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Machina Ex Machina Artificially Intelligent Systems as Inventors under Polish Legal Framework

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Keywords

Artificial intelligence; Invention; Inventor; Patentable subject matter; Patent eligibility; Industrial property

Abstract

Not only do advanced artificially intelligent (AI) systems play an increasingly important role in modern society, but they also significantly enhance industrial and economic development. AI systems are already capable of generating outputs, which, had they been created by humans, would be eligible for patent protection. Polish patent regime has yet to determine how it will address inventive computational results. This paper aims at addressing a question whether AI-generated outputs can be considered patentable inventions under Polish legal framework and if so, who would be recognized as the inventor. The author draws conclusions de lege lata and briefly outlines de lege ferenda observations. The author argues that vesting the inventor status in one of the persons who contributed to the AI-generated result offers a reasonable incentive to actors involved in the innovation process and, at the same time, leaving aside vexed problem of computational personhood, does not undermine established legal paradigms, in particular the traditional notion of human creator (inventor).

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I. Introduction

With the advent of digital technology, national, European and international regulatory framework is challenged by the looming arrival of advanced artificial intelligence (AI) systems. Technologies exploiting AI have already become an ubiquitous part of our everyday life as autonomous machines are percolating through modern society. AI is also an increasingly powerful source of innovation.

It is widely believed that advanced, autonomous and automated AI systems are to become major drivers of economic growth.[1] Such systems are already capable of autonomously generating 'real world inventions' and it is estimated they will take on an increasing proportion of the creative, problem-solving work, gradually becoming primary source of inventiveness.[2] Undoubtedly, the economic impact of the inventive machines permeating modern business will be tremendous. At the same time, a question of how law should be shaped when faced with widespread use of inventive machines is a complex one as it poses major challenges to the established paradigm of patentability and traditional notions of inventor and inventorship.[3]

This paper aims at addressing a question whether AI-generated outputs can be considered patentable inventions and if so, who would be recognized as the inventor under the Polish patent law. Is there a genuine need to change our understanding of the notion of inventor as natural person? The author draws conclusions de lege lata and briefly outlines de lege ferenda observations.

II. Artificial Intelligence

Providing a uniform definition of AI poses a major challenge, as definitions vary significantly depending on the adopted research approach and assessment context.[4] Nevertheless, the most relevant for purposes of this paper appears to be

1 Shlomit Yanisky-Ravid and Xiaoqiong (Jackie) Liu, 'When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era' (2018) 39 Cardozo Law Review 2215, 2223–2230; Ryan Abbott, 'Patenting the Output of Autonomously Inventive Machines' (2017) 10 No. 1 Landslide 16.

2 Ryan Abbott, 'Patenting the Output of Autonomously Inventive Machines' (n 1); Ryan Abbott, 'I Think, therefore I Invent: Creative Computers and the Future of Patent Law' (2016) 57 Boston College Law Review 1079, 1080; Peter M. Kohlhepp, 'When the Invention is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes' (2008) 93 Minnesota Law Review 779, 779; Liza Vertinsky and Todd M. Rice, 'Thinking about Thinking Machines: Implications of Machine Inventors for Patent Law' (2002) 8 Boston University Journal of Science and Technology Law 574, 576.

3 Ryan Abbott, 'Everything is Obvious' (2019) 66 UCLA Law Review 2, 5.

4 Yanisky- Ravid, Liu (n 1) 2223.

Scherer's observation that intelligent machines are 'capable of performing tasks that, if performed by a human, would be said to require intelligence'[5] such as visual perception, speech recognition, decision-making, translation.

Initially, AI researchers focused primarily on 'emulation,' that is, mimicking observable intelligent behaviour. However, superficial mimicry resulted in anything but intelligence, at least one equivalent to its human benchmark.[6] Soon after, in the mid-20th century, AI systems started to flourish when AI research bifurcated into two directions, both of which are currently propelling machine intelligence development.[7] The traditional methodology has been enriched by a novel simulation approach inspired by human nervous system, and aimed at engineering structures capable of simulating brain activity.[8] These structures, referred to as artificial neural networks analyse data by applying a series of mathematical transformations and thereby execute processes resembling human learning experiences.[9]

Interestingly, computers are believed to have been autonomously creating patentable results for at least twenty years. In 1994, computer scientist Stephen Thaler disclosed an invention called 'Creativity Machine,' which combines an artificial neural network generating new ideas, an 'imagitron,' together with another network, a 'perceptron,' that perceives value or utility in the stream of outputs.[10] The machine is the subject matter of a patent 'Device for the Autonomous Generation of Useful Information' (U.S. Patent No. 5,659,666). On January 26, 1996, a second patent application was filed in Thaler's name. Subsequently, on December 22, 1998, the U.S. Patent Office granted a patent for 'Neural Network Based Prototyping System and Method' (U.S. Patent No. 5,852,815).

Although S. Thaler is named as the inventor of both of the inventions, he states that in fact it was the Creativity Machine that autonomously invented the second patent's subject matter.[11] Since then, the Creativity Machine has been credited with a number of inventions, inter alia the design of the Oral-B Cross

5 Matthew U. Scherer, 'Regulating Artificial Intelligent Systems: Risks, Challenges, Competencies, and Strategies' (2016) 29 Harvard Journal of Law & Technology 353, 362 as cited in Yanisky- Ravid, Liu (n 1) 2224.

6 John Buyers, *Artificial Intelligence. The Practical Legal Issues* (Law Brief Publishing 2018) 5.

7 ibid.

8 ibid.

9 Robin C. Feldman, 'Artificial Intelligence' (2018) 21 Green Bag 2d 201, 202–203.; Madeleine de Cock Buning, 'Autonomous Intelligent Systems as Creative Agents under the EU Framework for Intellectual Property' (2016) 7 European Journal of Risk Regulation 310, 312.

10 Aaron M. Cohen, 'Stephen Thaler's Imagination Machines' (July–August 2009) 43(4) The Futurist 28 <https://www.researchgate.net/publication/299169623_Stephen_Thaler's_Imagination_Machines> accessed 10 September 2019.

11 Abbott, 'I think, Therefore I Invent: Creative Computers and the Future of Patent Law' (n 3), 1085–1086.

Action toothbrush.[12] The U.S. Patent Office has thus, apparently unknowingly (S. Thaler did not disclose the Creativity Machine's involvement to the Office), granted a patent for a computational invention back in 1998.[13]

III. Legal Threshold of Inventorship

The Act of June 30, 2000 on Industrial Property Law (ustawa z dnia 30 czerwca 2000 r. Prawo własności przemysłowej) does not introduce the notion of inventor, instead using the broad term creator with regard to all the inventive projects. However, for the sake of comprehension hereof, concepts will be used interchangeably.

The notion of inventive projects is an umbrella term for certain industrial property rights' objects. Not only does it cover inventions but also utility models, industrial designs, topographies of integrated circuits and rationalization projects. Thus, the term does not refer to trademarks and geographical indications. This leads to the conclusion that industrial property objects' ontological character differs, and so does their normative status.[14] What distinguishes inventive projects from other objects of industrial property is that they are intellectual creations. Scholars argue that novelty and originality deriving from creator's creative abilities are therefore premises for recognition of a certain intangible good as an inventive project and hence granting protection under the provisions of Industrial Property Law Act.[15]

Nevertheless, the Act remains silent with regard to the definition of a creator, even though it uses notion thereof on several occasions. Neither does the Act provide explicitly inventorship requirements. It is generally derived from the wording of the relevant provisions and their ratio legis that although patent ownership can be held by legal persons, only natural persons can accomplish an intellectual creation and, therefore, be invertors.[16]

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12 ibid.

13 ibid.

14 Jerzy Szczotka, 'Tytuł I. Przepisy ogólne. Art. 3' in Tomasz Demendecki and others (eds), *Prawo własności przemysłowej. Komentarz* (Wolters Kluwer Polska 2015) 32.

15 Piotr Kostański, 'Tytuł I. Przepisy ogólne. Art. 3' in Piotr Kostański (ed), *Prawo własności przemysłowej. Komentarz* (2 nd edn, CH Beck 2014) 34.

16 Janusz Szwaja and Agnieszka Kubiak-Cyrul, 'Twórcy projektów wynalazczych' in Ryszard Skubisz (ed), *System Prawa Prywatnego, T. 14A, Prawo własności przemysłowej* (CH Beck 2017); Szczotka 'Tytuł I. Przepisy ogólne. Art. 8' in Tomasz Demendecki and others (eds), *Prawo własności przemysłowej. Komentarz* (Wolters Kluwer Polska 2015), 52; Michał du Vall 'Podmioty i prawa podmiotowe' in Elżbieta. Traple (ed), *Prawo Patentowe* (2nd edn, Wolters Kluwer Polska 2017) 301.

Fulfilment of the patentability requirements implies that whoever conceived the invention has creatively contributed to the subject matter of the patent and is therefore eligible for status of creator.[17] Therefore, whenever the invention is a result of the inventive work of sole creator, there is no need to enquire into whether the inventor's effort satisfies creativity criteria.[18] This conclusion however does not suffice to establish catalogue of involvement types that meet the threshold of inventorship, where there is more than one player participating in the inventive process. It is therefore joint inventorship that raises question of qualitative and quantitative criteria of the contribution assessment.[19] Polish Industrial Property Law does not determine explicitly who shall be considered a co-inventor and the doctrine does not seem to reach a common conclusion on the matter either.

There is a long standing consensus that the contribution shall be recognized as legally relevant insofar as it is creative.[20] However, uniform criteria of the creativity assessment reflecting on co-inventorship eligibility have not been elaborated. Hence, lack of objective criteria of creativity, which would allow to distinguish the technical and organizational contribution from the creative contribution appears to be the underlying dilemma.[21] The issue has been widely discussed with majority of the literature and commentators addressing the question of whether it is essential for each contribution to meet the non-obviousness requirement.

Some argue that to qualify as a joint inventor, one must contribute to the invention's conception or at least to inspiration thereof.[22] Such stance has been widely criticized as overly liberal. It has been held that merely providing an idea or an inspiration does not suffice to deem one co-inventor, as such contribution plays ancillary, albeit rudimentary role in the process of creating a technical solution itself.[23]

Other scholars argue that in order to constitute a legally relevant contribution, one's involvement must directly relate to the element of the subject matter, which

17 du Vall (n 16) 301

18 Krystyna Szczepanowska-Kozłowska, 'Zagadnienia Podmiotowe' in Ewa Nowińska, Urszula Promińska and Krystyna Szczepanowska-Kozłowska (eds), *Własność przemysłowa i jej ochrona* (Lexis Nexis 2014) 352.

19 Szczepanowska-Kozłowska (n 19); Szwaja, Kubiak-Cyrul (n 16) 494.

20 Janina Preussner- Zamorska, 'Autorstwo projektu wynalazczego' in Stafan Grzybowski and Andrzej Kopff (eds), *Prawo Wynalazcze. Zagadnienia Wybrane* (Państwowe Wydawnictwo Naukowe 1978) 118–120.

21 Szwaja, Kubiak-Cyrul (n 16) 493–494.

22 Janina Preussner- Zamorska, 'Prawo do autorstwa wynalazku' (1974) 2 Zeszyty Naukowe Uniwersytetu Jagiellońskiego 5, 62.

23 du Vall (n 16) 302.

is subject to non-obviousness assessment.[24] Thus, one shall enjoy the status of a co-inventor whenever its respective contribution results in the invention's component, which meets the said patentability criterion. This stance however is generally regarded as being too rigid.[25]

The prevailing view appears to be that in order to qualify as a co-inventor, one must make a creative contribution, which, assessed together with other players' inputs, will lead to creation of a solution meeting the non-obviousness requirement, hence a patentable subject matter.[26] This approach emphasizes the impact that assessed contribution has on the final outcome of the inventive process.[27]

Nevertheless, there appears to be a broad agreement that neither carrying out trials and calculations, dossier preparation, provision of technical support nor funding shall be considered as creative and players making such contribution must not be therefore considered co-inventors.[28] For the same reasons, an actor exercising management control over the research team will not enjoy the status of a co-inventor either.[29] It is therefore a commonly accepted view that a contribution limited to routine, mechanical or administrative activities lacks creative character, thus it does not suffice to recognize the provider thereof as a joint inventor.[30]

As demonstrated above, the assessment of the creative character of the input is indirect and based on a presumption that only a creative contribution results in an output that meets the non-obviousness requirement. Question of whether the contributor's effort satisfies creativity criteria is hence answered by drawing inference from the end result. While this deductive reasoning's usefulness cannot be denied as it facilitates listing those eligible for inventor status, it does not alone impose a conclusion that outputs generated by non-humans cannot attract intellectual property rights.

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24 Stanisław Sołtysiński, *Prawo Wynalazcze. Komentarz* (Instytut Wydawniczy Centralnej Rady Związków Zawodowych 1975) 70; du Vall (n 16) 302.

25 Szwaja, Kubiak-Cyrul (n 16) 494.

26 Ibid.; Urszula Promińska, 'Zagadnienia podmiotowe' in Ewa Nowińska and Krystyna Szczepanowska-Kozłowska (eds), *System Prawa Handlowego, T. 3, Prawo własności przemysłowej* (CH Beck 2015) 188–189.

27 Andrzej Szajkowski, *Wynalazki wspólne. Aspekty prawne* (Zakład Narodowy im. Ossolińskich 1982) 24–25; Szczepanowska- Kozłowska (n 19) 353.

28 Szwaja, Kubiak-Cyrul (n 16) 494; Michał Staszków, *Prawo wynalazcze* (Państwowe Wydawnictwo Naukowe 1989) 82; Ryszard Markiewicz, *Ochrona prac naukowych* (Państwowe Wydawnictwo Naukowe 1990) 77; Szczotka (n 16).

29 Preussner- Zamorska, 'Prawo do autorstwa wynalazku' (n 22) 74; Staszków (n 28) 83.

30 Preussner- Zamorska, 'Prawo do autorstwa wynalazku' (n 22) 63.

It is necessary to distinguish between the actor (the action) and the object of the action. Advanced AI systems have the capacity to generate outcomes that meet statutory prerequisites of patentability, that is, are new, involve an inventive step (are non-obvious) and are susceptible of industrial application, hence, would be worthy of patent protection had they been developed by humans. Therefore, when the creativity is assessed solely from patentable subject matter's perspective, lack of human intervention does not preclude an AI-generated output from being classified as a patentable invention. Not only is precluding a limine, the possibility of attracting intellectual property rights by non-human inventions unjustified form a legal perspective, but it is also questionable from an economic point of view as it neglects to provide incentives to players participating in the process of developing AI-generated results.

As already indicated, the assessment of the patent eligibility of the subject matter is de facto based upon the nature of the subject itself rather than upon the nature of the mental processes of the inventor by which he achieved the non-obviousness. As previously outlined, the Act on the Industrial Property Law does not include any provision explicitly defining the notion of a creator, nor does it provide prerequisites for the assessment of the act of intellectual creation. The prevailing view, however, is that only natural persons can accomplish an intellectual creation and, therefore, be invertors. This results from the fact that throughout history, human being has been assumed to be exclusive source of creativity. This assumption, however, is challenged by developments in computer technology.[31] The contentious debate whether computers will ever be creative in the sense that humans face substantial difficulty in producing a viable definition of creativity.[32]

Over the years, creativity has been described as the ability to do the unpredictable, to defy rules and break the routine.[33] Thus, machines' deterministic nature used to be regarded as having foreclosing effect on computational creativity.[34] Modern computers however can, in fact, be programmed to generate unexpected results. Hence, some argue, that taking unpredictability as a proxy for creativity, we can make computers creative by instructing them to employ

31 Ralpf D. Clifford, 'Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up?' (1997) 71 Tulane Law Review 1675, 1676.

32 Annemarie Bridy, 'Coding Creativity: Copyright and the Artificially Intelligent Author' (2012) Stanford Technology Law Review 5, 22.

33 ibid 22–23, citing Ada Lovelace, 19th century mathematician and writer, who cautioned against overoptimism about the potential of Charles Babbage's proposed mechanical general-purpose computer-Analytical Engine ('It is desirable to guard against the possibility of exaggerated ideas that might arise as to the powers of the Analytical Engine. The Analytical Engine has no pretensions whatever to originate anything. It can do (only) whatever we know how to order it to perform').

34 ibid 23.

randomness into their choices. Programmed randomness would thus suffice to breed creativity.[35]

Nevertheless, with the ongoing development of the AI technologies, we observe continuous rise of the threshold of machine creativity. Many scholars define computational creativity in terms of human consciousness. Abandoning less onerous, albeit more clear and measurable criterion of unpredictability, they adopted a belief that creativity requires consciousness. Some scholars argue that human thought is nothing but a very sophisticated algorithm and that, hence, humans and machines are in fact not as different as we are prone to admit.[36] There are those who strongly believe that 'humans think by means of algorithms' and that 'sequences of mental steps and algorithms are the same thing'[37]. On the other end of the spectrum there are sceptics, who argue that 'the way people [...] reason can't be reduced to an algorithmic procedure like arithmetic or formal logic'[38] and that human creativity is 'inherently mystical'[39]. The latter, proponents of the so-called 'weak AI,' further claim that 'future robots may exhibit much of the behavior of persons, but none of these robots will ever be a person; their inner life will be as empty as a rock's'[40]. On the other hand, those who hold that human thought can be broken down into a series of algorithmic operations argue that 'AI engineers will eventually replicate the human mind and create a genuinely self-conscious robot replete with feelings and emotions'[41]. Whilst neuroscientific studies have recently undertaken the challenge of understanding cognitive functions in order to learn the causal chain of neural events underlining cognition,[42] they have not yet discovered the precise mechanisms governing human consciousness.[43] It is therefore impossible to establish beyond reasonable doubt that advanced AI systems and human creativity share the same biological axioms.

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35 David Cope, *Computer Models of Musical Creativity* (MIT Press 2005) 12; David Levy, *Robots Unlimited: Life in a Virtual Age* (CRC Press 2005), 151.

36 Bridy (n 32) 25.

37 Allen Newell, 'Response: The Models Are Broken, The Models Are Broken!' (1986) 47 University of Pittsburgh Law Review 1023, 1025 as cited in Bridy (n 32) footnote 68.

38 Peter Kassan, 'AI Gone Awry: The Futile Quest for Artificial Intelligence' (2006) 12 Skeptic 30, 34. as cited in Bridy (n 32) footnote 68.

39 Roger Schank and Christopher Owens, 'The Mechanics of Creativity' in Raymond Kurzweil (ed), *The Age* of *Intelligent Machines* (MIT Press 1990) 394 as cited in Bridy (n 32) footnote 58.

40 Selmer Bringsjord, 'Chess is Too Easy' (1998) 101/2 Technology Review 23, 24.

41 Ibid 23.

42 Barbara Bottalico, 'Cognitive Neuroscience, Decision Making and the Law' (2011) 2 European Journal of Risk Regulation 427.

43 Kohlhepp (n 2) 808.

Consciousness and creativity are surely fascinating phenomena. Nevertheless it appears that reflection thereon only adds to the struggle to articulate a comprehensible and workable approach to inventiveness. Therefore, from a functional point of view, 'whether or not creative computers >think< or have something analogous to consciousness should be irrelevant with regards to inventorship criteria'[44]. Patentability of computational inventions shall be indifferent to the means by which invention comes about and should be thus based on the assessment of a computer's output "rather than on a clumsy anthropomorphism'[45].

IV. AI Inventions under Polish Legal Framework

AI-generated outputs should not be a limine denied patent protection as they, under Industrial Property Law Act provisions, are capable of satisfying the patentability threshold. This conclusion however raises the fundamental question of who, if anyone, could be attributed with the status of a creator of a computational invention? It is crucial to comprehensively address this question since the inventor is the original owner of the entitlement to the right to a patent (Article 8(1).1 of the Industrial Property Law Act 2000) and has the moral right to be named as inventor in the patent specification (Article 8(1).3 of the Industrial Property Law Act 2000). It should be emphasized that discretion to refrain from exercising the right to authorship (inventorship) is subject to a limitation under Article 32 of the Industrial Property Law Act, which provides that where the patent applicant is not the inventor, he shall be obliged to name the inventor in the request and state the grounds on which his own right to a patent is based. As from the receipt of the patent application and throughout the patent granting proceedings, the Polish Patent Office shall invite the applicant to complete the application or to remedy any identified omissions within a fixed time limit. Failure to comply with Office's order will result in discontinuance of the proceedings (Article 42(1) of the Industrial Property Law Act 2000). Hence, where it is impossible to name an inventor, the patent cannot be granted.

Those most frequently listed as possible stakeholders are: the software programmer, the data supplier, the user of the system, and the AI system itself.[46] It can be argued that by creating the creative software, the programmer undertakes an intellectual effort, which translates to the computational result. However, it is

44 Abbott, 'I think, Therefore I Invent: Creative Computers and the Future of Patent Law' (n 2) 1108.

45 ibid 1110–1111.

46 Yanisky-Ravid, Liu (n 1) 2231–2234.

questionable to what extent the programmer's contribution reflects in the final output.[47] Although the programmer designs AI software to develop patentable results, there is no reason for the programmer to qualify as an inventor of the AI's unpredictable output, unless the AI had been created 'in order to solve a particular problem', and a particular result was foreseeable).[48] Otherwise, AI distinctive features such as autonomy and evolving nature hinder the programmer from enjoying inventor status. Some scholars observe parallels between the programmer's status and the position of the stakeholders over a piano, a brush, a camera, a computer, or a printer who, certainly, 'do not hold the rights over the rhythm, the painting, the photo, or the story created by those instruments'.[49]

Data supplier provides the AI system with data that the system exploits and learns from.[50] For example, in case of facial recognition, the data supplier provides the AI system with millions of pictures of human faces.[51] Hence, the data supplier's role is merely providing the system with access to already existing knowledge. However, since the AI system learns autonomously, no individual actions of the supplier should be regarded as creative, thus significantly contributing to the creation of the computational invention.

The user operates the AI system by indicating the goal to be achieved and initiating the creative process. The latter is generally limited to 'pressing the button.' It needs to be borne in mind, that employing another actor to invent does not make one an inventor.[52] Thus, by analogy, user's contribution will be insufficient for deeming him an inventor.

This simplified study of some of the actors involved in the computational creative process leads to the conclusion that AI systems create independently of programmer, data supplier and user alike. Human input is, undoubtedly, essential for the creation of an AI-generated invention, as neither do intelligent machines originate from void, nor do they operate by themselves. But the human contribution, however necessary, does not meet the threshold of creativity, and consequently, none of the human actors could be deemed an inventor under the current notion thereof.

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47 Emily Dorotheou, 'Reap the Benefits and Avoid the Legal Uncertainty: Who Owns the Creations of Artificial Intelligence?' (2015) 21(4) Computer and Telecommunications Law Review 85, 89.

48 Abbott, 'I think, Therefore I invent: Creative Computers and the Future of Patent Law' (n 2) 1095.

49 Yanisky-Ravid, Liu (n 1) 2237.

50 ibid 2232–2233.

51 ibid.

52 W. Michael Schuster, 'Artificial Intelligence and Patent Ownership' (2018) 75 Washington and Lee Law Review 1945, 1961.

Can the AI system itself be therefore considered an inventor? None of the existing legal systems recognizes computers as legal entities and it is generally assumed that AI will not be granted legal personhood anytime soon.[53] AI thus cannot enjoy economic nor moral rights. Machines – regardless of how advanced and autonomous – do not possess personhood necessary to own the moral and property rights of the inventor.[54] Nevertheless, should the legal system cloak intelligent machines with personhood, the question pertaining to who should be regarded as the inventor remains relevant. This is because under the Polish industrial property law, only a natural person can be an inventor. Neither legal persons nor organizational units without legal personality qualify as such.[55] Thus, prima facie, even if the law assigned legal personhood to computers, under existing legal framework, AI systems would not be regarded as inventors. Had the law not been intended for human inventors alone, intelligent machines having legal personality might have been entitled to patent protection of their inventive outputs.[56]

It should be emphasized, however, that legal persons have been denied inventor status in order to protect and safeguard moral rights, in particular the right to authorship (inventorship) of the individuals participating in the inventive process. The idea of a human-inventor defied the concept of an 'enterprise's invention' (*l'invention d'enterprise, Betriebserfindung, wynalazek zakładowy*) based on a legal fiction of an 'invention without an inventor.'[57] Where a number of people involved in the creative process obstructed indication of those whose contribution was sufficient for deeming them inventors, the enterprise would be considered to be one.[58] This concept, popularized at the turn of the 19th and 20th century, was soon relinquished as violating provisions of the Paris Convention for the Protection of Industrial Property, as revised at London on June 2, 1934 (new Article 4ter provided that the inventor shall have the right to be mentioned as such in the patent).

On the contrary, computational inventions are de facto 'inventions without an inventor.' As already demonstrated, natural persons' involvement in the inventive process of AI systems is generally indirect and insignificant. Thus, indicating a human-inventor with regard to AI-generated outputs is impossible, as none of the actors satisfies the threshold of inventorship. Consequently, no

53 Id., p. 1114; Yanisky- Ravid, Liu (n 1) 2228;

54 Robert C. Denicola, 'Ex Machina: Copyright Protection for Computer-Generated Works' (2016) 69 Rutgers University Law Review 251, 274.

55 Promińska (n 26) 185.

56 Yanisky- Ravid, Liu (n 1) 2231.

57 Promińska (n 26) 185.

58 ibid.

right to authorship (inventorship) would be violated by a legal fiction vesting patent rights in one of the stakeholders. AI systems do not hold rights that could be thereby infringed, for they are not recognized as legal entities. If, however, legal personhood was assigned to autonomous computers, they could themselves enjoy inventor status and there would be no necessity to introduce aforementioned legal fiction.

Legal fiction of 'computational invention' vesting the inventor status and rights thereby conferred in one of the stakeholders would introduce profoundly different rationale than legal fiction of the 'enterprise's invention' did. The legal justification for such fiction would not evoke to the difficulty with indicating the inventor-in-fact but to the lack thereof. The computational inventions' inventor-in-fact is the AI system itself which, at least for the time being, cannot enjoy legal status of an inventor. Said solution, by vesting the inventor status in one of the persons who contributed to the AI-generated result would offer a reasonable incentive to actors involved in the innovation process and, at the same time, leaving aside vexed problem of computational personhood, would not undermine established legal paradigms.

Determining who ought to enjoy the default inventor status, should the Polish legislator decide to grant patents for AI-generated outputs, entails a dilemma of who among multiple actors involved in the creative process shall be granted patent rights with respect to the given invention. Assignment of exclusive intellectual property rights ought to be studied from an economic perspective. Being able to support legal reasoning by reference to economics enhances the justifiability thereof, since, naturally, an instrument that is recognized as economically efficient carries a stronger weight of justifiability. The concept of economic efficiency, that is, maximization of socioeconomic utility, does provide a useful guide in interpreting, applying and developing the law. Whilst there are a number of traditional justifications for intellectual property rights,[59] law-and-economic approach to the intellectual property system focuses on promoting the production and distribution of scientific and cultural goods by providing incentives for creative activities. The reward and incentive argument, constituting the core of the law-and-economics approach,[60] shall thus become the cornerstone for efficient allocation of patent rights in the AI realm. Adopting the law-and-economics framework, we ought to consider vesting patent rights to computational inventions in one of the players having particular interest in lucratively engaging

59 Peter Drahos, *A Philosophy of Intellectual Property Rights* (Routledge 1996); William Fisher 'Theories of Intellectual Property' in Stephen Munzer (ed), *New Essays in the Legal and Political Theory of Property* (Cambridge University Press 2001)168.

60 William M. Landes and Richard A. Posner, *The Economic Structure of Intellectual Property Law* (Belknap Press 2003).

in patent monetization (i.e., the AI software programmer, the owner of the AI system or the user of the AI system).

Incentive appears to be a strong argument supporting the programmer's claim for patent rights as it is the developer's activity that constitutes a pedigree for computational inventions. However, as argued by Pamela Samuelson,[61] 'the programmer can already be rewarded for the commercial value of the program – which is what he created – through sales of the program or license fees for use of the program'. Increased consumer demand for inventive computers would thus be a sufficient incentive for software developers.[62]

Ryan Abbott concludes that 'ownership rights to computational inventions should vest in a computer's owner because it would be most consistent with the way personal property (including both computers and patents) is treated [...] and it would most incentivize computational invention'.[63] He further argues that, should the patent rights for computational inventions be granted to AI users, the software owner would be tempted to restrict user access, whereas assigning the invention to the software owner would encourage externalizing the inventive process. In the former scenario, economic efficiency would not be achieved as the patents would not be allocated to market participants.[64] Recalling the normative Coase theorem, according to which in order to maximize economic efficiency, the legislator should create a legal system that minimizes or eliminates obstacles (i.e., transaction costs) to agreements among individuals, hence allocating property entitlements to the party that most values them, W. Michael Schuster concludes that benefits arising from patent ownership are most valuable when the patentee participates in the relevant market.[65]

Circumventing patent allocation by internalizing the inventive process in order to become a right-holder would be indeed the expected response from software companies, should patent rights for computational inventions be granted to AI users. Ronald H. Coase argued, however, that companies will externalize whenever the costs of internalization is greater than the cost of externalization.[66] Hence, W. Michael Schuster further argues that software companies are not likely to 'internalize AI invention on a significant scale' as due to the costs of obtaining

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61 Pamela Samuelson, 'Allocating Ownership Rights in Computer-Generated Works' (1986) 47 University of Pittsburgh Law Review 1185, 1225.

62 Abbott, 'I Think, Therefore I Invent: Creative Computers and the Future of Patent Law' (n 3) 1116.

63 Abbott, 'I think, Therefore I Invent: Creative Computers and the Future of Patent Law' (n 3) 1114–1115

64 ibid.

65 Schuster (n 52) 1985.

66 Ronald H. Coase, 'The Nature of the Firm' (1937) 4 Economica 386, 395 as cited in Schuster (n 52) footnote 277.

and maintaining technical information relevant in a given field, such policy would not prove financially viable.[67] Software companies and programmers in the AI innovation realm are thus 'unlikely to be engaged in commerce specific to any particular area of invention beyond the creation of AI'.[68] Taking into consideration that benefits arising from patent ownership, including the traditionally recognized perk of market exclusivity, are most valuable when the patentee participates in the relevant market, W. Michael Schuster concludes that it is the AI user, who would maximally value the patents arising therefrom and the mere fact that other players are potentially capable of engaging in patent monetization (e.g., by patent licensing) does not dissuade this conclusion.[69]

V. The DABUS Case

In November 2018, Stephen Thaler filed with the European Patent Office (EPO) two patent applications: EP 18 275 163 and EP 18 275 174, concerning a food container and a flickering *light* system for attracting enhanced attention, respectively. The field for indicating the inventor was left empty. With response to the invitation to remedy this deficiency, Thaler filed a designation, indicating a machine, DABUS, as the inventor. The applicant explained that DABUS is a type of connectionist AI and further claimed that he had acquired the right to the European patent from the inventor by being its successor in title. Thaler argued that as the DABUS's owner, he was an assignee of any intellectual property rights created by the machine.[70]

Following the oral proceedings, both applications were refused by the Receiving Section of the EPO, which based its holding on two primary grounds. Firstly, The Receiving Section noted that the application does not meet the formal requirements of Article 81 and Rule 19(1) of the European Patent Convention (EPC).[71] Pursuant to Article 81 EPC, the European patent application shall designate the inventor and that, if the applicant is not the inventor or is not the sole inventor, the designation shall contain a statement indicating the origin of the right to the European patent. Rule 19(1) EPC prescribes that designation shall state the family name, given names and full address of the inventor, contain the

67 Schuster (n 52) 1995.

68 ibid 1989.

69 ibid 1985.

70 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [1–5]; Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [1–5].

71 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [19] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [20].

statement indicating the origin of the right to the European patent and bear the signature of the applicant or his representative. The Receiving Section of the EPO ruled that indicating the name of a machine cannot be deemed to meet the said requirements.[72] The Receiving Section further noted that under legal framework of the European patent system, the term inventor shall be understood as referring to a natural persons only[73] and that the adopted understanding of the said term appears to be an internationally applicable standard.[74] Secondly, The Receiving Section held that Thaler's statements indicating that he acquired the right to the European patent from DABUS being its successor in title do not meet the requirements of the abovementioned Article 81 as well as Article 60(1) EPC.[75] According to the latter, the right to a European patent shall belong to the inventor or his successor in title. The Receiving Section noted that since AI systems have no legal personality and thus, cannot have any legal title over their output, there is no right that could be transferred.[76] What is worth noting is that the EPO did not face the necessity to examine whether DABUS actually created the invention set out in the application. Rather, the refusal resulted from failure to meet formal requirements. [77]

Likewise, patent applications indicating DABUS as the inventor filed by Thaler with the Intellectual Property Office of the United Kingdom (UKIPO)[78] and the United States Patent and Trademark Office (USPTO)[79] were rejected on the grounds that a non-human cannot be named as an inventor on a patent.[80] While it has been thereby determined, whether non-humans, including AI systems, can be indicated as inventors on a patent application, the DABUS case

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72 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [21] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [22].

73 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [22–28] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [23–29].

74 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [29] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [30].

75 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [30] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [31].

76 Grounds for the EPO decision of 27 January 2020 on EP 18 275 163 [31–33] and Grounds for the EPO decision of 27 January 2020 on EP 18 275 174 [32–34].

77 For a detailed analysis of EPO's reasoning see: Martin Stierle, Artificial Intelligence Designated as Inventor – An Analysis of the Recent EPO Case Law (2020) 69(9) GRUR International 918–924.

78 UK IPO patent decision BL O/741/19 of 4 December 2019, <https://www.ipo.gov.uk/p-challenge-decision-results/p-challenge-decision-results-bl?BL_Number=O/741/19> accessed 1 October 2020

79 USPTO decision of 22 April 2020 on Application No. 16/524,350, <https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf> accessed 1 October 2020.

80 David Flint, 'Intelligence: The Artificial Way' (2020) 41 Business Law Review 4, 151–152.

should be considered no more than a starting point for further reflection, as a number of other material questions are left unanswered. In May 2020, the World Intellectual Property Organization (WIPO) published a Revised Issues Paper on Artificial Intelligence and IP Policy, identifying the main questions and issues arising for IP policy in consequence of the advent of AI as an increasingly widely used general-purpose technology.[81] Among substantive legal issues raised by AI for patent policy that need to be addressed, WIPO recognizes the question of whether AI-generated-inventions require patent protection or a similar incentive system at all.[82] Furthermore, it should be investigated whether it is necessary, in the context of AI-generated inventions, to retain the traditional, fundamentally associated with human acts of invention, requirements of inventive step or non-obviousness.[83] There is also the question of what ramifications would the question of inventorship and ownership have on related issues, such as, infringement and liability.[84] These, and many other substantial questions, remain open.

VI. Conclusion

Without doubt, increasingly advanced AI systems challenge well-established notions of inventorship and inventor. The author argues that existing legal framework suffices for recognizing AI-generated outputs as patentable inventions. What subsequently sparks controversy, however, is query as to whoever, if anyone at all, meets the threshold of inventorship and can be thus named an inventor. As already demonstrated, it is questionable whether any of the actors involved in the computational creative process satisfies the standard. Thus, the author argues, that de lege lata, computational results do not enjoy patent protection due to the impossibility of indicating a human inventor. As already indicated, where it is impossible to name an inventor due to lack thereof, the patent cannot be granted.

Nevertheless, denying computational inventions patent protection encourages AI-systems' operators to maintain the secrecy of otherwise patentable technical solutions. It can be argued that lack of patent protection and excessive trade secrecy resulting therefrom slows down the dissemination of technological

81 WIPO, Revised Issues Paper on Intellectual Property Policy and Artificial Intelligence (WIPO/IP/AI/2/GE/20/1 REV.) 21 May 2020 <https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_ai_ 2_ge_20/wipo_ip_ai_2 _ge_20_1_rev.pdf> accessed 1 October 2020.

82 ibid [issue 2, 17(i)].

83 ibid [issue 4, 20(i)].

84 ibid [issue 2, 17(viii)].

advances, hence doing a disservice to the social welfare.[85] It could be therefore concluded that lack of patent protection would deprive society from benefits arising from information creation and dissemination. Furthermore, denying patent protection for AI-generated outputs encourages naming a human as a creator, where the subject matter was in fact achieved by an autonomous creative machine.[86] Thus, excluding otherwise patentable solutions from patent protection appears to be contrary to one of the main rationales for the patent system, that is, ensuring public access to knowledge.

The author argues that legal fiction of 'computational invention,' by vesting the inventor status and rights thereby conferred in one of the stakeholders having particular interest in patent monetization, would offer a reasonable solution in a rapidly changing creative domain; yet, it would not undermine the established legal paradigms. The pending question of whoever ought to be assigned with patent rights shall be given serious consideration by policy makers. It is further necessary to address the issue of how to protect AI-generated outputs.

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85 Luigi Alberto Franzoni and Arun Kumar Kaushik, 'The Optimal Scope of Trade Secrets Law' (2016) 45 International Review of Law and Economics 45, 45.

86 Schuster (n 52) 2001–2002; Ryszard Markiewicz, 'Sztuczna inteligencja i własność intelektualna' in Alicja Adamczak (ed), *100 lat ochrony własności przemysłowej w Polsce. Księga jubileuszowa Urzędu Patentowego Rzeczypospolitej Polskiej* (Wolters Kluwer 2018)1434–1458.

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