at 5.2.
[50] EPO, 'Patents and the Fourth Industrial Revolution: The Inventions Behind Digital Transformation' December 2017, 21. <https://www.lemoci.com/wp-content/uploads/2017/12/Patents-and-the-Fourth-industrial-Revolution-2017.pdf> Accessed Nov 28, 2020.
[51] T 1965/11 (Cost-based Materialised View Selection/MICROSOFT TECHNOLOGY LICENSING) of 24.3.2018; T 0697/17 (SQL extensions/MICROSOFT TECHNOLOGY LICENSING) of 17.10.2019, at 5.3.4.
[52] EPO Guidelines for Examination 3.3:1 AI and Machine Learning.

7. Could there be patentability issues in the future as AI technology develops?

Whether patentability issues will arise in the future as AI technology develops depends on *how* it develops. As of now, AI technology is unable to complete tasks without any human instructions, meaning AI systems have not yet reached the level of autonomy that would pose a real issue for patentability. In other words, systems are automated, but not autonomous. And even neural networks, which necessitate less human intervention, may evolve in a manner where human are more involved. For instance, in May of 2019, Frankle and Carbin groundbreakingly proposed a new way of deriving correlations within neural networks where humans may play a greater role.[53] On the other hand, Artificial General Intelligence, AI that mimics (or supersedes) human intelligence**,** may encounter patentability issues in the future as this type of technology is 'truly' autonomous. But this technology is not expected to arrive before 2099.[54]

8. How difficult do the list of excluded categories in UK law make it to secure patent protection for AI inventions? Where should be the line be drawn here to best stimulate innovation?

The exclusion from patentability of computer programmes under section 1(2)(c) of the Patents Act 1977 makes patenting AI difficult. While setting a high threshold for AI patentability, it is preferable that this test continues to operate on a case-by-case basis in the courts.

An AI algorithm is patentable if the patent directs to an algorithm implemented on a device.[55] A second hurdle has been elaborated at the EU level: that the invention is capable of bringing about a technical effect going beyond the normal operation of software on hardware.[56] Framed another way, has an objective technical problem been overcome?[57] While UK courts adopt a different 'signpost' methodology to answer this question,[58] in practice they have been held to reach substantially the same result.[59]
The main problem this test presents to AI inventors is that of uncertainty. It has been critiqued as supplying an additional procedural hurdle to granting AI patents while Europe remains without a Unified Patent Court, making European patent offices less desirable for registration than US counterparts.[60]

However, it is preferable that section 1(2)(c) continues to be decided a case-by-case basis to prevent over-reach of patentable subject matter, and its potentially deleterious effect on downstream innovation. For example, the recent UKIPO decision to reject an artificial genome for AI under section 1(2)(c) exemplifies the need for this case-by-case evaluation, as the patenting of a 'structure' for AI may well have resulted in an unduly broad patent claim with the potential to stifle follow-on innovation.[61]

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[53] Jonathan Frankle and Michael Carbin, 'The Lottery Ticket Hypothesis: Finding Sparse, Trainable Neural Networks' (2019) ICLR https://arxiv.org/abs/1803.03635.
[54] Kim (no 18) 444.
[55] Utku and Strowe (n 44) 490.
[56] *G-3/08, Programs for Computers* [2010] O.J.E.P.O 17 (12 May 2010).
[57] European Patent Office Guidelines, Part C IV 2.
[58] *AT&T's Application* [2009] EWHC 343 Pat [40]; *HTC v Apple* [2013] RPC 30 [50-51].
[59] *Lenovo (Singapore) PTE Ltd v Comptroller General of* Patents [2020] EWHC 1706 (Pat), [9].
[60] Utku and Strowe (n 44).
[61] United Kingdom Intellectual Property Office Patent Decision O/284/20.

9. Do restrictions on the availability of patent rights cause problems for ethical oversight of AI inventions?

Algorithms, algorithmic models and their corresponding information are primarily protected as trade secrets. This is in large parts due to the issues of protecting algorithms under copyright and patent law. Their trade secrecy protection is also in some parts due to the 'convenience' afforded by trade secrets law. It allows vendors to effectively escape regulation, withhold crucial evidence in court proceedings and elude accountability, whether intentionally or unintentionally. When why and how automated decisions are reached is thus shielded under trade secrecy laws, creating one type of 'black-box'. As a consequence of this IP black-box, algorithms are not disclosed at all, raising serious explainability, transparency and accountability concerns. This necessitates greater transparency, as well as more attention to how the IP framework may be adapted to this new age of AI. Accordingly, the EPO ascertains that,

> "From the perspective of innovation for the benefit of society, there should be as much incentive as possible for innovators to disclose AI innovations – such as the algorithms and how they were trained – and not to choose the option of trade secrets".[62]

Restrictions on AI patentability may impede disclosure of information for ethical oversight of AI. Firstly, the disclosure function of patent law reveals inventions that otherwise would be kept secret.[63] Patent specification under section 14(3) of the Patents Act 1977 requires that the claims provide sufficient information to make the invention workable by a skilled person. Such information on the working of the invention may be invaluable to solving the 'black box' problem.[64] Secondly, patents serve a signalling function to the marketplace. Patents signal information which can be persuasive in purchases of patent portfolios.[65] Without mandatory disclosure requirements, the public at large, or portfolio acquiring market players themselves may be unaware of the ethics of AI patents.

A different analysis may view refusals from patentability as part of ethical oversight of AI. For example, the 'public ordre' exclusion under Article 53(a) of the European Patent Convention can ensure ethical development of emerging technologies, i.e., biotechnologies.[66] Ethical oversight may mean excluding AI from patentability under the analogous exclusion under section 1(3) of the Patents Act 1977.

10. Does the requirement for a patent to provide sufficient detail to allow a skilled person to perform an invention pose problems for AI inventions?

Whether the requirement for a patent to provide sufficient detail to allow a skilled person to perform an invention poses problems for AI systems may depend on the type of algorithm in question. It should be possible to 'perform an invention' on AI systems because they can be

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[62] EPO, 'Patenting Artificial Intelligence', Conference Summary (May 2018) at 3 <https://e-courses.epo.org/pluginfile.php/23523/mod_resource/content/2/Summary%20Artificial%20Intelligence%20Conference.pdf> Accessed Nov 28, 2020.
[63] *Thaler* (n 29), [25-28].
[64] Frank Pasquale, *The Black Box Society: The Secret Algorithms that Control Money and Information* (Harvard University Press 2015).
[65] Clarisa Long 'Patent Signals' (2002) 69(2) U Chi L Rev 625.
[66] Justine Pila, 'Adapting the Ordre Oublic and Morality Exclusion of European Patent Law to Accommodate Emerging Technologies' (2020) 38 Nat Biotechnol 546.

reproducible. In order for a patent examiner to achieve this, however, there is a need for the patent application to contain detailed information and instructions about the invention, the type of data used and its training process, not just the basic trained AI model. Importantly, the same data may be used to train different models, meaning this disclosure might competitors a competitive advantage, but this depends on whether the training data itself attains IP protection, such as under copyright law.

11. In the future could there be reasons for the law to provide sufficient detail of an AI invention for societal reasons that go beyond the current purposes of patent law?

Reasons for the law to require sufficient detail of an AI invention that go beyond the current purposes of patent law for societal interests exist *now.* Greater regulation is necessary for the AI sector as a whole. This includes formal industry standards, as well as validation protocols for high risk algorithms, and testing procedures if suspicions over harms arise, and tort liability.

Auditing is suggested in several scholarly papers, albeit predominantly as a measure to alleviate algorithmic harm post-implementation.[67] Such audits involve studying or manipulating algorithms, or emulating user experiences and sending queries to detect errors, or harms such as discrimination.[68] Auditing algorithms may thus help divulge more information about AI inventions, particularly data that is paramount to the functioning of society. The UK's Information Commissioner's Office is developing an algorithmic auditing framework.[69] However, auditing *all* algorithms is unfeasible given their continuous evolvement – Google tweaks its algorithm over 100 times per year[70] - but for algorithms employed in matters significantly impacting humans lives, such as the in the justice system, they are critical, and should underpin submissions to regulatory bodies for approval.

To motivate vendors to release algorithms and any relevant information fully, regulatory bodies may sign NDAs and treat results as trade secrets. When countries require actors to submit undisclosed data to ensure the legality of a pharmaceuticals or agricultural chemical products in order obtain market authorisation, for instance, Article 39 of TRIPS stipulates that members must protect information as such, unless "where necessary to protect the public". A market authorisation regulatory system should similarly be introduced for AI, and compliment patent law.

12. Does or will AI challenge the level of inventive step required to obtain a patent? If yes, can this challenge be accommodated by current patent law?

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[67] David Demortain and Bilel Benbouzid, 'Evaluating Predictive Algorithms' in A. Leighton et. al. (eds.) *Algorithmic Regulation (2017) LSE Discussion Paper No. 85,* 13 <https://orca-mwe.cf.ac.uk/105059/1/DP85-Algorithmic-Regulation-Sep-2017%281%29.pdf>

[68] Christian Sandvig et. al., 'Auditing Algorithms: Research Methods for Detecting Discrimination on Internet Platforms' Paper presented to "Data and Discrimination: Converting Critical Concerns into Productive Inquiry," a preconference at the 64th Annual Meeting of the International Communication Association. May 22, 2014; Seattle, WA, USA, <http://www-personal.umich.edu/~csandvig/research/Auditing%20Algorithms%20--%20Sandvig%20--%20ICA%202014%20Data%20and%20Discrimination%20Preconference.pdf>.

[69] ICO, 'Information Commissioner's Office Appoint In-House Expert to Research and Investigate the Impact of Artificial Intelligence on Data Privacy' 20 November 2018 <https://ico.org.uk/about-the-ico/news-and-events/news-and-blogs/2018/11/information-commissioner-s-office-appoints-in-house-expert-to-research-and-investigate-the-impact-of-artificial-intelligence-on-data-privacy/> accessed 20 Nov, 2020.

[70] Council of Europe, 'Study on the Human Rights Dimensions of Automated Data Processing Techniques (In Particular Algorithms) and Possible Regulatory Implications' (2017) DGI 12, 38.

AI does not currently challenge the level of inventive step in patent law, though this standard should incorporate the assistance of AI to the 'person skilled in the art' (PSA).The main challenge AI presents to inventive step is a determination of the PSA under section 3 of the Patents Act 1977. AI is increasingly used to develop new inventions.[71] Abbott argues the law on the PSA can and ought to incorporate the use of AI in invention given the PSA historically developed to reflect the average worker in a field.[72]

To make AI the relevant PSA would impose a higher bar for human inventors which is unjustifiable while AI remains a tool to assist innovation. For one, the PSA test itself is imbued with human characteristics which preclude AI. For example, the prejudices of one's field.[73] Such biases have previously been evidentiary in the inventive step test.[74] Secondly, AI's advanced ability to process prior art is equivalent to an expert PSA. This approach is contrary to recent restatements that the PSA is to have the 'typical' level of skill and knowledge in his field, not the utmost expertise.[75] Thirdly, it may be difficult to identify one PSA for AI given its use of data from multiple domains.[76] This would set a higher bar for inventive step that may even go so far to award AI-assisted innovation over purely human-driven innovation.

By retaining a human PSA, expanded interpretation of the common general knowledge (CGK) requirement can more appropriately accommodate the increasing impact of AI on innovation. For example, *Actavis* recently restated that the CGK involves factors such as the motive to find a solution, the effort involved in pursuing a solution, and expectation of success (applying *Generics v Lundbeck* [2007]).[77] Secondly, analysing the contribution of AI under the CGK promotes patent quality. For example, extensive use of AI in invention may leave the patentee open to the challenge of obviousness if it can be evidenced there is a lack of **human** motive, a lack of **human** effort, or that AI generated random testing (as evidence for a lack of expectation of success). AI may be incorporated into the test as a tool in use by researchers whilst ensuring patent quality – without unduly heightening the test.

13. Should we extend the concept of "the person skilled in the art" to "the machine trained in the art"?

The person filing the patent application should share enough information that allows for the AI system and its data to be reproduced, tested, audited and/or verified. The person skilled in the art may use a 'machine' to assist in performing the invention, but a machine should not take over the role of the person skilled in the art *per se*. If no natural person can reproduce or test the invention, this would pose a risk because it would allow inventions to enter society with little to no human oversight.

14. Who is liable when AI infringes a patent, particularly when this action could not have been predicted by a human?

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[71] Francesca Mazzi, 'Patentability of AI Generated Drugs' (2020) 4 EPLR 17.
[72] Ryan Abbott, 'Everything is Obvious' (2018) 66 UCLA L. Rev. 2.
[73] *Technip France's Patent* [2004] RPC 46.
[74] *Dyson Limited v Hoover Limited* [2002] EWHC 500; [2002] R.P.C. 42.
[75] *Lufthansa v Astronics* [2020] EWHC 1968 Pat; *Koninklijke Philips NV v Asustek Computer Incorporation* [2018] EWHC 1224 (Pat).
[76] Liza Vertinsky and Todd M Rice, 'Thinking about Thinking Machines: Implications of Machine Inventors for Patent Law' (2002) 8 BU J Sci & Tech L 574, 595.
[77] *Actavis v ICOS* [2019] UK SC 15.

At present, AI cannot be liable for patent infringement, though this remains problematic while AI makes evidencing patent infringement difficult. It is preferable that rules develop to identify a natural person liable for AI-driven patent infringement to ensure responsible and ethical use of AI.

AI should not be liable for patent infringement. No court has addressed whether AI can be liable in patent law, nor whether a party who sells or operates AI may be liable for direct or indirect patent infringement.[78] However, consistent interpretation of 'persons' as above under section 60 of the Patents Act 1977 to mean natural persons or legal persons however would preclude AI from liability.

A first problem with making AI liable relates to the degree to which liability relies on subjective intent or foreseeability. Under section 60(1)(a) of the Patents Act 1977, direct infringement of a product has no intent requirement. However, process direct infringement under section 60(1)(b);(c), and indirect infringement under section 60(2) require knowledge or foreseeability. Foreseeability may make it harder to establish liability for indirect or direct process infringement due to the 'black box' nature of AI activity.

This difficulty may be obviated by catching AI infringement under the category of what is "obvious to a reasonable person in the circumstances" under section 60(1). This may be achieved by relying on knowledge as to the intention of the ultimate user (or a future intention of an ultimate future user).[79]

Secondly, identifying a single infringing liable natural person may be difficult in practice because AI development and use often involves several parties. For example, should developers, trainers, testers or predictors be liable - or simply whomever owns the AI patent once it is commercialised?

A test on the degree to which a party exercises direction or control over AI may be provide guidance. In the US, it was held that a defendant could not be liable under 35 U.S.C. § 271(a) unless performing all steps of a method claim – it was not available to a claimant to combine the steps taken by the defendant and their customers to form an infringing act.[80] Interestingly, the Federal Circuit held that as the "entity responsible for other's performance of a part of the patented invention", the defendant is liable for direct infringement even not fulfilling the method claim which includes the steps for installing and executing the AI software "where that entity directs or controls others' performance".[81] While the Supreme Court overturned the Federal Circuit decision, this approach to liability as contingent on 'direction' or 'control' may protect rights-holders and ensure transparent and responsible use of AI by owners.

More unclear is on what basis culpability for a natural person can be justified when AI commits unpredictable patent infringement. While holding an AI owner may be instrumentally justified by reference to the protection of patent right-holders, lack of foreseeability due to the 'black box' problem justifies a balanced approach. A test which balances factors like degree of

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[78] Bridget Watson, 'A Mind of Its Own - Direct Infringement by Users of Artificial Intelligence Systems' (2017) 58 IDEA 65, 69.
[79] *Grimme v Scott* [2010] EWCA Civ 1110; [2011] FSR 7*; KCI v Smith & Nephew* [2010] EWCA Civ 1260; [2010] FSR 8.
[80] *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 136 S. Ct. 1661 (2016).
[81] *Akamai Technologies v. Limelight Networks,* 797 F.3d 1020, 1022 (Fed. Cir. 2015) (US).

foreseeability, degree of direction and control may be used to prevent Type 1 errors and onerous findings of liability.

15. Could there be problems proving patent infringement by AI? If yes, can you estimate the size and the impacts of the problem?

The first difficulty will be evidencing where infringement took place, given a claim requires that infringement must occur in the United Kingdom.[82] For example, AI can have a neural network composed of cloud technology based on servers globally, with patent infringement may occur in several locations.

The relevant location should be that of the end-user of the infringing AI. This follows the general principles in *William Hill v Menashe* where it was held that the location of the patented invention (the terminal) is immaterial to the *end-user* if the (infringing) means to put the patent into effect occurred in the UK.[83] This obviates the possibility that patentees can escape liability by demonstrating that essential components of their technology are abroad. Moreover, in *RIM v Motorola* [2010] EWHC 118 (Pat), it was mentioned that the location of the patentee in using the patented invention would be immaterial. The end-user standard provides legal certainty and safeguards the right to redress for right-holders.

It may be difficult to determine where patent infringement occurs in an AI process. AI can be developed by start-up company A, sold to a conglomerate B, operated by C and trained with data-sets by D. Machine learning uses such iterative training exercises, where infringement may occur at several points.

Thirdly, evidencing the means by which AI infringes a patent will be burdensome. AI's ease of reverse engineering presents innumerable ways to infringe a patent.[84] Patents may often be infringed, either unbeknownst to patentees, or with them being unable to evidence how infringement occurred.

A fourth difficulty relates to the doctrine of equivalents Rather than impede work-arounds, the scope of this doctrine may catch innocuous activities by AI.[85] Until further understanding of the impact this has on patentees versus innovation in AI, a narrow interpretation should be applied to AI activities.

[82] Patents Act 1977 s.60(1); s132(3) & (4).
[83] *William Hill v Menashe* [2002] EWCA Civ 1702.
[84] Vertinsky (n 76) 682.
[85] ibid, 602-603.