To Whom it May Concern:

The attached document "ARTIFICIAL INTELLIGENCE ("A/I") INVENTIONS – A New Statutory Class?" is respectfully submitted in response to the August 27, 2019 Notice published in the Federal Register No. 84 FR 44889 that requested "Comments on Patenting Artificial Intelligence Inventions."

A word about the format, which became a somewhat lengthy discussion. Consideration of the issues involved in this topic led to the need to investigate the meaning of terms that are familiar but abstract in that they often mean different things depending on the context of their usage.

That said, the author appreciates the opportunity to participate in this discussion and comment opportunity. Respectfully,

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ARTIFICIAL INTELLIGENCE ("A/I") INVENTIONS – A New Statutory Class?
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On August 27, 2019 a Notice by the Patent and Trademark Office (PTO) published in the Federal Register (No. 84 FR 44889) requested Comments on Patenting Artificial Intelligence Inventions. This article, essentially a monograph that draws on the author's nearly 20 years as a practicing engineer and 30 years as a registered patent practitioner, will address this request and the enumerated issues for comment in the Notice, following a discussion of the nature of invention and related topics.

DISCLAIMER

The following discussion and ideas are solely the opinions of the author and do not represent the position of the Whitaker, Chalk, Swindle & Schwartz Law firm on this matter.

INTRODUCTION

A basic premise of the discussion that follows is to distinguish inventive activity in the following way. An invention produced by a natural person or human relies on imagination taking place in a loosely-structured human database - the site of mental evaluation, analysis, reasoning, and imagination. In contrast, an invention produced by A/I or "machine" intelligence – a "virtual invention" relies on the literal terms of the operative algorithms in the machine taking place in association with a tightly-structured database environment that contains defined content responsive to defined operative protocols.

In view of the above considerations a simple, unambiguous term is needed to distinguish invention produced by A/I from invention produced by a natural person. The term "machine" is simple, but suffers the ambiguity of its use in the Patent Statute as one of the four statutory categories of inventions patentable. The term "artificial intelligence" is a bit less simple, and may be a bit awkward in use because it is more abstract than machine. For purposes of this discussion, the author will adapt the term "virtual" as a descriptive term to distinguish a machine-produced invention from an invention produced by a natural person. This choice is for convenience only; in the course of developing statutory revisions, a most suitable term may be determined.

WHAT IS INVENTION ?

The word "invention" is a noun that has several meanings. For example, The Patent Statute, 35 U. S. Code §100 defines "invention" to mean "invention or discovery." Alternatively, *The New Oxford American Dictionary*, © 2001 by the Oxford University Press defines invention as "the action of inventing something, typically a process or device as in contriving or fabricating something." Further, in *The New Shorter Oxford English Dictionary, © 1993,* (by the Oxford University Press) invention may also be "The devising of a subject, idea, or method of treatment for a work of art or literature, by means of the intellect or imagination."

These definitions suggest that invention is the act of devising or contriving something by means of the intellect or imagination to originate a new device or process. It is a definition that utilizes human intellect or imagination – essentially a mental activity, a thought process – to contrive something new, something original.

In this discussion the object is to distinguish invention arising from human mental activity from invention that may occur through the actions of a machine – a non-human entity. One operative attribute of human mental activity that is embodied in invention is imagination, a distinctly human trait, which suggests a convenient way to distinguish invention by a human from invention by a non-human entity. To phase it another way, the essential characteristic of a natural (human) invention is that imagination plays an essential role in its creation. Why imagination? Because it may be the term that best describes what the human mind does – consciously or unconsciously – when an invention is being conceived. Further, the term imagination is construed to refer to a trait not found in a machine process.

One aspect of imagination is comprehending, often though not exclusively through an unconscious activity, a relationship, an association, or a connection that is not obviously apparent in some aggregation of information or remembered experience, whether organized or not. By contrast, a computing machine, governed by explicitly programmed software instructions, is limited to processes or algorithms for analyzing for patterns or relationships according to predefined rules or criteria in defined assemblages of data or information. Whether the machine is organized to seek predefined patterns in such information, or to "learn" or adapt according to a predefined set of conditions or an outcome in activity that is directed to a defined object, it is a literal process that is itself not imaginative because its outcome is limited by the operative rules of the algorithm and the defined, bounded body of data it is applied to.

WHAT IS HUMAN INTELLIGENCE ?

Human intelligence may be defined as the ability or aptitude to reason, to acquire and apply knowledge and skills to a new problem or circumstance, and to imagine a solution to the new problem or circumstance. It is a native capability inherent in the human brain that through the exercise of that capability, mental activity can imagine and develop an idea or concept that is original (novel), not readily apparent to other persons (not obvious) and, when the idea solves a problem that serves a useful purpose (utility).

It is a characteristic of human intelligence that it can draw on or operate with its own built-in "database" (memory) that stores vast amounts of information acquired through experience and study or learning. Another characteristic is that the database of each human person is not only vast (and becoming more so as the person ages) but also unlike any other because different person's experience and learning differ widely in subject matter and scope. Further, such human "database" is in substantial part likely not well organized or purpose-directed as would a machine learning system would be. In a word, the human "database" is relatively unstructured. Moreover, such human database operates on its own unique protocol, responsive to the person's efforts to recall

information, think about a question, or reason through a problem. If there is a systematic process in a human mind or brain used to exercise its intelligence, that process may not yet be well understood.

WHAT IS MACHINE INTELLIGENCE?

Intelligence of a human may be defined as the ability to comprehend and to reason among facts and ideas associated with a question or other subject matter. In contrast, an intelligent "device, system, or machine [is] able to vary its behavior in response to varying situations, requirements, and past experience." See, e.g., *The New Shorter Oxford English Dictionary*, © 1993. Another published definition is that "Intelligence [of a machine] measures an agent's ability to achieve goals in a wide range of environments." See the article *"What is machine intelligence & how can we measure it*?" by Pranav Budhwant, published December 20, 2018 at https://www.medium.com/binaryandmore.

For purposes of this discussion, artificial or machine intelligence or learning is considered to require two essential structural elements: (A) a database of defined, known content, extent, and protocol or formatting; and (B) an algorithm or set of algorithms for interacting with the database to produce an outcome designed into the algorithm(s). In order to be accessed and the data stored therein utilized and manipulated through the operation of the algorithm(s), the database A must be systematically structured or susceptible to access by an algorithm configured for learning a suitable protocol to navigate in the database A. Such an algorithm, a series of process steps, is embodied in computer software that is structured to perform the required interactions with the database(s) in accordance with a defined set of rules that govern the interactions. The computer software is a concise work of human authorship. Thus the database and the operative algorithm(s) are necessarily a pair of coordinated, mutually dependent structures.

Simply stated, a human brain has an unstructured database and an access protocol that is undefined but useable by the individual human to conceive ideas. The human brain, however, has a third aspect (C), it can also exercise imagination. In contrast, an A/I machine has only a structured algorithm (A) and a structured database and access protocol (B), but lacking (C), because its activity is literal and not imaginative, is not capable of conceiving a natural invention in the same way that a natural person can.

Under the present Patent Statute, an invention by a natural person may be a process, machine, manufacture, or composition of matter. These are all concrete things or concepts that arise through the activity of imagination. However, if an invention is produced through the activity of a machine – that is, a computer operating under software control – it may then be called a "machine (non-human) – produced" or "virtual invention" because its literal but abstract result is produced by an algorithmic machine process that inherently produces a predefined, literal outcome constrained by the terms of the algorithm.

The use of this term "virtual Invention" will be discussed further when considering how such virtual inventions are treated in the Patent Statute.

THE PRESENT STATUTORY SCHEME

Article I, § 8, ¶ 8 of the U. S. Constitution grants to Congress the 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 present statutory scheme set forth in 35 U. S. Code §101 Inventions Patentable states "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." Note: a word about the term "discovers" in this statute and also in Section 100 discussed below is that these terms are limited by the language of the statute to "any new and useful process, machine, manufacture, or composition of matter."

The conditions for patentability include novelty, non-obvious subject matter, and the formal requirements of an application for patent that includes a Specification, as set forth in Sections 102, 103, and 112 of Title 35 of the U. S. Code.

The Specification, defined in Section 112 in principal part "shall contain a written description of the invention, and of the manner and process of making and using it . . . and shall set forth the best mode contemplated by the inventor . . . of carrying out the invention," and "conclude with one or more claims particularly pointing out . . . the subject matter which the inventor . . . regards as the invention."

Section 100 of Title 35 defines an "**inventor**" as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention; and a "**patentee**" as "not only the patentee to whom the patent was issued but also the successors in title to the patentee." An "**applicant**" for a patent is either the inventor (See Section 111) or, per Section 118 "[a] person to whom the inventor has assigned or is under an obligation to assign the invention," or "[a] person who otherwise shows sufficient proprietary interest in the matter may make an application for patent on behalf of and as agent for the inventor . . ."

Section 261 of Title 35 states that "patents shall have the attributes of personal property" and that "applications for patent, patents, or any interest therein, shall be assignable in law by an instrument in writing."

MACHINE INVENTION DISTINGUISHED

Thus, under the present statutory scheme, a patented invention is conceived by a **natural person** for a new and useful process, machine, manufacture, or composition of matter. For convenience such an invention may be termed a "**natural invention**" because it is the act of a

natural person. Following the reasoning presented in the discussion presented herein, a new class of "**virtual invention**" is proposed, along with revisions to the statutory scheme to accommodate inventions created by other than a natural person or persons.

A virtual invention produced by A/I or machine intelligence may be defined as: an invention conceived, not by a natural person but by a non-human or machine inventive agent. Such an invention is the result of "virtual inventive activity, by an agent that is "not physically existing as such but [one] made by software to appear to do so" or appear to be real. The portion of this definition in quotation marks is the definition of the term "virtual" as used in the computer arts from The New Oxford American Dictionary, ©2001 by the Oxford University Press.

Thus a virtual invention is one that is conceived by a machine process, where the inventive agent is the machine process. Thus we may further reason that the applicant for a patent on such machine invention is the author or creator of the machine process and the owner of the machine invention conceived by the operation(s) carried out by the machine process. The "inventive agent" or inventor of the machine invention is the machine process – the A/I or machine intelligence.

DISCUSSION OF ARTIFICIAL INTELLIGENCE (A/I) AND MACHINE LEARNING

We have seen that human invention is fundamentally an imaginative act, a form of conscious reasoning that occurs in the human mind or brain. In one example, the imaginative, reasoning activity, in considering (consciously or not) a question or a problem, may combine, connect, or associate two or more things or ideas, similar or disparate, such as (1) a problem and a way to solve it; (2) a first thing and a second thing that may become or suggest a third thing; (3) a first thing that is redefined or modified according to some second thing into a third thing; etc. The resulting thing, an invention, will be characterized by having structure or form, and function or utility, the basic elements of any invention whether produced by a human agent or an A/I or machine agent.

We noted previously that a human brain is distinguished by a substantially unstructured database and at best a less-than-well understood access protocol but that it can exercise imagination. In contrast, an A/I machine has a structured or defined database and a structured, dedicated access protocol but is not capable of exercising of what we have identified as imagination. So the question arises: can an algorithm in an A/I or machine process mimic human imagination to form the kind of connections or associations among things or ideas to form what we have defined is an invention?

DISCUSSION: PATENTING A/I INVENTIONS

The question of whether A/I inventions are patentable can be stated as: How can a machine intelligence exercise imagination, a necessary ingredient of invention? What sort of process must be present to produce an imaginative outcome? Artificial intelligence seeks to find patterns or relationships within a known environment or aggregation of data. In order to perceive or identify

such patterns or relationships, it must define the pattern it seeks or the criteria used to identify them, to distinguish the pattern or relationship from the body of data in the environment or database. Thus there is a one-to-one relationship between the sought pattern and the outcome; i.e., it is literal, not imaginative.

But imagination – because it is capable of identifying a connection or relationship (or a pattern) among an undefined body of data where one does not appear to be present – results from operating without the benefit of a conscious, known, or predefined algorithm or process. It "just happens." It must be noted that after the conscious realization of the idea (the connection or relationship between two or more ideas or fragments of data), a human inventor may be able to reconstruct a plausible statement of how the product of the exercise of his imagination occurred. But this does not explain or reveal the mechanism responsible for the outcome except that "it just happened."

But it must also be considered whether artificial or machine intelligence (or learning), designated A/I, can produce outcomes that are novel, not obvious, and possess utility, the conditions stated in the Patent Statute. This is analogous to asking whether A/I can duplicate the imaginative process of a natural person and originate an "inventive step" to conceive a new combination of elements or steps. The questions then become, if it is recognized that A/I can produce an invention, (a) how can such an invention be distinguished from an invention produced by a human; and if so (b) what changes are required to the Patent Statute to allow for patenting an A/I invention; and (c) how can such invention be protected and given the attributes of intellectual property?

A TEST FOR INVENTIVE CONCEPT OR STEP

For example, consider one possible method to determine whether a machine invention embodies an inventive concept or step. The method, which seeks to identify whether an element or step in a claim is distinct or different from the elements and or steps in the prior art for the subject matter of the claim, might proceed as follows. The method compares each element or step of a claimed combination with a known set of subject matter – the prior art directed to the subject matter of the claimed machine invention.

Consider an algorithmic process that searches for a prior art publication or patent directed to subject matter "X" (the same as the claimed machine invention) for a process, machine, article of manufacture, or composition of matter. The illustrative method begins by asking: is there an element or step "Y" (as recited in the claimed machine invention) disclosed or described in the prior art publication or patent? If the result of the search is affirmative, then the use of that element or step "Y" may not be a distinctive use in that subject matter "X." If the result of the search is negative, then the use of that element or step "Y" may be a distinctive use in the subject matter "X." The method should be repeated for each different element or step "Y" in the claimed machine invention to fully consider the item of prior art being reviewed.

If the claimed combination of the machine invention includes at least one distinctive element or step "Y," then the claimed combination is distinct from the item of prior art under review and may, at a minimum, contain an inventive concept or step. Once it is established (as a first order determination) that a machine-conceived invention contains at least one element or step that is distinct or different from any prior art combination within the same subject matter "X", then the invention should be compared with the prior art through a systematic search and examination for novelty, non-obviousness, and utility.

SECTION 103, "INVENTIVE STEP," AND VIRTUAL INVENTIONS

A remaining issue to be considered is the operative role of two statutory provisions, one of U. S. law; the other of European law: (1) the "manner of making" a machine invention, a clause of 35 U. S. C. §103; and (2) application of an "inventive step" rule as recited in Article 56 of the European Patent Convention ("EPC") of 5 October 1973.

The last sentence of Section 103 of Title 35 states that "Patentability shall not be negated by the manner in which the invention was made." This provision appears to state that an invention conceived by – in the manner of – an inventive agent other than a natural person may be patented if it satisfies "the conditions and requirements of this title." In other words, the patentability of a machine invention shall not be negated – refused consideration for patenting – merely because it was not conceived by a natural person. The consequence of this provision suggests that the U. S. statute already accommodates machine inventions.

Article 56 of the EPC, the first sentence, states "An invention shall be considered as involving an inventive step if, in regard to the state of the art, it is not obvious to a person skilled in the art." This provision is very similar in applicability with the U. S. Title 35 §103, which defines the patentability standard of non-obviousness. Moreover, the "inventive step" language also shares similarity with the case law of the Federal Circuit that forms the supporting legal basis for Step Two A of the *2019 Revised patent Subject Matter Eligibility Guidance* ("2019 PEG") published January 7, 2019 by the U. S. Patent and Trademark Office ("PTO").

Step 2A of the 2019 PEG concerns whether a claim directed to a Judicial Exception embodies an "inventive concept." This Step 2A is revised by an October 2019 Update, which separates the analysis of whether a claim is directed to a Judicial Exception into Prong One and Prong Two to determine whether the claim embodies an "inventive concept." If in Prong One of the revised Step 2A the claim is found to "recite an abstract idea, law of nature, or natural phenomenon," Prong Two of the revised Step 2A – the inventive concept test – inquires "Does the claim recite additional elements that integrate the Judicial Exception into a practical application?"

A machine invention conceived by A/I may fall within the ambit of a Judicial Exception as being directed to an abstract idea by virtue of its conception by software in an A/I system. If so, Prong Two requires a determination whether the claimed invention embodies the required "additional elements" to satisfy the "inventive concept" test. Thus, the 2019 PEG appropriately

borrows the useful idea of applying the "inventive concept" test to a claim considered to be an abstract idea.

FORMAL REQUIREMENTS OF AN APPLICATION FOR PATENT

The Patent Statute 35 U. S. Code requires that the description of an invention must satisfy both the enablement and best mode provisions of Section 112. The written description must (a) describe the inventive step or concept (i.e., enablement); and (b) describe at least one way to provide that concept (i.e., best mode). These requirements are as applicable to virtual inventions as they are for inventions produced by natural persons.

A PROPOSAL FOR ACCOMMODATING A/I INVENTIONS IN TITLE 35 OF THE STATUTE

The applicability of the Patent Statute to virtual inventions produced by A/I can be simply stated, consistent with the foregoing discussion, by defining a new class of inventions called "**Virtual Inventions**" that arise from A/I or machine learning to distinguish them from "**Natural Inventions**" that arise from a human mind or brain. Similarly, it follows that the same statutory conditions for patentability of Sections 102, 103, and 101 of Title 35 – novelty, non-obviousness, and utility – should apply to virtual inventions. Similarly, the requirements of Sections 111 (content of the application) and 112 (written description, enablement, best mode, etc.) should also apply to applications for patenting virtual inventions. However, several definitions need to be added or revised (Section 100) to accommodate virtual inventions.

It is proposed herein that, in addition to definitions of virtual invention and natural invention, the Inventor of a virtual invention be defined as the A/I machine that produced or invented the claimed virtual invention; and the Applicant of the virtual invention defined as the human individual or individuals who devised the device, system, or A/I machine that produced the virtual invention. Further, a patent granted to an A/I machine (inventor) and the creator of the A/I machine (applicant) should bear a distinguishing mark closely associated with the issued patent number. For example, following the practice for distinguishing Design patents from Utility patents by use of the prefix "D" to the patent number, a virtual patent could be identified by using the prefix "V" to the patent number. This proposal preserves the applicability of the statutory provisions regarding ownership and assignment of Section 261 of Title 35.

ADDRESSING THE 12 ISSUES RAISED IN THE NOTICE BY THE PTO

Within the foregoing context or rationale that considers a role for AI or "Virtual" inventions, the following responses to the 12 inquiries are offered.

1. What are the elements of AI inventions?
   Any invention, whether produced by a human agent or an AI or machine agent, is characterized by having structure or form, and function or utility. These are the basic elements of any invention. Further, an application for patent must comply with the

conditions and requirements presently set forth in Title 35 in Sections 100, 101, 102, 103 and 112.

2. What are the different ways that a natural person can contribute to conception of an invention and be eligible to be a named inventor?
The contributions of a natural person to a virtual invention is as a named applicant for a patent on the virtual invention produced by the AI machine or system devised by the natural person(s) that produced the virtual invention.

3. Do current patent laws and regulations need to be revised to take into account inventions where an entity or entities other than a natural person contributed to the conception of an invention?
Yes, by (a) recognizing, defining, and distinguishing virtual invention as outlined herein; and (b) by stating that virtual inventions are subject to the same conditions and requirements of Title 35 as identified in Inquiry Number 1 above as may be revised as discussed herein.

4. Should an entity or entities other than a natural person, or company to which a natural person assigns an invention, be able to own a patent on an AI invention?
The owner of an AI invention is the entity that devised the AI machine or system that produced the AI "virtual" invention.

5. Are there any patent eligibility considerations unique to AI inventions?
AI or virtual inventions should be subject to the same conditions and requirements of Title 35 as inventions produced by natural persons.

6. Are there any disclosure considerations unique to AI inventions? Does there need to be a change in the level of detail an applicant must provide in order to comply with the written description requirement?
Yes, by disclosing a description of the inventive agent – the AI machine – that produced the virtual invention, including a statement of the level of skill embodied in the AI machine. Such statement may address the problems overcome in devising the virtual invention.

7. How can patent applications for AI inventions best comply with the enablement requirement, particularly given the unpredictability of certain AI systems?
By fully describing the relevance of the inventive agent's (the AI machine) level of skill to the resulting virtual invention.

8. Does AI impact the level of a person of ordinary skill in the art? If so, how?
Yes. During examination under Section 103 of Title 35 it may occur that a virtual invention is unpatentable in view of prior art; that is, it fails a test for non-obviousness or inventive step.

9. Are there any prior art considerations unique to AI inventions?
Until a body of prior art in the AI space is established, virtual inventions should be subject to the entire body of prior art of inventions produced by natural persons and AI or machine agents.

10. Are there any new forms of intellectual property protections that are needed by AI inventions, such as data protection?

11. Are there any other issues pertinent to patenting AI inventions that we should examine?
Considering questions 10 and 11 together: The analysis presented herein is an effort to accommodate AI or virtual inventions within the present statutory scheme and operational processes of the PTO, while outlining suggested revisions to them. As virtual inventions become patented and form their own body of technological art, additional issues may arise that require revisiting this type of review and which may lead to further revisions of both the Patent Statutes and the Patent Examining Procedures.

12. Are there any relevant policies or practices from other major patent agencies that may help inform USPTO's policies and practices regarding patenting of AI inventions?
Globalization, and the consequent review to determine the need for normalization of rules and Procedures suggests that the cross-fertilization of relevant policies and practices from other major patent agencies may be helpful. But efforts to revise U. S. policies and practices should always be considered from the perspective of clearly defined U. S. objectives in the economic sphere for technological development and fairness of trade, protection of intellectual property rights, etc.

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