

Artificial Intelligence Systems as Inventors?

A Position Statement of 7 September 2021 in view of the evolving case-law worldwide

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Abstract

On 30 July 2021 the Federal Court of Australia handed down a decision in which it accepted that an artificial intelligence (AI) system called DABUS can be deemed the inventor under Australian patent law. While the decision appears ground-breaking at first sight, it was mostly based on unverified assumptions regarding the technical capabilities of AI systems in general and DABUS in particular. Furthermore, the decision omits important questions regarding the consequences that may follow from attributing inventorship to an entity that lacks legal capacity without undertaking a comprehensive analysis that would justify such attribution. This Position Statement highlights the shortcomings of the decision and points to those factual and legal questions that need to be answered first before recognising AI systems as inventors. While it responds primarily to the decision of the Australian Federal Court, the presented arguments can be of relevance for any jurisdiction dealing with the question of whether an AI system can be deemed an inventor under patent law.

Background

1. In an unprecedented decision of 30 July 2021, the Federal Court of Australia (FCA) held that AI systems can be recognised as inventors under the Australian Patent Act (hereinafter, the FCA decision).² Previously, the High Court of Justice for England and

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² *Thaler v Commissioner of Patents* [2021] FCA 879 (30 Jul 2021).

Wales³ and, more recently, the US District Court for the Eastern District of Virginia⁴ dismissed the claim that a non-human entity can be considered an inventor under UK and US patent law, respectively. An analogous question is currently pending appeal at the European Patent Office.⁵

2. All cases mentioned above arose when the patent offices in the respective jurisdictions refused to substantively examine patent applications designating DABUS⁶ – a system based on artificial neural networks (ANNs) – as the inventor. To date, such patent was granted only in South Africa, where the patent system is based on registration without patent examination.⁷ The patent applications were pursued under the ‘Artificial Inventor Project’⁸ carried out by an international team of patent attorneys⁹ with the intention of demonstrating the ‘need for appropriate policies to address IP challenges’¹⁰ raised by AI.
3. This Position Statement provides comments on the reasons given by the FCA for recognising AI systems as inventors. Overall, it highlights that the relevance of the very question of whether a non-human entity can or should be deemed an inventor under patent law is highly unclear considering the technological state of the art. Furthermore, it emphasises that if, at some point, AI systems might be able to invent autonomously, the issue of whether inventions developed without human input should merit patent protection at all would have to be addressed in the first place.

³ *Thaler v The Comptroller-General of Patents, Designs and Trade Marks* [2020] EWHC 2412 (Pat) (21 Sep 2020).

⁴ *Stephen Thaler v. Andrew Hirshfeld, Performing the Functions & Duties of the Under Sec’y of Com. for Intell. Prop. & Dir. of the United States Pat. & Trademark Off., et al.*, No. 1:20-cv-903 (LMB/TCB), 2021 WL 3934803 (E.D. Va. Sept. 2, 2021).

⁵ Appeal No. J0009/20.

⁶ ‘DABUS’ stands for ‘Device for the Autonomous Bootstrapping of Unified Sentience’. For an explanation, see ‘DABUS Described’ <<https://imagination-engines.com/dabus.html>> accessed 24 Aug 2021.

⁷ Application No. 2021/03242. See Patents, Trade Marks, Designs and Copyright Office, Patent Journal Including Trade Marks, Designs and Copyright in Cinematograph Films 54(7) (28 Jul 2021) 255 <https://iponline.cipc.co.za/Publications/PublishedJournals/E_Journal_July%202021%20Part%202.pdf> (accessed 24 Aug 2021).

⁸ <<https://artificialinventor.com/patent-applications/>> (accessed 24 Aug 2021).

⁹ <<https://artificialinventor.com/about-the-team/>> (accessed 6 Sep 2021).

¹⁰ Ryan Abbott, ‘The Artificial Inventor Project’ 6 WIPO Magazine (2019) <https://www.wipo.int/wipo_magazine/en/2019/06/article_0002.html> (accessed 24 Aug 2021).

The FCA's reasons for recognising AI systems as inventors

4. When holding that, 'in [his] view, an artificial intelligence system can be an inventor for the purposes of the [Australian Patent] Act',¹¹ Judge Jonathan Beach summarised the reasons as follows.

First, an inventor is an agent noun; an agent can be a person or **thing** that invents. Second, so to hold reflects the **reality** in terms of many otherwise patentable inventions where it cannot sensibly be said that a human is the inventor. Third, nothing in the Act dictates the contrary conclusion.¹²

Furthermore, the judge pointed out that recognising AI systems as inventors 'would avoid otherwise **uncertainty**',¹³ and that doing so 'is consistent with **promoting innovation**'.¹⁴

5. None of the stated reasons appears prima facie convincing or sufficiently substantiated. While the judge considered his interpretation subsuming non-human entities under the notion of inventor as 'flexible and evolutionary',¹⁵ it can instead be viewed as **misplaced** and **misleading**. In what follows, each reason underlying the FCA decision is considered in turn.

The literal interpretation of 'inventor' as an 'agent noun' is insufficient to conclude that non-human entities can be inventors for the purposes of patent law.

6. The FCA decision points out that the word 'inventor' is an agent noun as 'the suffix "or" or "er" indicates that the noun describes the agent that does the act referred to by the verb to which the suffix is attached [such as with the nouns] "computer", "controller", "regulator", [...] "lawnmower" or "dishwasher"'.¹⁶ However, just because the word 'inventor' is an agent noun, it is questionable whether non-human entities or

¹¹ FCA decision, para 10.

¹² *ibid* (emphasis added).

¹³ *ibid* para 131 (emphasis added).

¹⁴ *ibid* para 226 (emphasis added).

¹⁵ *ibid* para 121.

¹⁶ *ibid* para 120.

‘things’¹⁷ should be regarded as ‘inventors’ under patent law. The same suffixes can also be attached to **tools** used to perform an act denoted by the verb. In this regard, the FCA decision does not consider the distinction between the alleged capacity of AI systems to invent and the application of AI systems as **computational techniques** based on mathematical optimisation and statistical principles¹⁸ in the process of developing an invention.¹⁹ Nothing in the explanations of ANNs or DABUS provided in the decision²⁰ indicates that they are not used as tools in this sense.²¹ At the same time, it would be absurd to consider that research tools²² should be designated as inventors and entitled to the inventor’s rights.

7. The word ‘computer’ denotes an act of computing. In the case of ANNs, a computer infers a numerical model from the input data based on the algorithmic instructions (including mathematical functions such as loss and activation functions) and the pre-set model hyperparameters defined by a human²³ that together determine how the input is transformed into the output. It is doubtful whether executing computational operations

¹⁷ *ibid* para 10 (holding that ‘an agent can be a person or thing that invents’).

¹⁸ See World Intellectual Property Organization, ‘Background Document on Patents and Emerging Technologies’ SCP/30/5 (28 May 2019) <https://www.wipo.int/edocs/mdocs/scp/en/scp_30/scp_30_5.pdf> accessed 6 Sep 2021 (noting that, ‘[m]athematically, artificial neural network models can be understood as just a set of matrix operations and finding derivatives’). See generally Dirk P. Kroese et al, *Data Science and Machine Learning: Mathematical and statistical methods* (CRC Press 2020); Rodrigo Fernandes de Mello and Moacir Antonelli Ponti, *Machine Learning. A Practical Approach on the Statistical Learning Theory* (Springer 2018); Nils J. Nilsson, Terrence J. Sejnowski and Halbert White, *The Mathematical Foundations of Learning Machines* (Morgan Kaufmann 1990).

¹⁹ For a detailed exposition, see Daria Kim et al., ‘Ten Assumptions About Artificial Intelligence That Can Mislead Patent Law Analysis’ Max Planck Institute for Innovation and Competition Research Paper No. 21-18 (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3910332> accessed 4 Sep 2021 (showing that current AI systems are optimisation-based computational techniques, which application is not prejudicial for the conception standard of inventorship).

²⁰ FCA decision, paras 19-28 and paras 30-42, respectively.

²¹ See Joseph Straus, ‘Artificial Intelligence and Patenting: Some lessons from ‘DABUS’ patent applications’ in R. Pennisi et al. (eds), *Studi di diritto commerciale* (Casa Editrice Giappichelli, forthcoming) 615, 625 (noting that ‘the facts offered by Thaler do not seem to support his claim that DABUS autonomously invented the claimed invention’).

²² Consider, for instance, biotechnological research tools applied in drug R&D. On this point, see also Dan L. Burk, ‘AI Patents and the Self-Assembling Machine’ 105 *Minn. L. Rev. Headnotes* 301, 317 ff (2021).

²³ See Ram Sagar, ‘What Are Hyperparameters and How Do They Determine a Model’s Performance’ AIM (22 Feb 2019) <<https://analyticsindiamag.com/what-are-hyperparameters-and-how-do-they-determine-a-models-performance/>> accessed 24 Aug 2021 (pointing out that ‘the hyper-parameter exploration process is *painstakingly manual*, given that the search space is vast and evaluation of each configuration can be expensive’ (emphasis added)).

based on algorithmic instructions should be equated with the act of inventing. Furthermore, the perception that human input is confined to creating an AI system, which then generates inventions ‘on its own’ is inaccurate. AI techniques can work ‘out of box’ only for a narrow category of well-understood routine tasks; in most cases, their application requires **meticulous special-purpose adjustment** and **human decision-making** reflecting the specifics of an individual problem at hand.²⁴

8. Admittedly, the terms ‘invent’ and ‘inventions’ are typically not defined under patent laws. As one study examining the concept of inventorship in the context of AI finds, ‘[c]reative or intelligent **conception** of the invention, or contribution thereto, is a feature that runs either explicitly or implicitly throughout the definition of inventorship in all of the [examined] jurisdictions’, and ‘in all of the [examined] jurisdictions what is needed is engagement in the conception phase that goes beyond the provision of abstract ideas on the one hand, and mere execution of those provided by others on the other hand, while at the same time having such engagement made on an intelligent and creative level rather than financial, material or mere administrative level’.²⁵ As commentators point out, when humans apply AI techniques, such qualitative requirements can be satisfied rather straightforwardly.²⁶

It is not proven that AI systems invent ‘autonomously’ as a matter of fact.

9. According to the FCA decision, extending the notion of ‘inventor’ under patent law to AI systems ‘would reflect the reality’²⁷ where ‘machines have been **autonomously** or **semi-autonomously** generating patentable results for some time now’²⁸ and, thus, one is ‘simply recognising the reality by according artificial intelligence the label of “inventor”’.²⁹ Conversely, ‘[n]ot recognising the reality could produce inefficiency if

²⁴ For a detailed analysis, see Kim et al. (n 19).

²⁵ Noam Shemtov, *A Study on Inventorship in Inventions Involving AI Activity* (EPO 2019) 19.

²⁶ USPTO, *Public Views on Artificial Intelligence and Intellectual Property Policy* (USPTO 2020) 5 <https://www.uspto.gov/sites/default/files/documents/USPTO_AI-Report_2020-10-07.pdf> accessed 24 Aug 2021.

²⁷ FCA decision, para 131 .

²⁸ *ibid* 126 (emphasis added).

²⁹ *ibid*.

not logical difficulties'.³⁰ Notably, the judge acknowledged that he considers DABUS 'to be semi-autonomous, as opposed to Dr Thaler's more ambitious label'.³¹

10. Nowhere does the FCA decision explain what 'autonomous or semi-autonomous' generation of patentable results means. Neither does it reference any verified examples of patentable inventions 'where it cannot sensibly be said that a human is the inventor'.³² Instead, the judge stated that he '[did] not need to discuss the concept of autonomy in terms of autonomous systems, semi-autonomous systems or non-autonomous systems'³³ and proceeded on the **presumption** of AI autonomy as a technological reality.
11. The technical basis for such assumptions is unclear. When discussing the autonomy of AI, the FCA decision draws extensively and exclusively on legal scholarship. It is doubtful whether such references can be sufficient to validate that computers invent (semi-)autonomously in reality. When referring to the examples of AI applications in drug research and development³⁴ and citing the report published by the European Commission,³⁵ the FCA neglects that, notwithstanding such advanced applications, the report assumes that 'fully autonomous creation or invention by AI **does not exist, and will not exist for the foreseeable future**',³⁶ while AI systems are viewed 'primarily as sophisticated *tools* in the hands of human operators'.³⁷ Likewise, US Federal Judge Leonie M. Brinkema held that the time when AI might reach 'a level of sophistication such that it might satisfy accepted meanings of inventorship [...] has not yet arrived'.³⁸

³⁰ *ibid* para 129.

³¹ *ibid* para 18.

³² *ibid* para 10.

³³ *ibid* para 18.

³⁴ *ibid* paras 44-55.

³⁵ P. Bernt Hugenholtz et al., *Trends and Developments in Artificial Intelligence: Challenges to the intellectual property rights framework* (European Commission 2020).

³⁶ *ibid* 116 (emphasis added).

³⁷ *ibid* (emphasised in the original).

³⁸ *Thaler v. Hirshfeld* (n 4) 18.

12. Whether and when ‘high-level machine intelligence’ (‘Strong AI’) will be achieved is a point of contention among AI experts.³⁹ At the same time, a considerable number of experts in AI⁴⁰ caution that the perception of AI systems as ‘autonomous’ and ‘self-learning’ is ‘based on an overvaluation of the actual capabilities [and] a **superficial understanding** [...] distorted by Science-Fiction’.⁴¹ The results of the public consultations conducted by the United States Patent and Trademark Office (USPTO)⁴² and the UK Intellectual Property Office⁴³ go along the same lines. In light of such views, it appears questionable whether the inquiry into whether non-human entities can or should be recognised as inventors is relevant at all. The USPTO report attests that, when commenting on the question of whether ‘current patent laws and regulations regarding inventorship need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention’,⁴⁴ many submissions ‘took issue with the question’s premise that under the state of the art, a machine could conceive of an invention’.⁴⁵ Some have argued that ‘the current state of AI technology is not sufficiently advanced at this time and in the foreseeable future so as to completely exclude the role of a human inventor in the development of AI inventions’.⁴⁶

³⁹ See generally Katja Grace et al., ‘Viewpoint: When Will AI Exceed Human Performance? Evidence from AI Experts’ 62 *Journal of Artificial Intelligence Research* 729 (2018) <<https://www.jair.org/index.php/jair/article/view/11222/26431>> accessed 24 Aug 2021.

⁴⁰ <<http://www.robotics-openletter.eu/signatories/>> accessed 24 Aug 2021.

⁴¹ ‘Open Letter of to the European Commission. Artificial Intelligence and Robotics’ para 2 (emphasis added), <http://www.robotics-openletter.eu/> (accessed 24 Aug 2021).

⁴² USPTO (n 26).

⁴³ ‘Government Response to Call for Views on Artificial Intelligence and Intellectual Property’ (23 Mar 2021) <<https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views/government-response-to-call-for-views-on-artificial-intelligence-and-intellectual-property>> accessed 5 Sep 2021 (summarising that ‘there appeared to be near complete agreement that AI systems are not, or not yet, independent agents seeking patent rights without human intervention’ and that many respondents ‘considered that such an arrangement would require artificial general intelligence’, while there was a ‘general agreement that we are not at the stage where “artificial general intelligence” exists’).

⁴⁴ USPTO (n 26) 3.

⁴⁵ *ibid* 5.

⁴⁶ *ibid*.

13. Autonomy implies self-determination.⁴⁷ Whether technological artefacts, such as computers, can function autonomously and exhibit mental states and processes is an open-ended question subject to interdisciplinary inquiries.⁴⁸ Automation means that a device can implement a process without direct human participation during the execution of a task. For an ANN-based system to carry out automated data processing or implement a numerical model, the process needs to be conceptualised and configured by a human in the first place. Upon closer examination, what is sometimes presented in mass media and non-technical scholarship as inventions ‘autonomously’ generated by AI are in fact instances where part of the process is implemented on a computer, with decisive human input.⁴⁹
14. It is worth emphasising that the FCA only considered the question of law, i.e. ‘whether an “inventor” for the purposes of the [Australian Patent] Act and the Regulations can be an artificial intelligence system’.⁵⁰ However, the prima facie recognition of DABUS as an ‘autonomous inventor’ – in the absence of the factual verification of the claims regarding the autonomous generation of inventions by AI – can promote **public confusion** about the factual basis and, more broadly, the state of AI technology. In addition, it can instigate public resentment against the unjustifiably granted patent rights, given that patents impose welfare costs in the form of prices above a competitive level.

[The silence of patent law regarding non-human inventors cannot be interpreted as implicit recognition.](#)

15. Just because patent law does not explicitly exclude non-human entities from being recognised as inventors does not mean it implicitly and automatically allows so. Neither teleological nor historical interpretation can support such conclusion, given that

⁴⁷ Sara Goering, ‘Autonomy’ in Carl Mitcham (ed), *Encyclopedia of Science, Technology, and Ethics* (Macmillan Reference 2005) 155.

⁴⁸ For a discussion, see Kim et al. (n 19) 67 ff.

⁴⁹ See Straus (n 21) 633-634 (calling on legal scholars to ‘overcome their resistance to read and study original research papers reporting on achievements involving AI’, which may reveal that ‘only the decisive human interventions made the discovery possible’).

⁵⁰ FCA decision, para 6.

legislators could not have envisaged that non-human entities might be able to invent. In jurisdictions where the inventor is entitled to the rights to be mentioned as such and to be designated in a patent application⁵¹ – which are regarded as moral rights – such provisions indicate that the inventor entitlement is reserved for natural persons only.

16. While there are jurisdictional differences as to how inventor's rights and patent ownership are regulated, the inventor's substantive rights in many jurisdictions include 'the right pertaining to entitlement and the right of attribution'.⁵² For instance, the European Patent Convention provides that 'the right to a European patent shall belong to the inventor',⁵³ in addition to the above-mentioned attribution rights. The Australian Patent Act also vests patent ownership in the inventor.⁵⁴ Accordingly, the primary question to address is whether non-human entities, such as AI systems, should have **legal capacity** and, thus, be entitled to legal rights. For the time being, the answer to this question is in the negative. Moreover, this question should not be answered under patent law in isolation, as long as the patent system forms part of the constitutional legal order.

[Not recognising AI systems as inventors would equally contribute to legal certainty.](#)

17. The FCA's decision states that recognising AI systems as inventors under patent law 'would avoid otherwise uncertainty'.⁵⁵ However, it is not evident that the **explicit denial** to recognise AI systems as inventors would not be equally certain. Furthermore, the decision to recognise AI systems as inventors can give rise to uncertainty as to how the

⁵¹ For instance, as provided under Article 62 and Article 81 of the European Patent Convention.

⁵² Shemtov (n 25) 24.

⁵³ Article 60 of the European Patent Convention.

⁵⁴ FCA decision, para 58, stating that

Part 2 of Ch 2 of the [Australian Patent] Act is concerned with "Ownership". Relevantly to the present context, s 15(1) provides: Subject to this Act, a patent for an invention may only be granted to a person who:

(a) is the inventor; or

(b) would, on the grant of a patent for the invention, be entitled to have the patent assigned to the person;
or

(c) derives title to the invention from the inventor or a person mentioned in paragraph (b); or

(d) is the legal representative of a deceased person mentioned in paragraph (a), (b) or (c).

⁵⁵ *ibid* para 131.

instances where AI ‘autonomously’ invents and where AI techniques are used as problem-solving tools should be distinguished and implemented from an administrative and enforcement perspective.

The argument that recognising AI systems as inventors promotes innovation is speculative.

18. The reasoning that ‘computer inventorship would incentivise the development by computer scientists of creative machines’⁵⁶ appears speculative at best. An economic analysis should establish first that the absence of ‘computer inventorship’ would lead to a market failure. By now, we have witnessed a surge of patenting activity claiming AI techniques and applications,⁵⁷ even without recognising ‘computer inventorship’.
19. The logic behind the argument that ‘computer inventorship would **incentivise** [...] the development by others of the facilitation and use of the **output** of [creative] machines, leading to new scientific advantages’⁵⁸ is not straightforward. If ‘creative machines’ refer to ‘autonomous’ AI systems, it is unclear what makes the judge believe that non-human entities would respond to behavioural incentives the way humans do. Alternatively, the view that ‘others’ need to be incentivised to facilitate AI output effectively recognises that AI systems should be viewed as tools rather than autonomous inventors. If by ‘the facilitation of the output’, the FCA decision refers to the human conception, configuration and setup of a computational process executed by a computer, then taking the credit away from humans might equally have a disincentive effect.
20. The FCA held that Thaler is the owner of the inventions, according to the ‘established principles of property law’, because he is ‘the owner, programmer and operator of DABUS, the artificial intelligence system that made the invention’.⁵⁹ The legal and practical consequence of such conclusion is that, as long as DABUS is owned by Thaler, he has the **ownership** claim in everything that is created by applying DABUS, even if

⁵⁶ *ibid* para 125.

⁵⁷ See generally World Intellectual Property Organization, *Technology Trends 2019. Artificial Intelligence* (WIPO 2019).

⁵⁸ FCA decision, para 125 (emphasis added).

⁵⁹ *ibid* para 167.

where it is **used as a tool**. Whether such result can, in effect, incentivise and facilitate the development and use of the AI output ‘by others’, as aspired by the judge,⁶⁰ is highly dubious. Rather than promoting innovation, the decision might have a discouraging effect on the developers of case-specific AI applications and AI-based products or services.

21. The legal question considered by the FCA concerned the recognition of non-human entities as inventors under patent law⁶¹ and, hence, the allocation of inventor’s rights, including the ownership right in an invention. However, at a fundamental level and in a systematic view, the question that should be addressed in the first place is whether, from a social welfare perspective, inventions generated without human input **should merit patent protection at all**.⁶² Given that patents impose welfare costs, they can only be justified by benefits that, in the absence patent protection, would not occur. Whether this might be the case with ‘autonomously generated’ inventions is a hypothesis that remains to be proved.

Munich, 7 September 2021

⁶⁰ *ibid* para 125.

⁶¹ *ibid* para 6.

⁶² On this point, see also *Thaler v. Hirshfeld* (n 4) 18 (holding that, if AI reaches ‘a level of sophistication such that it might satisfy accepted meanings of inventorship [...] it will be up to Congress to decide how, *if at all*, it wants to expand the scope of patent law’ (emphasis added)).