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THE ABILITY TO CHASE DOWN OUR DREAMS. INVENTIVE STEP AND ARTIFICIAL INTELLIGENCE.

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The ability to chase down our dreams. Inventive step and artificial intelligence.*

Summary: 1. The artificial intelligence and the development methods of the computational innovation. – 2. Patentability requirements: novelty and non-obviousness. – 3. Photographers and monkeys: the rewarding moment of the innovation. – 4. Final remarks.

1. The artificial intelligence and the development methods of the computational innovation. – The definition of artificial intelligence[1] dates back to the '50s of the last century. This term defines in a synthetic way (and wide ranging) some informatic technologies, often different from each other, which are characterized by the performance of peculiar tasks of the human intelligence, according to a so to speak

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[1] In the scientific literature it is not well represented a unique conception of "intelligence"; it would seem to appear that there is not an official definition and/or generally accepted in the scientific fields of the term and the abilities object of "intelligence", see LEGG, HUTTER, *A Collection of Definitions of Intelligence: Intelligence measures an agent's ability to achieve goals in a wide range environments*, in IDSIA 2007, available also on https.//arxiv.org/pdf/0706.3639.pdf; GOTTFREDSON, *Mainstream science on intelligence: An editorial with 52 signatories, history and biography*, in Intelligence, 24 file 1, 1997, 13.

imitative way. Typically, the most advanced development fields are the automatic learning (so called machine learning) and the deep automatized comprehension techniques (so called deep learning).

The technology of the so-called *machine learning* can receive a series of (theoretically infinite) data to understand its content and process the final result information. This technology can modify internal operating algorithms as the machine receives and verifies the information itself. In this case the AI is a machine with the possibility to create its algorithms both based on the automatic learning and by relating the information provided to it (s.c. *training*). The more data will be provided to the machine, the better the effectiveness of the operation and the results of the learning algorithm[2] will be.

The deep learning uses large models of neural computer networks with various processing units to offer the computational machine the possibility of both acquiring a huge amount of data and

[2] First of all, I would like to point out that the real comprehension of the technical phenomenon at the base of AI (even those more elementary) is not easy to understand for those who do not have a scientific background. It follows that often the technical reference readings of the AI (also basic) used by jurists are studies that could be defined "intermediation"; by part of the technicians, who summarize and simplify the material for dissemination purposes, filtering data from the database and information. On the other hand, the writings of a specifically patent nature (on the modalities of drafting of patents concerning AI as *computer implemented inventions*) do not help, since always have a very technical content or otherwise suppose an in-depth scientific knowledge. In my opinion, this is not an insignificant circumstance in the context of the exegesis of the phenomenon from a legal point of view, and this represents a serious obstacle to whoever's about to study the subject. In any case, the works that have proved useful for the understanding of the phenomenon of AI were mainly the following: FRANCO and JEREZ (edited by) *Constructive Neural Networks*, Berlin, 2009; APOLLONI, MARINARO, NICOSIA and TAGLIAFERRI (edited by), *Neural Nets. Lecture Notes in Computer Science*, Springer, Berlin, 2006; *Rise of the Machines*, in *The Economist*, 2015; *Artificial intelligence and life in 2030. One Hundred Year Study on Artificial Intelligence Report of the 2015-2016 Study Panel*, 2016, http://ai100.stanford.edu/2016-report; CALO, *Artificial intelligence policy: a primer and a roadmap*, 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3015350.

processing complex information. Both these technologies of the AI are often integrated with each other[3]. The applications of the AI typically allow the organization of data[4], the comprehension of the language, the identification of objects and sounds, learning and solving problems arising from the processing of the information collected. Very often, these computational practices are useful to the industry of the so-called IoT (*internet of things*). However, these technologies are used in any sector and for the most varied uses[5].

The basic technical approach of the AI is based, therefore, on the functioning of the so-called artificial neural networks, which are computer systems that physically imitate the mechanism of the human mind, through the architecture of mathematical models composed of artificial "neurons"; inspired by biological structures, and that develop their potential by having as a starting point the training of the algorithm of learning and processing. This phase of fundamental importance is implemented by providing the machine with a series of correct

[3] The distinction between "strong" and "weak" AI is also recurrent in AI studies. If I see correctly, this distinction is attributable to SEARLE, *Minds, Brains and Programs Behavioral and Brain Sciences*, 1980, 417-457, which for the first time intended to identify, on the one hand, a machine hypothetically and adequately programmed and which could be such as to have cognitive states identical to those of humans, definable as "strong AI"; and on the other hand, to group together the artificial intelligence systems, even complex ones, which only partially reproduced these processes, definable as "weak AI"; moreover, the identification of the AI as "strong" or "weak" would also derive from the application of tests, among which the most known are the "Turing test" and the "Chinese room test".

[4] On this topic see OTTOLIA, *L'utilizzo computazionale dell'opera dell'ingegno in internet*, in AIDA, Giuffrè, I, 2014, 386; IDEM, Big *Data e innovazione computazionale*, Turin, Giappichelli, 2017.

[5] The classic examples of machine learning are numerous, among the most common are the artificial vision systems and the so-called "artificial noses"; for example the computer machines that are able, through a computational system, to recognize the objects acquired by means of image sensors and/or substances in the air, or again the rapid cognitive systems, able to analyze and learn the scientific and diagnostic data of the clinical state analyzed, suggesting diagnosis and treatment for particular diseases.

examples, which over time provide the artificial network with the ability to give correct answers not only to the examples already contained in the training phase, but also to similar cases. In essence, the prior technical object to any task of the AI is not only to create and structure the operation computer systems, but also (subsequent) to train the machine properly. Another system at the base of the AI, that often integrates with the artificial neural network, is the one of the automatic reasoning that is based on scalar or logical reasoning schemes (so-called decision trees) that start from some premises (also to be understood as a presupposition of functioning and/or training of the machine)[6].

Because of the foregoing, and for the purposes of legal analysis[7], the AI can be said to be characterized by at least four main aspects. The AI is a computer technology which can (i) understand the environmental and external information provided by the machine

[6] Particularly appreciable for clarity in the Italian law doctrine is SARTOR, *L'informatica giuridica e le tecnologie dell'informazione*, Giappichelli, 2016, 279, on this topic see also the most significant studies IDEM, *Le applicazioni giuridiche dell'intelligenza artificiale. La rappresentazione della conoscenza*, Giuffré, 1990; and ID., *Intelligenza artificiale e diritto. Un'introduzione*, Giuffrè, 1996.

[7] Studies analyzing the basic legal elements deduced from the methods of operation of AI in patent field are various; however, the debate seems to have been very much addressed in USA, on this topic see VERTINSKY and RICE, *Thinking about Thinking Machines: Implications Of Machine Inventors For Patent Law*, in *Boston University Journal of Science & Technology Law,* 2002, 574; PLOTKIN, *The Genie in the Machine: How Computer-automated Inventing is Revolutionizing Law& Business;* Stanford, 2009; KING, *The Robot Scientist Adam*, in *Computer*, 2009, 46; ABBOTT, *Hal the Inventor: Big Data and Its Use by Artificial Intelligence*, in SUGIMOTO, EKBIA and MATTIOLI (edited by), *Big Data Is Not a Monolith,* Cambridge, MIT Press, 2016, also in https://ssrn.com/abstract=2565950; ABBOTT, *I Think, Therefore I Invent: Creative Computers And The Future Of Patent Law, in Boston College Law Review,* 2016, 1079 also in http://papers.ssrn.com/sol3/papers.cfm?abstarct_id=2727884; MCLAUGHLIN, *Computer generated inventions*, 2018, 8, in https://papers.ssrn.com/sol3/paperps.cfm?abstract_id=3097822; RAMALHO, *Patentability of AI-Generated Inventions: Is a Reform of the Patent System Needed?,* 2018 https://ssrn.com//abstract=3168703.

through its sensors (visual individuation of objects, text analysis, tables) and correlate the data and to derive new computation objects from it; (ii) calculate automatically, with the logical and/or artificial neural tools of the algorithm of operation of the machine (and therefore to elaborate) the multiple information collected; (iii) integrate with the environment and the human; however (iv) all the phases indicated above always require a preliminary stage of learning in which the AI is specifically addressed to the problem (or to the requested result information), through a period of understanding, stimulated by the communication of "correct" incoming and outgoing data, such that the machine learns to perform the various functions typical of the specific task that is requested.

Focusing on the patent theme, it is widely reported that, at present, there are already many inventions produced by the AI. However, as far as this study is concerned, it seems certain that the inventive activities of the AI are characterized, with respect to the characteristics previously identified, by the (further) peculiarity that the final results of the inventive activities of the AI are always subjected to phases of selection and control by man: the machine, obviously, is not able to set itself patent objectives (or at least to set itself tasks) and to verify their achievement independently, and certainly does not patent alone[8].

[8] Despite the broad criticism of the possibility of patenting the inventions produced by the AI, the human activity of subsequent control and preliminary positioning of the request to the machine seems to me to emerge very clearly, even from some known examples of inventions attributed to the AI. According to PLOTKIN, *op. cit*., the so-called creativity machine created the configuration of the Oral-B Cross Action toothbrush, but this invention was selected from over two thousand results made available by the artificial machine. ABBOTT, *op. cit*., mentions at least three examples of invention due to the Thaler's Creativity Machine, also in this case, however, there is no lack of a preliminary intervention and a subsequent phase of selection of the results offered by the AI, conducted by human operators. Another well-known example of an invention created by artificial intelligence is the one related to the design of the cabin for airplanes now used by the Airbus A320, which has proved impressively (as stated

According to the present technological framework, therefore, the AI, which can participate in the creative processes is distinguished by being what it can be defined as artificial narrow intelligence, i. e. that specifically devotes itself to certain tasks and analyses[9]. And this will be the investigative direction of this study. On the other hand, the imposition of this route on the analysis is imposed for at least two reasons: the first is dictated by the important objective that at present this is the only available technology of AI; the second is suggested by the fact that we are not yet certain of being able to arrive at concrete operational hypotheses in the future of the most driven AI, and

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in the publication indicated below) to be stronger and lighter than any previous one. Again (as reported by CONTI, *The incredible inventions of intuitive AI*, also available at www. ted. com) there was a not small preliminary activity in which a racing car driver drove a car containing a digital nervous system connected to the chassis for a week, collecting a huge amount of data according to precise modalities, and on the other hand, even the AI that generated this innovative design ("Dreamcatcher") had initially received a specific computer architecture for the design of the chassis, and the results that had provided operators, ultimately, suggested a series of alternatives to be evaluated.

[9] Interesting is the Cloem system (www.cloem.com) that exploits an AI machine particularly aimed at transforming, by drafting a patent application in a complete (and not interfering) way, the general inventive ideas that are submitted to it through an initial text describing the innovation. Using this type of AI, the inventor only must describe, explaining (briefly and simply) his innovation in a text and the machine then calculates the data and provides for the drafting of the text and claims. The system has been built to process the language used by the patent documents of the EPO and USPTO, the guidelines of the patent offices, and the technical reference documents. In addition, the AI can make any changes to the text through a combined use of interventions, including on synonyms, and is able to develop claims based on more than 100 algorithms of formulation and recombination. Finally, it is equipped with the possibility of analyzing its own work by comparing the scientific information that can be found on the Internet. Moreover, the issue is also addressed by FRASER, *Computers As Inventors – Legal And Policy Legal Implications Of Artificial Intelligence On Patent Law*, in *Scripted,* Volume 13, Issue 3, December 2016; and by HATTEN BACH and GLUCOFT, *Patents in an Era of Infinite Monkeys and Artificial Intelligence*, in *Stanford Technology Law Review*, 32, 2015.

therefore of AI endowed with a real conscience. In essence, this study will analyze exclusively the problem of the inventions made by the AI, which always involve a minimum of human intervention (so called *narrow artificial intelligence*). Currently, this seems to be the higher level of AI technology available and addressing the issue by imagining a totally autonomous machine, and therefore "conscious", in my opinion would imply the preliminary overcoming of disruptive questions of a philosophical and religious nature that go beyond the tasks of this study.

A further clarification, due to the completeness, derives from the need to circumscribe this study exactly to what was indicated above in the knowledge that the term «Artificial intelligence (AI) refers to systems that display intelligent behavior by analyzing their environment and taking actions – with some degree of autonomy – to achieve specific goals», and that «AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications).»[10]. In essence, the basic line that defines the character of this study is not so much to be found in the question whether there are inventions that are entirely and independently the result of the AI, but - as is more conceivable in terms of the technique currently present, and as said - in understanding whether the phases of autonomous processing of the AI that should be used within a creative process can empty the content of access to patent protection, because of the nature and methods of evaluation provided by law for the requirements of novelty and non-obviousness. In this sense, therefore, the first summary considerations of departure are as follows: the system of technological innovation produced by the AI is based on (a) a preliminary phase presided over by

[10] As specified by the European Commission on the topic of AI in communication of April 25th, 2018, COM (2018) 237 (final).

man of (more or less extensive) address and stimulation of the machine; (b) of a subsequent stage of processing and release of the results and/or performance of the required tasks, carried out entirely by the machine and its artificial intelligence algorithm, totally independent of any intervention by the operator and completely opaque to the possibility of making known the methods by which the result was obtained (so called *black box*); and (c) a next and final moment in which the human operator using AI (in a more or less articulated way) examines and selects the innovative outcomes supplied by the machine.

It seems then that the specific topic addressed in this study, i. e. the valuation of the presence of novelty and non-obviousness required for patentability in the innovations generated by the AI turns around the interpretation of the two aforementioned phases and especially the defined stage of so called *black box*.

The issue is not easy because the activity carried out independently by the AI is certainly characterized in terms of the assessment of the presence of the requirements of patentability. This is also due to the technical effects with which this technology is proposed, and in particular: i) the innovative maturity of the computational calculation, which is considerable in terms of computing power, data storage capacity and low energy consumption; ii) the fact that AI systems are able to operate real-time analysis of huge amounts of data in any form represented; iii) the fact that operational searches of artificial intelligence systems reveal information hidden in the data and/or recognize correlations that are not identifiable by man; iv) the additional circumstance that the final effects of calculation and processing offer unexpected and unpredictable (even if desired) technological results in terms of quality and efficiency compared to what the operator could have imagined in the preliminary phase of formulation of the problem to the machine[11].

[11] See KONONENKO and KUKAR, *Machine Learning and Data Mining*, Woodhead Publishing 2007, 7.

On the other hand, the topic is complicated by the fact that empirical data have always shown that technical knowledge is continuously expanded by the normal daily work of the average technician, using methods that do not involve research and study. These methods develop the normal modernization of products and processes, but these renewals do not deserve the monopolistic reward of the patent as they simply lead to the execution of what would have been done by any professional usually, without study and research, as a direct result of the technology used.

Patent, even if in the current regulatory framework (as accepted by the major patent and judicial systems) does not express high levels of creativity, always requires that novelty and non-obviousness are different from what is normally and directly indicated to us by the techniques already in use. The working hypotheses proposed by the AI in this sense can then be further, just thinking of inventions produced with the AI calculation tools that use pre-existing data and easy to find, or innovations that do not require specific efforts, net of those of instruction of the machine and/or subsequent evaluation of its results.

And so, the point of balance between the patent system in its general lines and the innovations produced by the AI is precisely to identify whether this technical possibility of improving the creative phases still leaves room for stages presided over by man that are not directly ordinary.

2. Patentability requirements: novelty and non-obviousness. – Patentability requirement of novelty is a concept that runs parallel throughout the entire system of intellectual property and is present with a substantially uniform discipline in all the systems that adopt the patent system and (in general) the rules for the protection of intangible assets. On the other hand, even from a historical perspective, recognizing an exclusive right only to those innovations that are not included in the state of the art (see for example art. 46 of the Italian IP law) is an

element inherent to the basic features of the system.[12]. Typically, the state of art is represented by the whole of knowledges which have been made accessible to the public before the filing date of the patent application.

The assessment of the novelty requirement is carried out according to fairly precise rules. The EPO, and in the same way the major national patent offices, proceed by carefully considering the content of the disclosure with the patent text, and specifically the claims. The technical knowledge included in a document already disclosed is considered not only for what is directly explained, but also for all the information that the expert person would be able to grasp effortlessly from the knowledge of that text[13]. Any difference (implicit or explicit) between the technical knowledge indicated in the information already disclosed and the patent text gives the invention the requirement of novelty, and this difference in technological teaching becomes the subject of analysis from the point of view of the inventive activity.

The examination of the novelty requirement is essentially an analysis of the identity between the content of the disclosure and the claims covered by the patent examined.

The regulation which currently regulates the non-obviousness requirement in the Italian patent system is art. 48 of Italian IP law that is overlapping to the old art. 16 of past Italian patent law, and both literally follow the art. 56 of the European Patent Convention: the identification of the requirement of non-obviousness derives from the circumstance that the invention, having regard to the state of the art, it is not obvious to a person skilled in the art. [14].

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[12] See also for the Italian patent system SENA, *I diritti sulle invenzioni e sui modelli industriali*, in *Tratt. Cicu Messineo*, 4th edition, Milan, 2011, 125.

[13] EPO, *Case Law of the Boards of Appeal of the EPO*,8th edition, 2016, I. CH.4.3, available also on www.epo.org.

[14] See also for the Italian law system FLORIDIA, *Il riassetto della proprietà intellettuale*, Giuffrè, 2006, 258; as well as FLORIDIA in AUTERI, FLORIDIA, MANGINI,

The presence of the requirement of non-obviousness since the introduction of the European Patent Convention has been interpreted by the doctrine and the law of both national and other conventional countries[15], according to a reconstruction widely shared and with methods increasingly close together. The verification of the presence of the requirement of non-obviousness was marked on the basis of three essential moments, i.e. i) the individuation of the technical sector in which the invention operates; ii) the definition of the model of the person skilled in the art; and so iii) the judgement that the invention is not obvious through the eyes of the expert outlined above.

Regarding the first point, all the knowledge relating to the relevant branch is collected, which will then necessarily have to be combined with general knowledge and acquisitions relating to the closest sectors. It is clear how not all types of skills are immediately relevant to the analysis and, indeed, it has always been argued that the level of accuracy of preparation may gradually be lower as we move from the leading sector to the more eccentric ones in the examination of innovation. This is allowed by having as reference point not a theoretical model but the real technological system to which the innovation concerns. A criterion has also been elaborated to distinguish the types of knowledge from a temporal point of view, and in particular, with a certain unambiguousness of opinion, it has been argued that past experiences, even very far in time, should be considered useful in the reconstruction of the state of the art where they refer to the pre-eminent

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OLIVIERI, RICOLFI and SPADA, *Diritto industriale, proprietà intellettuale e concorrenza*, 4th edition, Giappichelli, 2012, 193.

[15] See also comments published in *Case Law from The contracting States to the CBE 200-2011*, available on the European Patent Office website www.epo.org; however, as far as here is concerned, the differences between EPO, USPTO and JPTO can be surely defined as marginal, see WIPO, *Study on inventive step,* 2015, available on http://www.wipo.int.

technological branch which concerns innovation and, vice versa, should be excluded if they concern eccentric sectors[16].

The correlated nature of both requirements is revealed by the fact that the art. 56 CBE (and also 48 IPC) establishes that the state of the relevant technique for judging purposes on non-obviousness includes all the knowledge in any case made available to the public in the territory of the State or abroad before the date of filing of the patent or of the priority date.

Secondly, further foundation and justification of the institution, is the reconstruction of the model of a person skilled in the art in the abstract sense and, therefore, this figure will be the result of a summary of the intellectual and professional peculiarities that tend to exist in the average of the technicians working in that sector. And thirdly, on the basis of these premises, the requirement of non-obviousness was recognized when the innovation was the ultimate consequence of a research conducted on the basis of several conceivable perspectives and the investigation itself proved to be of particular commitment from both a qualitative and quantitative point of view and has followed a path of relocation of different techniques inconsistent and distant from each other.

So the exclusivity was based on the examination of non-obviousness for a person with experience in the branch, screened regarding the time of filing the application or the potential priority date.

Naturally, the criterion in question can be summarized in the concept of innovation which goes beyond the normal capacity of an average technician and, more precisely, has been placed in the resolution of a well-identified problem, i.e. in the technical application deriving from the exact identification of the reasons of a scientific event, or even, from the combination of different solutions in order to

[16] The topic is addressed with a series of further assessments in the Italian law doctrine by DI CATALDO, *L'originalità dell'invenzione*, Giuffré, 1983, 69 and ff.; and also, in IDEM, *I brevetti per invenzione e per modelli d'utilità. I disegni e modelli*, Giuffré, 2012, 139 and ff.

solve a technological gap that has long been felt in the relevant branch[17].

In this framework, which in many ways is wide, the evaluative articulation that is carried out by the EPO is more precise. In concrete terms, with regard to the corresponding fiction reconstructions (*persons skilled in the art*, *common knowledge* and so on) the European Patent Office, in view of assessing the non-obviousness in a more objective and predictable manner, systematically applies the so-called *problem-solution approach*, and indeed, the EPO guidelines themselves specify that any exception to this method must be considered completely exceptional[18]. This method of analysis is divided into three phases, in

[17] The identification of the inventive step was also proposed with reference to the factual clues of evidence and non-evidence, i.e. considering some data that can be found subsequently and objectively in order to confirm or deny the presence of the requirement, see PAGENBERG, *The concept of inventive step in the European Patent Convention*, IIC 1974, 2 158; PAGENBERG, *The Evaluation of the "Inventive Step" in the European Patent System-More objective standards needed*, IIC 1978, 1, 16; for the Italian patent system see DI CATALDO, *L'originalità op.cit.*, 69 and ff.; also in IDEM, *I brevetti op.cit.*, 139; and ETT.LUZZATTO, *Teoria e tecnica dei brevetti d'invenzione*, Milan, 1960, 119; also the EPO guidelines dedicate a paragraph to the so-called "secondary indicators" (Parte G, chapter VII, paragraph 10, edition June 2012) even if their concrete use does not seem to me to be relevant in the various stages of release and opposition. It is rare to find in the Italian case law and other national case law important and constant references on the evaluation method to evidence and non-evidence, but above all there are no decisions that analyze in detail the basic reasons that justify their use in the patent system.

[18] See *Guidelines for Examination in the European Patent Office* (Parte G, chapter VII, paragraph 5, edition of November 2017) available on the EPO website www.epo.org, on the topic see also for the Italian patent system GALLI, *Il rilievo delle rivendicazioni e l'equivalenza*, in GALLI (edited by), *Codice della Proprietà Industriale: la riforma 2010*, Milan, 2010, 85 and ff.; GALLI, *L'adeguamento a EPC 2000 e il nuovo approccio "realistico'' alla tutela dell'innovazione"*, in IDEM (edited by), *Codice della Proprietà Industriale: la riforma 2010*, Milan, 2010, 75; GALLI, *Per un approccio realistico al diritto dei brevetti*, in *IDI*, II, 2010, 133; in any case for a complete and precise examination of the EPO practice see PATERSON, *A concise guide to European Patents: Law and practice*, Sweet & Maxwell, 1995; PATERSON, *The*

the first the state of the art closest to the invention is determined, in the second the objective technical problem to which the solution object of the invention is directed is reconstructed and, finally, in the third, it is assessed whether, in the light of the prior art and the technical prejudice, the invention, as indicated in the claims, would have been evident to the expert person.

The closest prior art is the one that is identified in a single reference and that describes the combination of the most promising technological characteristics as a theoretical starting point for an obvious development that can then leads to the invention being assessed. In practice, the closest prior art is generally the one that corresponds to a similar use and requires the minimum of structural and functional modifications to arrive at the claimed invention[19].

In the second phase, the technical problem to be solved is established objectively. Even in this case the conceptual reconstruction seems to be very punctual, because the examiner will compare the invention, as claimed, with the closest prior art claiming a technological difference in terms of precise technical characteristics both structural and functional present, also defined as *the distinguishing feature*. Considering this distinctive characteristic will be then easy to identify the technical effect deriving from it, and consequently formulating the technical problem at the basis[20].

Although it may seem intuitive, it should be added that the definition of the technical problem is constantly interpreted by the office in a wide sense, since this concept refers only to a technical solution or an improvement over the prior art known. The technical problem may also consist of an alternative to a known device or in a process that provides with the same effects or it is more advantageous. Even in this case, and one more time, the office tends to be particularly

European Patent system, Sweet & Maxwell, 1992 VISSER, *The Annotated European Patent Convention*, Wolters Kluwer, 2017, *passim*.

[19] Ibidem.

[20] Ibidem.

precise by establishing that the existence of a technical problem simply derives from the fact that all the characteristics claimed have effects on which the invention in based.

In the third and final phase of the analysis, the office studies whether the state of the prior known technique contains a teaching that, even as a whole, (and the guidelines expressly specify «*not simply could, but would*») would have directed the expert person, faced with the technical problem identified, to modify or adapt the nearest prior technique, so as to arrive at a characteristic included within the tenor of the claims, the so-called. «*could-would approach*». In the end, therefore, the objective criterion for deciding whether the requirement is present should be to examine whether the structure or the juxtaposition of the various constructions existed or was unequivocally suggested beforehand.

This passage of fundamental importance is, in fact, to be solved in many cases with absolutely rigorous indications according to which «*the point is not whether the skilled person could have arrived at the invention by adapting or modifying the closest prior art, but whether he would have done so because the prior art incited him to do so in the hope of solving the objective technical problem or in expectation of some improvement or advantage*»[21].

The analysis of the requirements is based on the textual examination of the patent and in particular of the claims. The EPO *guidelines* themselves in this sense have a strong addressing power, as

[21] The central issue is to understand not whether the average technician of the sector could have achieved the inventive result by modifying and improving the most significant prior technique, but whether he would have done so because within the knowledge derived from the known technique there was a direct or indirect suggestion to that effect, useful in demonstrating that the expert person would have combined the elements in the manner then claimed in the invention examined; see T257/98 «Even an implicit prompting or implicitly recognizable incentive is sufficient to show that the skilled person would have combined the elements from the prior art» available also on the EPO website www.epo.org; see also *Case Law of the Boards of Appeal* (sixth edition 2010).

they are structured in such a way as to make the way in which the application is drafted absolutely clear and, extremely, the subsequent interpretative passages of the patent text very clear, all the more so as they are very schematic and almost automatically applicable[22].

For its part, the office has in any case an interest in checking that the techniques are as accurate, homogeneous and widespread as possible. In this exegetical direction, a prominent importance is, therefore, assumed by the fact that the invention is circumscribed and demarcated in a precise technical solution relating to a specific problem, strictly identified by the content of the claims[23]. This framework interfaces in a way that complies with the general system criteria and the resulting balancing of interests. The protection is related to what is expressly claimed, without prejudice to the extension resulting from the equivalents, it is also true that in this way a balance of positions in the field can be established: third party is set as able to identify the limits of what has already been technologically monopolized by the others and, consequently, the exclusivity is limited to the sole contribution (i. e. to the single technical solution) of the holder, allowing the subsequent innovation with a subsequent inventive activity, large or small, that is. Moreover, in this way, the invention can be defined as an original solution of a technical problem in terms of an object or a proceeding, as defined in its constructive aspects and planning characteristics and concrete realization, and so it is described and claimed.

[22] Please refer to *Guidelines for Examination in the European Patent Office* (Parte G, chapter VII, paragraph 5, edition of June 2012 and 2017) available on the EPO website www.epo.org.

[23] About the history of the introduction of patent claims in the patent system, please refer to STAUDER, *The History of Art. 69 (1) EPC and Art. 8 (3) Strasbourg Convention on the Extent of Patent Protection*, in *IIC* 1992, 311; and to the third chapter of mine, *Il passo inventivo*, Giuffrè, 2012.

In fact, the most important national patent offices provide with precise and detailed information on the methods of filling in claims and these instructions are in the sense of absolute compositional precision.

In particular, the EPO clearly indicates i) that the essential characteristics are those which are technically functional to the realization of the technical solution which is the subject of the invention [24]; ii) that generalizations and ambiguous terms must be avoided, the characteristics of the invention must be given a level of detail in the text such that an expert can realize the invention[25]; iii) the words used in the patent must have the same meaning and scope as those normally used in the technical sector of reference, except in special cases, and also in view of the fact that only the claims of the patent will be published in all the official languages of the EPO; iv) the textual contradictions between the claims and the description must be avoided; v) claims referring exclusively to the generic function of a device or product are not permitted, vi) preferably, claims should not contain so-called relative terms such as 'thin', 'strong', 'high'; or imprecise such as 'up',

[24] A significant precedent (also much cited) that derives from the EPO practice is T 1055/92 available on the EPO website www.epo.org, whose headnotes further clarify the point by establishing: «1. The form and content of the claims in a European patent application are governed by the requirements of Article 84 and Rule 29 EPC. According to Article 84, the claims shall define the matter for which protection is sought. This function of the claims should be clearly distinguished from the requirement that the European patent application must disclose the invention in such a way that it enables a person skilled in the art to carry out that same invention. // 2. Under Article 83, sufficient disclosure is required in a European patent application, i.e. in the application as a whole, comprising the claims, together with the description and the drawings, but not of an individual claim as such. // 3. A claim in a European patent application must comprise the essential features of the invention (see T 32/82, OJ EPO 1984, 354); the essential features should in particular comprise those features which distinguish the invention from the closest prior art»; for more information, see also *Case Law of the Boards of Appeal* (sixth edition 2010).

[25]See T 23/86, T 16/87, T 717/98, e T 556/02 on the EPO website www.epo.org; see also *Case Law of the Boards of Appeal* (sixth edition 2010).

'about'; or 'in preference'.[26]; finally, vii) it is important to note a low tolerance of references to the description or drawings within the claims, as they are only allowed if "absolutely necessary" (indeed, it is clarified that usual references such as "in the manner described in the part of the description", or "illustrated in figure 1 of the drawings"; are not correct formulas)[27].

[26] Regarding the use of imprecise or vague terms the practice of EPO has established in T 487/89 the use of the indications like "tenacity" and "toughness" involved the use of «parameters objectionable if they related to an inherently desirable characteristic. The board, however, held that whether the absence of an upper or lower limit was acceptable in a claim in any individual case depended on all the surrounding circumstances»; moreover in T 586/97 it was found that «the absence from any independent claim of any upper limit on the amount of a particular detrimental but necessary component in the chemical composition claimed was at variance with the aim of the invention as set out in the description, namely, to decrease the percentage of the undesirable ingredient in the claimed composition. The claim was thus so broad it went beyond the scope of the invention as disclosed in the description. Therefore, the requirement of Art. 84, second sentence, EPC 1973 was not met»; still in T 227/91 it has been stated that «the claims comprised a coating thickness defined by a formula with two parameters (a) and (t). Parameter (a) represented the thermal diffusivity of the coating means and was therefore a feature inherent in the instrument. Parameter (t) represented the effective pulse time of the laser and was related to the laser operating conditions, not to the structure of either the laser or the instrument. The thickness defined in the claims was still connected with the mode of operation of the laser, that is, with a human factor irrelevant to the instrument per se. The extent of the protection conferred by the subject-matter of the claims was therefore regarded by the board as ambiguous and indefinite». A special case is the one in which the invention refers to chemical products, whose functions in some cases can be defined only by graphs or diagrams. As for the negative limitations, also called disclaimers, they are allowed by the EPO only if the addition of positive characteristics for the affirmation of a technology turns out to be absolutely unclear making the found unprotectable (G 1/03 and T 4/80) or creating a limitation of the scope of protection (T 1050/93).

[27] The text of the Rule 43 offers a concrete example of the meticulous attention that is paid to the compositional and drafting techniques of the patent text and claims; in particular, the specific rule that: «(2) Without prejudice to Article 82, a European patent application may contain more than one independent claim in the same category (product, process, apparatus or use) only if the subject-matter of the application

In summary terms, therefore, a series of notations seem to emerge. The first: there is a deep symmetry of the existing rules on the drafting and interpretation of claims, in relation to the scope of protection and assessment of the requirements of novelty and non-obviousness[28]. The second: all these rules aim at achieving an efficient innovation market and maximizing the supply of products in the market by encouraging the possibility of obtaining patents in relation to incremental innovations. The third: finally, there is no doubt that the entire theorization on the reconstruction of the average technician and the known art is reduced in the field of evaluation to a documentary examination aimed at admitting or removing acts from which derive technological knowledge useful for the purpose of judging non-obviousness.

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involves one of the following: (a) a plurality of interrelated products, (b) different uses of a product or apparatus, (c) alternative solutions to a particular problem, where it is inappropriate to cover these alternatives by a single claim. // (3) Any claim stating the essential features of an invention may be followed by one or more claims concerning particular embodiments of that invention. // (4) Any claim which includes all the features of any other claim (dependent claim) shall contain, if possible, at the beginning, a reference to the other claim and then state the additional features. A dependent claim directly referring to another dependent claim shall also be admissible. All dependent claims referring back to a single previous claim, and all dependent claims referring back to several previous claims, shall be grouped together to the extent and in the most appropriate way possible. // (5) The number of claims shall be reasonable with regard to the nature of the invention claimed. The claims shall be numbered consecutively in Arabic numerals. // (6) Except where absolutely necessary, claims shall not rely on references to the description or drawings in specifying the technical features of the invention. In particular, they shall not contain such expressions as "as described in part ... of the description", or "as illustrated in figure ... of the drawings". // (7) Where the European patent application contains drawings including reference signs, the technical features specified in the claims shall preferably be followed by such reference signs relating to these features, placed in parentheses, if the intelligibility of the claim can thereby be increased. These reference signs shall not be construed as limiting the claim».

[28] See PAGENBERG and CORNISH, *op. cit.*, 228.

In essence a normative framework thus defined is mostly characterized by i) the enhancement of any element that can be determined in terms of incremental innovation, filtered through ii) the strongly documentary analysis, sculpted by the semantic rules of drafting patent applications, also the innovations produced by the AI can find room for their protection as inventions.

3. Photographers and monkeys: the rewarding moment of the innovation.– In the technological framework outlined above, it is therefore certainly conceivable that in the event of an invention produced by the AI, the following circumstances may arise: i) that all documentation and technical information relevant to the assessment of the novelty requirement is actually stored (before) and processed (after) by the machine; ii) this technical possibility is greatly facilitated, on the one hand, by the possibility for the artificial system to recognize texts, tables and drawings, and, on the other hand, by the tendency towards precision of the terms that can be used in patent texts and by the specific scanning of the rules for the drafting of claims that circumscribe the technological scope of the monopoly[29]; iii) that new innovations, possibly endowed with the inventive step, assessed on the basis of procedural rules endowed with a certain level of detail, as

[29] It seems obvious to me that the development of the technologies of the AI goes in line with the evolution of the evaluating parameters of the requirements of patentability of novelty and non-obviousness: the modalities of characterization of requirements can be found first of all in the principal regulating rule (art 56 CBE) and then in a series of rules that turn around the concept of inventive step and complete it, and are: i) the importance of claims in the interpretation of the patent; ii) the editing and interpretative techniques of claims with a strong tendency to the very parceled and letteral assessment of the technological characteristics; iii) the documental nature of the analysis on requirements and the strong influence that the new methods of scientific research have with the use of computers (this revealed a spread and needed information to the innovation); iv) the fast technological rhythm and with few rooms of diversity among the difference found and products on the market.

indicated above, are proposed as a direct result of the elaboration of the AI algorithm.

In essence, the so-called *machine learning* can create a type of innovation that meets, at least in principle, the requirements of novelty and non-obviousness. Consequently, then, the question is to ask oneself about the value of the activity performed by the man who tries to invent using the AI, in the first instance representing the problem to the machine, and then selecting the results that are returned to him by the algorithm.

Therefore, assuming that the AI may produce innovations of a technological nature and that - at present - it operates according to the relevant modalities at the beginning, it is therefore necessary to ask oneself whether the requirements of novelty and inventive step, as reconstructed so far, are present in such creations. In this regard, it would seem that - always in the light of the current state of technology - the central element of the theme is to define the role played by the phase of the so-called *black box*.

It seems perceivable to deduce that in the inventive phases (and consequently in the assessment of the presence of the requirements phase) of the innovations produced by the AI, the role played by the so-called *black box*, compresses and unifies the phases of research of novelty and inventive solution, and the machine in essence, with its considerable computing power (facilitated by the textual structure of the patents), tends on the one hand to easily find, by difference, new solutions, i.e. those that have not already been claimed in the known technique, and on the other hand is able to enhance these researches in such a way that the novelty is more qualified (and therefore inventive), because the AI will have learned the system to develop optimal solutions or more distant than the previous art.

It follows that these circumstances tend to pose problems which, at first sight, seem insurmountable in the light of the regulatory apparatus outlined above. The activities of the so-called *black box* phase are in principle creative, but *i)* are not performed by men; and *ii)*

in the context of the automatic mechanisms of the AI machine, they appear to be obvious and routine. According to a firs-impact assessment, the creative phase in inventions generated by the AI no longer belongs to man and the innovation would seem an automatic product generated by the machine.

In my opinion, this does not mean that the machine invents or that the requirements for access to protection are not the result of human activity. Highlighting the activities of the so-called *black box* phase certainly means highlighting the extraordinary technological capabilities offered by the AI, but on the other hand it would be tantamount to devaluing the contribution of man who, even in this scientific field, is not at all modest. The study of the mechanisms of functioning of the IA, also through the introductory framework of this study, can be valued along a different direction: the inventions of the AI always require a series of preliminary actions consisting of experimentation, education and the formulation of the technological theme to be developed by the AI[30]. These research, implementation and preliminary specification activities involve tasks that are not always simple, but which are often the result of significant human and economic investment. Nevertheless, the subsequent selection (and possible verification) of the results provided by the machine may require no less effort than the preliminary ones[31]. Consistently, therefore, the appreciation of these activities within the process aimed

[30] See SARTOR, *op. cit.*, 313.

[31] Although, most researches in this field often reports, however, that the subsequent selection effort is less recurrent and, above all, much less onerous than the preliminary effort, see PLOTKIN, *op. cit.*; see GOODFELLOW, BENGIO and COURVILLE, *Deep Learning*, Mit Press, Cambridge USA, 2016, 149, which seem to confirm the concept above indicated, and moreover these authors emphasize as a crucial node of the AI system and of its ability to release concrete and innovative results, the initial activities of modelling the "reasoning" systems of the machine, the completeness of the data provided and the accuracy of the sources for updating the information that is administered to the learning machine afterwords; see also LANIER, *Dueling Demigods*, New York, 2017, *passim*.

at having inventions produced by the AI means that the analysis of the presence of requirements can (and must) shift only to these phases subject to human intervention. Those phases, indeed, are always characterized to be i) provided with wide rooms of choice by the human operator in the selection of information to give to the machine; ii) shaped on the basis of research projects which require economic investments and techno-scientific skills, not easy to acquire.

Those characterization elements are separate from each other. They typically represent the fundamental aspects on which the system of patentability protection has been based in the last decades. This solution, on the other hand, does not seem to me even far from the typical choices of intellectual property system and this is also sustained by solid historical - systematic reasons already enhanced in the past for the protection of other intangible assets.

A first reason (for many ways create also a factual affinity with the AI) I think could be rediscovered in the fact that, in the past, it has never been seriously doubted that the originality of the invention could be verified by looking the analysis at strategy of research applied before arriving at the invention in the new vegetal varieties and biotechnologies cases, and equally where the innovation has been obtained with routine methods and/or composite modalities.[32]

[32] In this sense, it seems to me that this is not excluded by DI CATALDO , *La brevettabilità delle biotecnologie. Novità, attività inventiva, industrialità*, in *Riv. Dir. Ind.* 1999, I, 177; SHERMAN, *Patent Law in a Time of Change: Non-obviousness and Biotechnology*, in *Oxford Journal of Legal Studies*, 10, No. 2, Oxford University Press, 1999, 278 and ff.; BOSTYN, *Enabling biotechnological inventions in Europe and United States. A study of the patentability of proteins and DNA sequence with special emphasis on disclosure requirements*, EPO scripts Series No. 4, 2001; GALLI, *Problemi in materia di invenzioni biotecnologiche e di organismi geneticamente modificati*, in *Riv. dir. ind.*, I, 2002, 398; GUGLIELMETTI, *Commento all'art. 3 della L. 22 febbraio 2006 No. 78*, in DI CATALDO (edited by), *La protezione giuridica delle invenzioni biotecnologiche*, in *NLC*, 2008,376 and ff.; finally see also EUROPEAN COMMISSION, *Sviluppi e implicazioni del diritto dei brevetti nel campo della biotecnologia e dell'ingegneria genetica*, Bruxelles, October 7th, 2002, COM (2002).

Secondly, another basis for the proposed solution seems to me deriving from the legal protection of sui generis databases. In a certainly parallel way (and in a field that is not eccentric with respect to the interests of the AI) the builder of a database is granted a property right to the extent that the rewarding effort has been directed to the achievement, verification or presentation of their content and are the result of a significant investment in terms of quality or quantity[33]. In fact, the investment made by the person who enjoys the protection, here more than elsewhere, finds recognition on the level of the economic-legal function of the protection.

A third basic motivation can then be found in the legal and economic basis of the requirements of patentability of novelty and non-obviousness: they ultimately represent a monopolistic lever in the market to make it more functional and competitive. If we want to rephrase in more detail the economic legal function underlying the above approach, it is sufficient to consider that, in the absence of constitutional rules aimed at constructing intellectual property rights with a view to maximising the incentive to progress,[34] the market

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For the Italian case law see Court of Milan, November 11th , 999, in *Giur. ann. dir. ind.*1999, No. 4030/4; also, in *Riv. Dir. Ind.* 2000, 364 and ff. with annotation of SENA, *Brevi note sulla brevettabilità delle scoperte e delle invenzioni biotecnologiche*; which seems to me being a confirmation in the indicated direction.

[33] For a summary on the subject of databases and an overview of doctrine and law see DERCLAYE, *The ECJ interprets the database sui generis right for the first time*, in European Law Review, 2005, 30, 420-430; for the Italian law system see LAVAGNINI, *Commento sub artt. 64 quinquies e 64 sexies*, in UBERTAZZI (edited by), *Commentario breve alle leggi su proprietà intellettuale e concorrenza*, Padua, 6th edition, 2016.

[34] It is interesting to note OTTOLIA, *op. cit.*, *ivi*; and also *amplius* in OTTOLIA, *The public interest and intellectual property models*, Giappichelli, Turin, 2010, *passim* which argues that the monopoly prize awarded by the State is a choice in order to pursue a common interest, and that this is the legal and economic justification for intellectual property rights. However, the recognition of intellectual property rights in the pursuit of public interests requires an express regulatory declaration in the legal system, and in this sense the author noted that only the United States legislative system provides for full recognition of the conferral of intellectual property rights in

remains the natural seat of the patent system. More specifically, the market creates a place of contractual and economic processing of great importance. Legal instruments are then assessed in terms of their ability to achieve the expected economic and protection results. It follows that the preference between alternative legal instruments or between different exegetical pathways is based on their suitability to consider the general economic interest.

It seems to me, then, that the strong productive proliferation that is the basis of the current production processes of the AI favors technologies and the distribution of scientific results among competitors, also through the recognition of patents on available

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its own constitution, and more specifically Article 1.8.8 awards on Congress the power to create exclusive rights to intellectual creations in order to promote progress «The Congress shall have Power to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries»; the consequence of this approach is that only social utility allows the exercise of the power of the Congress to grant rights of patent and that the maximization of technological innovation turns out to be also the filter through which (in the subject we deal with) the judge can modulate the interpretation of the requirements of patentability; differently in Italy the relationship that is created in Article 9 of the Constitution between the monopolistic property of IP rights and cultural promotion is not such as to condition the introduction or strengthening of exclusive rights and therefore (always for what concerns for the purposes of the present study) the maximization of innovation does not constitute for our legislator a condition of legitimacy for the exercise of his choices. In the fringes of this reconstruction, however, it must be made clear that, in my opinion, Italy is in fact one of the conventional countries of the CBE and that this accession means, in any case, adapting to the parameters and choices made at international level. As I have already seen, it seems that the tendency of international systems in the field of intellectual and industrial property, of which Italy is a member, is in any case to maximize innovation through the instrument of private property; for further information on the topic see LIBERTINI, *Impresa, proprietà intellettuale c costituzione*, in *AIDA* 2005, 50; and also IDEM, *La tutela della concorrenza nella costituzione italiana*, in *Rivista Italiana degli Economisti*, supplement 2005, 105 and ff.; SARTI, *Proprietà intellettuale, interessi protetti e diritto antitrust*, in *Riv. dir ind.* 2002, I, 550 and ff.

techniques[35]. It follows that this structure of interests in the field enhances the value of human intervention in the field of AI.

In this sense, indeed, the analysis carried out so far leads without doubt to the basis assumption that the AI works according to determined processes of induction and within a selection of information that is object of predetermination, study and will of man, even if updated by the machine itself. So, if the inventive activity for CBE and other national laws lies in the individuation of the sector where invention operates, in the definition of the model of the person skilled in the art and finally in the non-obviousness judgment of the invention, it is also true that this evaluating model, with all its implications previously seen can be certainly used by focusing the analysis not on the final result of the invention of AI, for some ways "neutral", but on the preparatory functioning of the selection of information and updating methods of the same, of human domination. The individuation of the state of art, the closest technique and the non-obviousness judgement are certainly evaluating parameters applicable to the initial and the so-called "constructive" phase of the AI, and there are no reasons to exclude this technological sector from the patentability and its comparison with scientific and patentability reading in the direction previously seen. Maybe, it is also predictable, because of the close link between the operation of the AI and the patent system, that the claim technique will also lead to an increased competition in this area due to the fragmentation of the available (and describable) technique.

On the other hand, the basic objection deriving from the fact that the AI can both update itself and achieve unpredictable results at the moment of programming of the machine, is easily conquerable. The update of the AI machine, indeed, is always conditioned by the source from which it draws information and the methods of filtering and

[35] On the topic of the relationship between available techniques, patenting and dissemination of innovation see also PAGENBERG and CORNISH, *Interpretation of Patents in Europe*, Heymanns, Munich, 2006, *passim*.

learning data as programmed by men. On the contrary, the conception of unpredictable results is a final figure which always implies a planning and re-elaboration of methods and information desired by man, no matter how surprising a result of AI machine may be.

Ultimately, the human activities of construction of the AI machine, in all its components, and the predisposition of application of the information to be processed by the system, can certainly be subject to analysis pursuant to art. 56 EPC, also in the light of the interpretations that the settled practices of the EPO and national courts over the years have developed.

In addition to what has already been said, in favor of the decision to identify the presence of novelty and non-obviousness in the inventions produced by the AI only at times presided over by human activity, there are other reasons more properly typical of the system of rules envisaged for patents for inventions.

It is widely argued, as already mentioned, that non-obviousness can also derive from the formulation of a question, i.e. of an unknown technical problem. This statement in the technological framework of the AI is certainly still effective, indeed, typically in the area considered here the technical questions are usually asked not for themselves, but to meet a need: the task of satisfying a given need (and therefore also a new problem) is (partially) solved also within the specific technical characteristics of the starting point. Indeed, the data analysis that is carried out by the AI must necessarily adapt (through the activity of the human operator) its deductive process on the basis of the peculiarities of operation of the technological sector of reference [36]. And it is not excluded that this process may be subject to errors, the introduction of

[36] It seems to me that the EPO often adopts decisions in which the requirements of novelty and non-obviousness are analyzed in the preliminary stages of the research which then leads to a patentable innovation; in this regard, the decision T 1439/09 Sclerostin/UCB PHARMA (*Epo Cases*) seems interesting to me, in this case, the non-obviousness was deemed to exist in the preliminary stages and for research implemented using a computer.

irregular or incomplete indications. If, therefore, for example, the AI has to analyze the automatic facilities for driving cars on unpaved terrain, this will imply the learning and programming by the machine of data relating, in general, to the recurring and/or rare characteristics of unpaved roads in different climatic conditions; the processing and induction of data in relation to the particularities and road behavior of cars in those particular road contexts, and finally, to verify everything, specifically, for the type of car being designed. And also in this specific example the learning activity may be subject to errors, even of a structural nature: consider the fact that the data provided to the AI machine will certainly concern cars with past construction techniques, information that may, therefore, report incorrect effects, distorting the final result.

The technique of patent and the textual methods described above are directly linked to the rhythm of innovation in the relevant technology area. Consistently, there is a reciprocal conditioning between scientific and patent information, and usually periods in which there are discoveries or techniques of great innovation follow cycles in which between competitors and in the market the technological distance tends to narrow in order to fully exploit the new results. Depending on the moment, it is therefore easy to imagine the circulatory effects of construction, scientific information and patentability protection methods. Preventing the assessment of the patentability requirements of the inventions produced by the AI (and the consequent lack of disclosure) would certainly hinder this effect, with the consequence that the circular dynamics of knowledge among competitors would tend to slow down the technological rhythm in this technical field. Finally, even according to a simply law interpretation, albeit partly eccentric, it should be noted that according to a general principle present in the field of copyright creations, the central figure remains always the author (with his personal choices), even in cases where modern technologies

tend to freely exploit the fragmentation of intellectual works and even in the case of creations developed with the use of computers[37].

In essence, the AI acts in the development proceeding of the inventive results as new means used by man: it is certainly an extraordinary instrument, but it is still a device subject to the control (albeit partial) of a human operator. On the other hand, even historically, man has always innovated, even in those areas of technology that improved or favored his creative stages, and even now there has never been any doubt about the protection of these tools.

Moreover, the common history of patents includes the need for the technician in the sector to obtain information, within the typical limits of relevance, on working procedures and on the technology that directly and indirectly invests his activity. And in this sense the inventions produced by the AI seem to be the natural extension of a cognitive journey that had been going on for at least a couple of decades. The knowledge deriving from the basic consultation of the scientific computer databases (also on patents) represented, in even less recent years, an unavoidable fact that was taken into account in all technological sectors, even those with a basic and low content of scientific research[38]. The AI probably forces the system to focus its

[37] See Infopaq, ECJ Case C-5/08 according to which «an act occurring during a data capture process, which consists of storing an extract of a protected work comprising 11 words and printing out that extract, is such as to come within the concept of reproduction in part within the meaning of Article 2 of Directive 2001/29, if the elements thus reproduced are the expression of the intellectual creation of their author; it is for the national court to make this determination»; BSA, ECJ Case C-393/09 in *AIDA* 2012 with annotation of *Lavagnini*, 378; Football Dataco, ECJ Case C-604/10 at the part in which it is established that «(…) hat criterion is not satisfied when the setting up of the database is dictated by technical considerations, rules or constraints which leave no room for creative freedom».

[38] The knowledge of innovation on the market seems to represent, generally, an important assessment element even for its economic reflexes; this reflection seems to shine also through GORMAN and CARLSON, *Interpreting Inventions a Cognitive Process: The Case of Alexander Graham Bell, Thomas Edison, and the Telephone*, in

interest more on the conduct of research carried out by the inventor in the search for innovative results, pushing beyond the possibilities of computational capabilities.

The justifications enumerated so far seem to be able also to eliminate at the foundations all the fears (widely expressed in much of the literature consulted) about the risk that the AI produces an excessive and undesirable proliferation of patents. As already mentioned, the level of protection conferred by patent law is anchored in the technological rhythm of innovation in the sector, and the rules laid down (also in practice) strongly tend to free the examination of patentability requirements from both overly broad conceptualizations and from any phases of synthesis (including legal) of technical characteristics: the AI, like any other patentable technology, will therefore tend to be incremental in nature, as required by the rules in force.

In conclusion, if we look at all the reasons behind the choice to identify the rewarding moment of AI innovation only in the phases subject to human activity, it is easy to bring to mind the well-known case of the monkey "Naruto"[39].

In my opinion, there was no doubt in that famous legal case: the idea and the prediction (in principle) of the creative result that the photographer had imagined attainable, expressed in leaving his camera on a tripod and allowing some monkeys to use it to get close shots, appears (to present date) rewarding to grant him exclusivity on those works. It is the man who conceived that method for those photos: the monkey Naruto pressed the button, but he was only the creative tool (already conceived and prepared) by the photographer. Ultimately, it

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15 *Sci. Tech. & Hum. Values* 1990, 131; in a historical prospective see the classic of our Italian law literature GALGANO, *Lex mercatoria*, Il Mulino, Bologna, 2001.

[39] The judicial case is often reported in U.S. literature on the subject of protected intellectual property of copyright law create by AI; see Naruto, et al. v. Slater, et al., no. 15-CV-04324 (N.D. Cal. January 28, 2016); for a non-juridical reading that deals with the event and the wide reputation achieved see LAURENT, *Monkey Selfie Lands Photographer in Legal Quagmire*, in *Time*, August 6th, 2014.

seems to me that the system can still be determined by putting at the center of the scene 'the free choice' of man.

4. Final remarks. – Ultimately, the concrete application of the interpretative rules already seen on the subject of novelty and non-obviousness would not seem to pose particular problems to the interpreter when directed to assess the inventions produced by the AI, and in particular when the exegesis is directed to consider exclusively the technical phases conducted by man.

In the final analysis, the typical question currently facing inventions is whether the prior art contains a teaching that would have guided the skilled person to innovatively transform the closest previous invention, in the AI technical field should no longer be asked by looking at the final result, but exclusively by focusing attention in the phase prior to the processing of data by the AI and/or subsequent selection of the results. In order to decide if the requirement of inventive step is present, we must ask ourselves if the structure of the research, the specific design of the so-called machine learning, the problem setting and/or the selection of the results were unequivocally suggested already before the computational phase carried out autonomously by the AI[40] from the prior art. The same solution could be found even if the setting up of all this initial stage of instruction of the AI machine, however routine, involved a significant investment both from the economic point of view and from the need to deploy a working group with different in-depth scientific skills. It is certain, in

[40] Moreover, as can be seen from EPO, *Patenting Artificial Intelligence, conference summary 30 May 2018*, Munich (the material and the whole conference is available on the website www.epo.org) and also by ROBINSON and SMITH, *Emerging Technologies Challenging Current Legal Paradigms*, in *Minn. J.L. Sci. & Tech.*, 2018, 355 and ff.; patent practice, at least in the main national patent offices, is to grant patents in which the stage of education and configuration of the architecture of the AI can be qualified as a *computer implemented invention* in which the result of the so-called *black box* processing of the machine can be qualified as a technical effect.

fact, that the organization of considerable scientific means and competences to achieve an inventive result represents an activity that goes beyond the competences of the average technician.

After all this conclusion seems to me to be useful in order to delete the interpretative quarrel, which certainly can arise in the process of patenting, between the rule of sufficient disclosure and the technical characteristics of the black-box phase of the AI[41].

In this direction of thinking, not different results should be achieved also regarding the documentation of the prior art (considered by the AI) and the evaluation of the novelty: the computing power of the AI will make it possible to enhance the value of those inventions that have been subject to prior training in distant and/or very eccentric scientific fields. It must be assumed, as a consequence, that the evaluation areas observe the possibility (conditioned by man) of educating the AI machine to identify and recognize technological aspects that are distant and unexpected with respect to the innovative result chosen as achievable. In essence, even the innovation produced by the AI does not escape the general criteria of patentability because it is clear its nature of applied technology.

The AI does not betray the basic principle of the system that excludes from access to patenting purely cognitive activities. Man and AI machine together create that value, generically understood, in which one can glimpse and enhance all the reasons supporting the patent system, and that the rules in the field have intended to ensure until now. Once again, in the patent law the emergence of a new technology sector

[41] On this topic see *Proposal by the delegation of Spain*, WIPO Standing Committee on the Law of Patents, June 18, 2018, SCP/28/7; BURK and LEMLEY, *Is Patent Law Technology-Specific?* in *Berkeley Technology Law Journal* 2002, vol. 17 – 4; JOHNSON HINES, *The Future of Functional Claiming, Part 1: Practical Implications of the Williamson Decision for Software Patents*, in *Intellectual Property & Technology Law* 2015.

poses challenges for the interpreter of intellectual property rules, and once again this opportunity seems being used to try to undermine the patent system. This has already happened with computer programs and biotechnology.

What seems certain is that at present this nascent and important technology must be encouraged and carefully studied [42], even if it is not excluded that in the future individual application problems may arise [43] for the adaptation of the rules in the field or further suggestions may be received from the concrete interpretative activity of the courts and patent offices.

[42] In this sense see OTTOLIA, *Big data op. cit.*

[43] Some aspects seem to emerge right now. The basic software technology for the development of the specific applications of the AI are the subject of extensive study and research based on the contractual technique of Open Source, see for example *Google AI* (on the topic see BENKLER, *Coase's Penguin, or, Linux and The Nature of the Firm*, in Yale Law Journal 2002, 369; LERNER e TIROLE, *Some simple economics on open source*, in Journal of Industrial Economics 2002, 197; LERNER e TIROLE, *The Scope of Open Source Licensing*, in The Journal of Law, Economics, and Organization 2005, 20; BENKLER, *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, Yale University Press 2006; and also my essay *Le licenze free e open source*, ESI, 2007); as a consequence, it is not excluded that the economic importance of the AI phenomenon together with the complexity of the hypotheses of circulation and exploitation of the technical results of the researches could be the subject of a new consideration of the issue. Typically, in the field of pharmacological research, the discovery of new drugs occurs regularly through routine techniques such as molecular screening, or through a series of analyses for tests and errors on new uses for existing compositions; in this direction, the considerable computing capabilities of AI would seem to have a significant impact.