E.I.P.R. 2017, 39(2), 69-73

European Intellectual Property Review
2017

The inventor's new tool: artificial intelligence - how does it fit in the European patent system?

Peter Blok [1]

Subject: Intellectual property
Other Related Subject: Information technology.

Keywords: Artificial intelligence; European patents; Inventive step; Inventors; Patentable subject matter;

Legislation:

art.52art.52, art.56

***69** *Artificial intelligence plays an increasingly important role in the development of new products and processes. This development raises the question how inventions made by means of artificial intelligence fit in the European patent system. This article argues that an artificial intelligence application should be seen as a tool, and that inventions made with that tool are patentable as long as the artificial intelligence application is not a tool the average skilled person would use routinely.*

Introduction

Inventing by means of artificial intelligence is not merely a popular subject of science fiction novels. Developments in the field of artificial intelligence have made "machine inventions" a reality. Artificial intellects have demonstrated to be capable of developing, for instance, new types of antennae, electrical circuits and nose cones of trains, with features superior to products invented by humans. [1] Recent achievements of self-learning systems and large investments by technological companies in the field of artificial intelligence indicate that artificial intelligence may soon become an important source of innovation. That raises the question whether the products of artificial intelligence can and should be rewarded with a patent monopoly. That is a different question from the issue whether the artificial intelligence appliance itself can be protected by patents. [2] This article deals with the patentability of the products and process created with the aid of an artificial intelligence tool, instead of the patentability of the tool. It discusses whether patents can be obtained for processes and products developed by means of artificial intelligence systems and, if so, who will be entitled to the patent. That question is answered on the basis of the rules and foundations of European patent law.

The state of the art

Artificial intelligence is not new. Since the 1950s researchers and engineers have tried to create "intelligent" systems, i.e. systems that exhibit characteristics associated with intelligence in human behaviour, including learning, reasoning and problem solving. [3] Since then, research has been done in various disciplines, such as computer science, mathematics, neuroscience and philosophy. These developments, in combination with a tremendous increase in computational power, have led to impressive achievements, such as the chess-playing system Deep Blue beating world champion Garry

Kasparov in 1997; IBM's "answering machine" Watson defeating two of the best participants in a quiz show in 2011; and the victory of Google's DeepMind over the Go world champion Lee Se-dol last year.

Many more successes are expected, as is demonstrated by the large investments in research on artificial intelligence by technological giants, such as Google, IBM and Facebook. There are at least two reasons for this optimism and they reinforce each other. The first is the progress that has been made in field of machine learning, i.e. software that can gain abilities from experience. After decades of disappointment, the performance of these self-learning systems and algorithms is exceeding that of humans in many areas. For instance, Microsoft reported that its neural network surpassed human-level performance in classifying images. [4] Similarly, scientists of IBM and Google demonstrated a system that outperforms humans at separating and recognising the speech of two people. ***70** [5]

The second reason is the tremendous increase in the amount of data that can be fed to the systems. Data sets are growing rapidly because of the expanding capabilities to capture, combine and query a wide variety of data types from a large number of sources. Therefore, many technological and pharmaceutical companies invest in large-scale data collection and analyses. For instance, Pfizer, the largest pharmaceutical drug manufacturer in the US, recently announced a partnership with the biotechnology firm 23andMe. Through this deal, Pfizer gets access to DNA data and granular personal information of 650,000 clients of 23andMe. [6] A large part of the research on machine learning is motivated by the goal of delving for the gold of these kinds of "big data" collections. [7]

The recent progress in the field of artificial intelligence has not resulted in general intelligence, i.e. a system that matches human intelligence in all respects. Nor is there a machine that can produce inventive concepts for every field of technology. Nonetheless, in various areas systems have been built that have capabilities that resemble, at least partly, the intellectual creative process that is characteristic of inventing. For instance, Thaler developed a "creativity machine" that designed the cross-action toothbrush for Oral-B. [8] Another example is the algorithm developed by the startup Berg Pharma. Berg Pharma discovered a cancer drug by analysing massive amounts of biological data and medical research by means of that algorithm. [9] The first results of the clinical trials indicate that the drug is effective. Similarly, Koza used genetic programming techniques to create a system that has generated a controller autonomously. [10] That controller is particularly interesting in the context of this article, because the US patent office has granted a patent for it. [11]

In all these examples, artificial intelligence did not take the initiative to invent. It was used by humans as a tool in the inventive process. In that sense, artificial intelligence does not invent autonomously. But unlike other tools, current artificial intelligence appliances are capable of doing more than performing a pre-defined task. They can autonomously create, test and select solutions to a given problem, for instance by using mechanisms that mimic neural networks in the human brain or evolutionary processes. Thus, artificial intelligence systems have become capable of delivering input in the inventive process that, if it was performed by a human inventor, would be rewarded with an entitlement to the resulting invention, or at least a partial entitlement. That raises the question how these inventions fit in the European patent system.

Patentability

Under European patent law, the fact that an invention has been made with the aid of artificial intelligence does not exclude it from being patented. In fact, the way in which an invention has been realised is irrelevant to the question of patentability. It is the result that counts. If the result is patentable subject-matter, is new, involves an inventive step and is susceptible of industrial application, a patent shall be granted, no matter how the invention has been made. In that sense, the European patent system is open to inventions created by means of artificial intelligence.

The fact that the products of an artificial intelligence system as such are not excluded from patentability, does not imply that these products will always be patentable, even if the intelligence of the system exceeds that of humans. Also the products of artificial intelligence systems will have to satisfy the general requirements for patentability of the arts 52 to 57 EPC. For the present study the requirement of inventive step (56 EPC) and the rule that discoveries are not regarded as patentable subject-matter (art.52(2)(a) EPC) are of particular interest.

Inventive step

Article 56 EPC requires that the invention is not obvious to a person skilled in the art. It follows that the definition of the skilled person is crucial to the patentability of an invention. The Guidelines of the European Patent Office define the skilled person as "a skilled practitioner in the relevant field of technology, who is possessed of average knowledge and ability". [12] It is generally assumed, at least implicitly, that the person skilled in the art is a human being and, thus, that the average knowledge and abilities of a *human* person are decisive.

The fact that the average skilled person is a human person does not imply that inventive step is given in the situation that an artificial intelligence application outperforms human intelligence. An artificial intelligence system can be seen as a tool and, according to the EPO Guidelines, the average skilled person is presumed to have at his disposal "the means and capacity for routine work and experimentation which are normal for the field of technology in question". This assumption, which is in ***71** line with the interpretation adopted by the patent courts in Europe and the Boards of Appeal, [13] offers an answer to the question how inventions by artificial intelligence fit in the European patent system. [14] In this interpretation, the main question is whether the use of a particular artificial intelligence application is or has become a "normal" tool for routine work in the relevant field of technology.

On the one hand, this means that, as long as the artificial intelligence application is not "normal" in the relevant field of technology, patents can be granted if the invention is not obvious to the average skilled person without use of artificial intelligence, even if an artificial intelligence application has done most or all of the inventive work. On the other hand, when artificial intelligence becomes a standard tool for routine work, the abilities of the average skilled person are assumed to have improved accordingly and, than, include the "inventive" capabilities of the artificial intelligence application. Under those circumstances, patents will not be granted if the invention is obvious to the average skilled person equipped with the artificial intelligence application, even if the inventor did not use artificial intelligence.

That does not mean that patents will become obsolete when the use of artificial intelligence becomes normal. Apart from the fact that human inventors may still be able to outperform artificial intelligence, inventors may use the standard artificial intelligence tools in a non-obvious manner to develop non-obvious products and processes or they may develop new artificial intelligence applications that are more powerful than the standard ones the average skilled person uses.

Still, machine inventions raise difficulties in applying the inventive step test. The toughest problem may be how to determine the capabilities of a "normal" artificial intelligence tool, and, more in particular, how examiners, patent attorneys and patent judges can establish whether the average skilled person equipped with that tool could and would create a specific product or process. Determining the reach of artificial intelligence is particularly difficult, because the output of an artificial intelligence application is hard to predict. For instance, the genetic programming techniques Professor Koza used in developing his patented controller, mimic evolutionary processes and, thus, include a random element. Koza's invention machine arbitrarily generates and mutates candidate solutions to a particular problem and tests the "fitness" of the solutions. The outcome of these processes cannot be determined in advance and, moreover, the output of the system may be different if the same input is fed to the system twice.

Discoveries

Another issue is whether the products of an artificial intelligence system can be qualified as patentable subject-matter in the sense of art.52 EPC. More in particular, the question can be raised whether such products should be regarded as discoveries, which pursuant to the negative definition of para.2 of art.52 EPC are not inventions. It has been argued that computer inventions belong to that excluded category, since the human "inventor" merely discovers what the computer has produced. [15]

In the prevailing interpretation of art.52 EPC, discoveries as such do not qualify as inventions because discoveries are merely knowledge without practical use. [16] Pursuant to this definition, the output of an artificial intelligence system may not qualify as an invention if (human) effort is required to put the output of the system to practice. [17] If someone, however, has taken the efforts and has translated the output in a technical teaching, there will be an invention in the sense of art.52 EPC. That the invention in that case is based on knowledge gained through a discovery is not relevant. Also in this context, it is not decisive how the claimed subject-matter has been realised by the inventor. Whether there is a discovery or an invention should be assessed objectively.

Entitlement

If the subject-matter realised with the aid of artificial intelligence is patentable, the next question is who qualifies as the inventor. That qualification is important since the inventor is the original owner of the entitlement to the right to a patent (art.60 EPC) [18] and has the moral right to be named as inventor in the patent application and the patent specification (arts 62 and 81 EPC and rr.19 and 20 of the Implementing Regulations to the EPC).

The concept of inventor is not defined in the European Patent Convention. It is generally accepted that only a natural person can be an inventor. [19] Consequently, legal ***72** persons, such as corporations and associations, do not qualify as inventors. Also, computers are excluded from the title of inventor by this definition, since a natural person is a human being. Moreover, computers do not have legal personality and therefore could not own the moral and property rights of the inventor.

In general, the inventor is described as the person that has made the invention, or, in other words, as the person that has made the creative effort. [20] Merely providing equipment is not deemed to contribute to the invention in terms of intellectual input. Therefore, if an invention is made with the aid of a computer, the owner or possessor of the hardware or software does not as such qualify as inventor. [21] The inventor is the natural person that, using the computer as a tool, has found the product or process that solves a particular technical problem.

The foundations of patent law

The preceding paragraphs demonstrate that the current rules of the EPC allow the grant of a patent to a person who has made an invention with the aid of artificial intelligence. A next question is whether that is a good thing. Answering that fundamental question requires going back to the foundations of patent law.

There are many theories on the foundations of the law of patents. [22] For the purpose of this article, the theories can be divided into utilitarian theories and deontological theories. The utilitarian theories focus on the benefits of innovation and the sharing of innovation for society. Deontological theories emphasise that the inventor has a right to be rewarded for his creative effort.

Utilitarian theories

The utilitarian theories seem a promising starting point for granting patents for inventions produced with the aid of artificial intelligence. Under the utilitarian theories, it is innovation itself and the sharing of innovation that is valued, no matter how the invention has been realised. If artificial intelligence succeeds in, for instance, finding a new effective drug, sharing that information with the rest of the world is as useful as it would have been when the same drug had been discovered by a human researcher. The fact that artificial intelligence is used in the inventive process is therefore no ground for denying a patent right under the utilitarian theories.

A closer look reveals that the problem is more complex. The utilitarian theories assume that the patent system stimulates innovation by "adding the fuel of interest to the fire of genius". [23] A system of artificial intelligence, however, will not be stimulated by the prospect of a patent monopoly, since robots, computers and other artificial intelligence systems are not responsive to these kinds of incentives. They do their work, whether patents are granted or not. Still, that does not rule out that the patent system can stimulate inventing by means of artificial intelligence. The prospect of a patent may motivate people and companies to invest in and use artificial intelligence and, thus, indirectly, in the innovations produced by means of systems of artificial intelligence. Actually, this indirect incentive may be a more realistic picture of how inventions are prompted in humans inventors as well, since, in general, the prospect of a reward will not directly trigger bright ideas in humans. The prospect of a patent monopoly may, however, stimulate companies to invest in research programmes in which smart people have the time and opportunity to develop innovative ideas. Similarly, the prospect of a patent can induce people to use and develop artificial intelligence applications that create new products and processes. [24]

Another problem is that utilitarian theories are built on the assumption that the average skilled person is able to reproduce inventions of others, but is incapable of inventing. Under those two conditions, patent protection is necessary to stimulate sharing of innovation, because, economically speaking, it does not make sense to spend efforts and money on innovation and share the fruits of those efforts for free. The rise of artificial intelligence may, however, lead to the paradoxical situation in which "inventing" comes within the reach of the average skilled person. For example, if artificial intelligence systems are widely available at low costs, those systems may become standard tools of the average skilled person. In that situation, a 20-year monopoly may not be necessary to stimulate the type of technological creativity that artificial intelligence systems can realise, even though the products and processes that these systems create would not be obvious to the average skilled person as such, that is, to a skilled person without an artificial intelligence tool. However, as explained above, under the current patent system, a patent will not be granted in that situation for lack of inventive step. A patent will only be granted if it would not be obvious to create the solution to a specific technical problem with the aid of the artificial intelligence tool used by the inventor. Hence, granting patents for inventions realised with artificial intelligence is in line with the utilitarian foundations, since the inventor by definition has achieved and shared something with the aid of artificial intelligence that the average skilled would not have achieved, with or without artificial intelligence. ***73**

The use of artificial intelligence systems in the inventive process raises other questions on the utility of the patent system as well. The automation of inventing may lead to a tremendous amount of inventions and patents in a particular field. The result may be a "patent thicket", i.e. a field that is so crowded with patents that the costs of examining all patents and obtain licences can prohibit companies from developing new products. [25] Consequently, the patent system may not stimulate but stifle innovation. In addition, it can be questioned whether the assumption is correct that the prospect of a patent monopoly is necessary to stimulate companies to invest in creative artificial intelligence applications and share the knowledge gained by using these applications. Critics have argued that market forces compel companies to innovate anyway, and that keeping valuable innovations secret is not an option in many cases since they are used in products that are on the market. These problems are not specific to inventions realised with artificial intelligence, however. Patent thickets and the effects of patents on innovation are the subject of a general debate. [26] The automation of invention may aggravate the problems discussed in those debates.

Deontological theories

At first sight, granting patents for inventions that are made by means artificial intelligence seems hard to reconcile with deontological theories. According to these theories, fairness requires that a patent is granted to the person that has made a creative effort. Applying these theories to the case of inventions by artificial intelligence suggests that at least part of the patent right should be granted to the artificial intelligence system itself, because it is the system that has solved the problem underlying the patent. Granting entitlements to patents to systems, computers or robots is not an option, however. Under the current legal framework, these objects do not have legal personality and, therefore, cannot own patent rights (or pay the fees that are charged for examining patent applications and maintaining patent rights). [27]

Still, the fact that artificial intelligence systems are excluded from the title of inventor does not imply that under the deontological theories no one is entitled to the inventions produced by means of artificial intelligence. As discussed above, the products of artificial intelligence will only be patentable if these products were not available to the average skilled person, for instance because the system is not routinely used in the relevant field or because putting the output of the system to practice requires inventive capabilities. So, by definition, there has been at least some human input in the inventive process, in the form of, for example, the selection of a particular artificial intelligence application, the creation of a specific algorithm for solving a technical problem or the translation of the output of the system to a technical teaching. Consequently, if the patentability requirements are satisfied, there will always be a human person involved.

The fact that the human intellectual effort may be small compared with the "intellectual effort" of the artificial intelligence system is not relevant. In many cases, inventions are based on luck or chance discoveries and have required little intellectual effort of the inventor. Nonetheless, in all these cases, it is deemed fair that the inventor obtains a patent, since he did achieve something that the average skilled person would not have achieved. Similarly, a person who has an made an invention by means of artificial intelligence deserves to be rewarded with a patent right, since through the publication of the patent document the public is provided with a solution to a technical problem that the average skilled person, by definition, would not have come up with himself.

Artificial intelligence as a tool

Given the more or less autonomous role artificial intelligence systems can play in the inventive process, it is tempting to give these systems the same position in patent law as human inventors have. This article has demonstrated that European patent law cannot and should not be interpreted in that way. Artificial intelligence systems are and should be treated as tools of inventors and skilled persons, instead of autonomous inventors. In that interpretation, the requirements of patentability ensure that patents are granted for solutions produced by means of artificial intelligence only if the skilled person would not come up with these solutions, for instance because it was not obvious to use the artificial intelligence application. If, on the other hand, the average skilled person would not have made the invention by means of the artificial intelligence tool (or his own intelligence), fairness and utilitarian considerations require the rewarding of the person who did do so and choose to share the resulting innovation with the rest of the world, just as much as when the invention was the result of pure human ingenuity.

Peter Blok

Utrecht University, Utrecht

Footnotes

1 Prof. mr. drs. P.H. Blok is professor at the Centre for Intellectual Property Law and the Centre for Access to and Acceptance of Autonomous Intelligence of Utrecht University and judge in the Intellectual Property chamber of the Court of Appeal of The Hague.

1 These examples are described in *R. Plotkin, The Genie in the Machine: How Computer-Automated Inventing Is Revolutionizing Law and Business (Stanford, CA: Stanford University Press, 2009)*.

2 On the issue of patenting inventing tools, see P.M. Kohlhepp, "When the Invention is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes" (2008) 93 Minnesota Law Review 779.

3 *A. Barr and E.A. Feigenbaum, The Handbook of Artificial Intelligence (Stanford, CA: William Kaufman, 1981)*.

4 *K. He et al., Microsoft Research, "Delving Deep into Rectifiers: Surpassing Human-Level Performance on ImageNet Classification" (6 February 2015)*, https://arxiv.org/pdf/1502.01852.pdf [Accessed 30 November 2016].

5 J.R. Hershey et al., "Super-human multi-talker speech recognition: A graphical modeling approach" (2010) 24 Computer Speech and Language 45.

6 See *C. Chen, "23andMe Turns Spit Into Dollars in Deal With Pfizer" (12 January 2015), Bloomberg*, http://www.bloomberg.com/news/articles/2015-01-12/23andme-gives-pfizer-dna-data-as-startup-seeks-growth [Accessed 30 November 2016].

7 *European Commission, Business Innovation Observatory, Artificial Intelligence (September 2013)*, http://ec.europa.eu/DocsRoom/documents/13411/attachments/2/translations/en/renditions/native [Accessed 30 November 2016].

8 *T. Hesman, "Stephen Thaler's Computer Creativity Machine Simulates the Human Brain", St Louis Post, 24 January 2004*, http://www.mindfully.org/Technology/2004/Creativity-Machine-Thaler24jan04.htm [Accessed 30 November 2016].

9 See *J. Medeiros, "The startup fighting cancer with AI" (22 March 2016), Wired*, http://www.wired.co.uk/magazine/archive/2016/04/features/ai-cancer-drugs-berg-pharma-startup [Accessed 30 November 2016].

10 See *J.R. Koza et al., Genetic programming III: Darwinian Invention and Problem Solving (San Francisco: Morgan Kaufman, 1999)*.

11 US 6,847,851.

12 European Patent Office, Guidelines for Examination in the European Patent Office (November 2015), G-VIII.3.

13 *Case Law of the Boards of Appeal of the European Patent Office, 7th edn (European Patent Office, 2013), D.8.1*; *M. Haedicke and H. Timman, Patent Law: A Handbook on European and German Patent Law (C.H. Beck/Hart/Nomos, 2014), §2.E.II*; *R. Kraßer, Patentrecht: Eind Lehr- und Handbuch zum Deutschen Patent- und Gebrauchsmusterrecht, Europäischen und Internationalen Patentrecht (München: C.H. Beck, 2009), §19.III*; *G. Benkard, Patentgesetz (München: Verlag C.H. Beck, 2006), §6*; *M. Singer and D. Stauder, European Patent Convention, A Commentary, Vol.1 (Köln: Carl Heymans Verlag, 2003), art.56 EPC, para.133*.

14 See on US patent law also *Plotkin, The Genie in the Machine (2009)*; W. Samore, "Artificial intelligence and the patent system: can a new tool render a once patentable idea obvious?" (2013) 29(3) Syracuse Journal of Science & Technology Law Reporter 113; L. Vertinsky and T.M. Rice, "Thinking about thinking machines: implications of machine inventors for patent law" (2002) 8(2) Boston University Journal of Science and Technology Law 574.

15 See E. Zipse, "Computer oder nachvollziehender Mensch als Erfinder" [1972] Mitteilungen der Deutschen Patentanwälte 41.

16 See, inter alia, EPO Guidelines (2015), G-II, 3.1; *EPO Case Law (2013), I 2.2.1*; *Haedicke and Timman, Patent Law (2014), §2 164*; *Kraßer, Patentrecht (2009), §11 II.1*; *W. Cornish, D. Llewelyn and T. Aplin, Intellectual Property, Patents, Copyright, Trade Marks and Allied Rights (London: Sweet & Maxwell, 2013), para.5-54*; *J.L.R.A. Huydecoper, P.A.C.E. van der Kooij, C.J.J.C. van Nispen and T. Cohen Jehoram, Industriële Eigendom, Deel 1: Bescherming van technische innovatie (Wolters Kluwer, 2016), p.130*.

17 It has been argued that for this reason computer inventions are impossible because a computer cannot autonomously conceive problems. See Schickedanz, "Kunstwerk und Erfindung" [1973] G.R.U.R. 343.

18 The entitlement to the patent can belong to successors in title and employers only through derivative acquisition, which presupposes original acquisition by the inventor.

19 See, inter alia, *Haedicke and Timman, Patent Law (2014), § 3.A.II.1*; Kraßer, 2009, § 19.II.1; *Benkard, Patentgesetz (2006), § 6.3*; *R. Schulte, Patentgesetz mit Europäischem Patentübereinkommen (Köln: Carl Heymans Verlag, 2008), §6.4.1*; *P. Mes, Patent- und Gebrauchsmustergesetz (C.H. Beck, 2015), §6 2.11*.

20 See, inter alia, *Haedicke and Timman, Patent Law (2014), §3.A*; *Kraßer, Patentrecht (2009), §19.III*; *Benkard, Patentgesetz (2006), § 6*; *Cornish, Llewelyn and Aplin, Intellectual Property, Patents, Copyright, Trade Marks and Allied Rights (2013), para.7-02*.

21 See *Kraßer, Patentrecht (2009), §19.II.1*; *Benkard, Patentgesetz (2006), §6.3.a*.

22 See, inter alia, *Haedicke and Timman, Patent Law (2014), §1.A*; *Cornish, Llewelyn and Aplin, Intellectual Property, Patents, Copyright, Trade Marks and Allied Rights (2013), paras 3-36 to 3-51*; *Benkard, Patentgesetz (2006), pp.90–94*; *Kraßer, Patentrecht (2009), §1.3*; *Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, United States Senate, An Economic Review of the Patent System, Study No.15 (Washington: United States Printing Office, 1958)*; *J. Pila and P. Torremans, European Intellectual Property Law (Oxford: Oxford University Press, 2016), Chs 1 and 3*.

23 *Abraham Lincoln, Lecture on discoveries and inventions (11 February 1859)*, http://www.abrahamlincolnonline.org/lincoln/speeches/discoveries.htm [Accessed 1 December 2016].

24 See also K.F. Milde, "Can a Computer be an 'Author' or 'Inventor'" (1969) 6 Journal of the Patent Office Society 378.

25 See Vertinsky and Rice, "Thinking about thinking machines" (2002) 8(2) Boston University Journal of Science and Technology Law 574; *Plotkin The Genie in the Machine (2009), p.136*.

26 On patent thickets see, inter alia, M.A. Lemley and C. Shapiro, "Patent Holdup and Royalty Stacking" (2007) 85 Texas Law Review 1991; M.A. Heller and R.S. Eisenberg, "Can Patents Deter Innovation? The Anti-Commons in Biomedical Research" [1998] Science 698; *C. Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting" in A.B. Jaffe et al. (eds), Innovation Policy and the Economy, Vol.1 (Cambridge, MA: MIT Press, 2001), pp.119–150*; J.M. Golden, "'Patent Trolls' and Patent Remedies" (2007) 85 Texas Law Review 2111; *M. Sonnenberg, Die Einschränkbarkeit des patentrechtlichen Unterlassungsanspruchs im Einzelfall (Wiesbadn: Springer Gabler, 2013), pp.10–16*; on the effects of patents on innovation see, inter alia, *Cornish, Llewelyn and Aplin, Intellectual Property, Patents, Copyright, Trade Marks and Allied Rights (2013), paras 3-38 to 3-48*; *Kraßer, Patentrecht (2009), §1.3.IV*; *Haededicke and Timman, Patent Law (2014), §1.A.II and III*.

27 Some have argued that computers should be granted legal personality; see, e.g., C.R. Davies, "An evolutionary step in intellectual property rights — Artificial intelligence and intellectual property" (2011) 27 Computer Law & Security Review 601.

E.I.P.R. 2017, 39(2), 69-73