



Artificial intelligence and the "natural person" criterion in patent inventorship

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Abstract

As generative artificial intelligence (AI) systems become integral to scientific and technological innovation, courts and patent offices are grappling with whether, and how, AI assistance affects inventorship. Current doctrine in leading jurisdictions limits inventorship to a "natural person", yet the accelerating convergence of robotics, synthetic biology, and neurotechnology exposes gaps in statutory definitions and policies. This article challenges the legal requirement of "natural person" for patent inventorship. It also discusses litigation involving AI-named inventors. This article also covers thought experiments involving legally recognized non-human or non-biological persons (*e.g.*, rivers granted legal personality, robots with formal citizenship) and biologically modified entities, to test boundary conditions and highlight policy risks. The discussion in this article revolves around the lack of clarity with cases of hybrids that could potentially fulfill the criteria of "natural person" and the operational mechanics of patent law including conception, reduction to practice, and chain of title and assignment. The article ends with suggestions related to clarifying the statutory language related to "natural person" inventorship. Without timely reform, inconsistent interpretations across jurisdictions could jeopardize patent validity, distort incentives, and invite strategic abuse. To address this, the article proposes clarifying the definition of "natural person" in patent law to eliminate interpretive ambiguity and expressly exclude artificial and hybrid entities from inventorship.

Graphical Abstract

The "natural person" requirement for patent inventorship warrants clarification in the age of artificial intelligence.



Keywords Artificial intelligence · Patent inventorship · Patent law · Natural person · Legal personhood

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1 Introduction

Generative AI tools are now embedded in laboratory discovery, software development, drug design, materials engineering, and beyond. Their widespread adoption highlights questions currently being asked with increasing frequency about the possibility of patenting AI-generated inventions, and whether AI itself can be an inventor [1]. While patent protection for AI-generated works is gaining acceptance worldwide, provided that transparency and substantial human contribution are shown, determining inventorship is becoming more complex. The complexity increases exponentially when assessing whether the human developer of the AI, the data provider, the end user, the AI system itself and/or a combination thereof, should be considered as the inventor(s) of the new invention [2]. Even more complex scenarios are currently being observed when one AI model generates another AI model that creates a new invention. As of today, except South Africa [3], all countries have achieved consensus that an AI cannot be an inventor because it is not a "natural person" [4]. However, this article shows that cybernetic hybrids could possibly fit the description of "natural person" according to current legal definitions. Thus, the creation of new, clear statutory language and consistent application across jurisdictions are needed to resolve these issues.

2 Literature

There have been recently more debates on AI inventorship and the status of non-human entities in law. However, the focus has largely been either on doctrinal patent questions (who can be an inventor) or on abstract discussions of legal robot personhood. There is currently a scarcity in the literature about the precise meaning of the "natural person" requirement and how that concept interfaces with broader current developments in legal subjectivity. This section presents how the existing literature differs from what is presented in this article.

Lim and Li argue that the Device for Autonomous Bootstrapping of Unified Sentence (DABUS) litigation reveals much ado about AI inventorship, because patent systems can continue to insist on "natural person" inventors while treating AI as a sophisticated tool [5]. They emphasize current statutory wording such as "individual" and "person" in US and UK laws and conclude that current doctrines already implicitly require natural person inventors, without needing radical reform [5]. This article builds on this doctrinal foundation but presses further by prospectively asking who should count as a "natural person" for these purposes, and by juxtaposing that inquiry with other corners of law where

personhood is being stretched. Many other studies conceptually clarify AI-generated inventions and distinguish between full autonomy by AI and inventions assisted by AI. For example, Kim concluded that inventorship in these cases is currently attributed to a human as long as AI is used as a computational method for problem solving [6]. Aboy, Liddell, and Lath interpreted the then in-place Inventorship Guidance for AI-assisted Inventions as issued by the U.S. Patent and Trademark Office (USPTO) in 2024, and focused on the significant human contribution standard and its roots in existing joint inventorship doctrine [7].

With an eye towards future improvements in the law, Ding and Deng proposed, from a Chinese perspective, a dual system in which AI outputs are patentable, but AI itself is not recognized as an inventor. In other words, they suggest a technical generation registration system for AI-created "inventions" while retaining "natural person" as the sole possible inventors in law [8]. However, the authors remain within the patent-administrative frame, focusing on compliance strategies for practitioners.

This article examines the deeper statutory premise in 35 U.S.C. §100(f) and related provisions that inventors must be "natural person" and explores the implications of this requirement as biological and technological boundaries blur. This article moves beyond the conceptual distinction of full vs. partial AI-assisted inventions by questioning whether "natural person", in patent law, should be read as exclusively *Homo sapiens*, and how this connects with emerging non-human legal subjects.

While on one side, almost all jurisdictions insist on having a human as an inventor, on the other side, Zhou questions the human inventorship requirement as AI systems become more capable [9]. Zhou challenges the anthropocentric focus in patent law by arguing that AI cases such as DABUS expose conceptual tensions underlying the requirement that inventors be natural persons. On the other hand, beyond patent law, Gordon investigates whether sophisticated robots should be granted moral and legal personhood [10]. They concluded that personhood should not be extended to current robots but could become justifiable once they reach capacities comparable to humans. Furthermore, Avila Negri critiques proposals for electronic personhood for robots [11]. They argue that analogies to corporate personhood obscure important differences between natural and artificial entities. While such literature discusses the legal distinction between natural and artificial persons, they do not connect it to the more technical notion of inventorship as this article does.

Furthermore, Bharati surveys AI and intellectual property more generally". They conclude that current IP remains anchored in human authorship and inventorship but faces mounting pressure from AI-driven creations [12]. Ferrero

Guillén and Breckwoldt Jurado, from a different angle, examine vagueness in AI-related patent claims and show how fuzzy drafting can weaken disclosure and legal certainty in AI patents [13]. Both contributions point out systemic fragilities, but neither unpacks definitional uncertainty around "natural person" for inventorship attribution.

Overall, the literature covers doctrinal responses to AI-generated inventions and AI-assisted inventorship, debates on whether and when AI systems or robots should become legal subjects, and also discusses jurisdictional variation with respect to maintaining or relaxing the focus on "natural person". Current literature either assumes that "natural person" implies ordinary human adult or jumps directly to whether AI could be an inventor. However, none of the existing literature systematically interrogates the "natural person" requirement itself, as a biological, legal, and philosophical concept, and connects it across patent law, human rights, corporate and non-human personhood (*e.g.*, rivers, animals, robots, etc.).

This article fills this gap by (a) reconstructing the "natural person" criterion from statutes, case law, and secondary materials in multiple jurisdictions and legal fields to provide an assessment of the current state of the law, (b) bridging patent inventorship with broader debates on legal personhood, (c) showing where patent law aligns with or diverges from developments such as electronic personhood or rivers bearing rights, and (d) proposing a clarified, defensible account of "natural person" inventor(s) moving forward that can guide both current examination practice (*e.g.*, under USPTO Guidance) and future legislative reform. In doing so, the article moves the discussion beyond a binary yes/no as to whether AI should qualify as an inventor toward a more nuanced understanding of whom the law seeks to protect when it insists that an inventor must be a "natural person".

3 Background and current laws

3.1 Current statutory text, case law, and regulations in the U.S.

In the United States, the general requirements for patent protection are laid out by Title 35 of the U.S. Code (U.S.C.). In this regard, 35 U.S.C. 101 currently states that "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvements thereof, may obtain a patent thereof, subject to the conditions and requirements of this title" [14]. As currently interpreted by the USPTO, one of the requirements of this statute is that an inventor must be named on each filed patent application [15]. Regarding patent

inventorship, 35 U.S.C. § 100(f) currently defines an inventor as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention" [16]. In describing the statements required of an inventor when applying for a patent, the U.S. patent statutes consistently refer to inventors and co-inventors as "individuals". The U.S. Court of Appeals for the Federal Circuit (CAFC) is on the record as interpreting this language to require that an inventor be a "natural person" [17, 18]. The question becomes, then, what happens should an AI be an inventor of an invention?

In this regard, consider the case of DABUS. DABUS is an AI machine that has been used to generate various inventions, which have led to the filing of numerous patent applications around the world naming DABUS as an inventor [19]. These patent applications were deliberately filed as strategic test cases to explore the limits of inventorship under the current "natural person" interpretation of the Patent Act [20]. In examining such a patent application, in April 2020, the USPTO clearly and unambiguously refused to allow the patent application, indicating that the relevant legislation and CAFC case law on inventorship require that an inventor must be a "natural person" [21]. This decision was affirmed by the U.S. court system on appeal, where it was noted that it is up to legislators, *i.e.*, the U.S. Congress, to expand the scope of inventorship to include the possibility of an AI, such as DABUS, to be an inventor on a patent application [22].

A few years later, in February 2024, the USPTO issued Inventorship Guidance for AI-Assisted Inventions (the 2024 Guidance). According to the 2024 Guidance, AI-assisted inventions were not categorically considered to be unpatentable for improper inventorship. Rather, the focus was on the human contributions to creation of the invention. That is, patent applications for AI-assisted inventions were required to name the "natural person" who significantly contributed to the invention as the inventor or joint inventor. Since then, the USPTO issued Revised Guidance on November 28, 2025 (the 2025 Guidance), officially rescinding the 2024 Guidance. Under the updated 2025 Guidance, there is no longer a separate, modified legal test for AI-assisted invention. Instead, the traditional test of conception applies moving forward to all inventions, "regardless of whether AI systems were used in the inventive process". Adapting this traditional test to the use of AI, the inventors of a patent application must be able to meticulously document and articulate their human contributions, including the formulation of specific prompts, curation of training data, or refinement of the AI output. There is currently no possibility of an AI system being named as an inventor or recognized as having made an inventive contribution. In fact, the guidelines specifically indicate an inventor must form the "definite and

permanent idea of the complete invention". AI systems, including generative AI and other computational models, are specifically mentioned as tools used by human inventors and, like any tool, while AI systems may assist inventors, such tools are expressly stated not to qualify as inventors or to confer inventorship on their users. Yet, despite the centrality of this limitation, U.S. patent law does not explicitly define what constitutes a "natural person".

Since U.S. federal law does not clearly define a "natural person", the laws of the various U.S. states were reviewed to see if they fill this gap. Even though every U.S. state has its own separate laws, there remain certain commonalities for how a "natural person" may be defined. For example, the Georgia Code OCGA § 1–2–1 specifies: "There are two classes of persons: natural and artificial. Corporation are artificial persons" [23]. Similarly, the Louisiana Civil Code La. C.C. § 24 states: "A juridical person is an entity to which the law attributes personality, such as a corporation or a partnership" [24].

What, then, is the difference between a "judicial person" and a "natural person"? A "natural person" is typically defined as a living human being with legal rights and responsibilities. As noted, the Louisiana Civil Code La. C.C. § 24 states: "A natural person is a human being" [24]. Legally, a "human being" is recognized as a member of the species *Homo sapiens*. In other areas of federal law, Congress has at times defined "human being" by reference to membership in the species *Homo sapiens* (see, e.g., 1 U.S.C. § 8). From the U.S. federal law perspective, 1 U.S.C. § 8(a) provides that the words "person", "human being", "child", and "individual" encompass every member of the species *Homo sapiens* who is born alive at any stage of development [25].

In contrast, the U.S. inventorship statute currently contains no such biological specification, as demonstrated above. This statutory silence invites consideration of whether membership in the species *Homo sapiens* is, in fact, a necessary condition for inventorship. Even if it did, U.S. patent law does not presently offer a legal definition of *Homo sapiens*. The term is primarily used in scientific and anthropological contexts. *Homo sapiens* is a Latin term that means "wise man" [26]. In contrast, an "animal" has been legally defined in the United States by Black's Law Dictionary as "a non-human, animate being which is endowed with the power of voluntary motion. Animal life other than man. *Bernardine v. City of New York*, 182 Misc. 609, 44 N.Y.S.2d 881, 883" [27]. Therefore, the statute of "natural person" rests on biological assumptions that are rarely articulated explicitly.

3.2 European patent office

The situation is not overly different in the European Patent Office (EPO). Article 81 of the European Patent Convention (EPC) provides: "The European patent application shall designate the inventor. If the applicant is not the inventor or is not the sole inventor, the designation shall contain a statement indicating the origin of the right to the European patent" [28]. Similarly, with regard to designation of an inventor, Rule 19(1) EPC states: "The designation shall state the family name, given names and country and place of residence of the inventor, contain the statement referred to in Article 81 and bear the signature of the applicant or his representative" [29]. Lastly, Article 60(1) EPC recites: "The right to a European patent shall belong to the inventor or his successor in title" [30].

With respect to DABUS-created inventions, the EPO Enlarged Board of Appeals has already held that the proper interpretation of the EPC leads to the conclusion that the inventor designated in a patent application must be a "natural person" (human) [31]. Accordingly, the EPO's position currently is that only a human being could be an inventor within the meaning of the EPC [32]. The EPO stressed that the designation of the inventor is mandatory because of its legal consequences, namely, to safeguard the status of inventor by giving him / her various rights, at least in part because a machine without legal capacity cannot exercise such inventor's rights [33].

3.3 Other jurisdictions

Comparable distinctions between natural and artificial persons appear across many legal systems, in which corporations, partnerships, and other entities are granted legal personality by statute while remaining distinct from "natural person". For example, the New Zealand parliament, in 2017, recognized the Whanganui River (Te Awa Tupua) as "an indivisible and living whole, comprising the Whanganui River from the mountains to the sea, incorporating all its physical and metaphysical elements". The intrinsic value and cultural significance of the River has been formally recognized and codified to have "all the rights, duties, and liabilities of a legal person" [34]. Similarly, on March 20, 2017, the Uttarakhand high court in India recognized two rivers (the Ganga and Yamuna Rivers) as "living entities" with fundamental rights, making it possible for designated humans to represent these Rivers in court and for complaints to be filed in these Rivers' names [35]. The court subsequently enlarged the order to extend rights to the glaciers which feed the Ganga and Yamuna rivers, as well as connected rivers, streams, air, meadows, dales, jungles, forests, wetlands, grasslands, springs, and waterfalls. This

recognition allows these "natural entities" to engage in legal matters as if they were individual persons, distinct from the "natural person" who form or govern them.

Additionally, corporations in the United Kingdom and Canada, as well as many other Western legal systems, are also recognized as legal persons, with rights and responsibilities like those of "natural person". For instance, within the jurisprudence of the European Convention on Human Rights, a "natural person" denotes a human being as a legal subject capable of holding rights and obligations, as distinguished from juridical entities such as corporations. In the United Kingdom, a "person" relates to an entity that the law recognizes as having its own distinct personality. Historically, this usually means that a "person", in the UK, is able to act in its own right, and is capable of possessing legal rights and liabilities, including individuals (or "natural person") and corporate organizations [36].

Even further, the European Parliament Resolution of February 16, 2017, established that a robot shall be considered intelligent when it has the following characteristics: (1) the existence of sensors capable of allowing it to exchange data with the environment; (2) the ability to learn from experience and interact with the environment; (3) the existence of material support; (4) the ability to adapt; and (5) the absence of life in the biological sense [37]. How, then, does this fit in with the current laws regarding the concept of the "natural person"?

Accordingly, while jurisdictions consistently distinguish "natural person" from artificial or juridical persons, the biological premises underlying this distinction to date are seldom examined explicitly. Emerging technologies that blur boundaries between biological and artificial entities invite closer scrutiny of these premises, even if current doctrine remains stable.

4 AI, hybrids, and legal constructs

As noted above, in the U.S., EPO, and other jurisdictions around the world, the foundation of the state of the law of personhood currently assumes that a "natural person" must be a human. Even further, when considering the current patent laws around the world, only such "natural person" are assumed capable of being inventors. However, the legal concept of a "natural person" can leave numerous gaps in coverage. As biotechnological and cybernetic developments advance, these assumptions may be tested in ways not previously contemplated. This represents a potential gap in the various patent laws around the world, including the U.S. and EPO, among others.

In this section, we focus on various changes to the patent laws that could or should be contemplated. The following

analysis is not intended as a proposal for reform, but rather as an exploration of how the current legal framework (*de lege lata*) could arguably extend to advanced artificial or hybrid entities. In other words, the scenarios discussed in this section are not predictions of imminent doctrinal change, nor do they suggest that existing law recognizes robots or biological hybrids as "natural person". Rather, these examples are hypotheticals to test boundaries. Further, this section suggests and explores necessary potential updates to the laws of inventorship to account for the ever-increasing capabilities of AI. By examining advanced robotics and biological modifications, the analysis exposes the implicit biological assumptions embedded within current patent inventorship doctrine and assesses whether those assumptions remain normatively justified. In this section, AI systems and cybernetic hybrids are evaluated not only against the current statutory text and abstract theories of personhood, but also against the underlying purposes of patent law, including utilitarian incentive theory and Lockean labor theory, as well as the operational mechanics of patent doctrine, such as conception, reduction to practice, and chain of title requirements.

4.1 Humanoid robots

Consider, in a first instance, Sophia, as developed by Hanson Robotics, the first robot to obtain Saudi Arabian citizenship in October 2017 [38]. Sophia was the first, and likely not the last, robot to receive legal personhood in any country. Under Saudi Arabian law, Sophia is legally a "person" [39]. Sophia has been marketed as a social robot capable of mimicking social behavior and inducing feelings of love in humans [40]. Since her activation, Sophia has participated in numerous interviews. Sophia has a computer vision algorithm that processes input from cameras within her eyes, giving her visual information on its surroundings [41]. She can follow faces, sustain eye contact, and recognize individuals. Sophia has functional legs and the ability to walk [42]. Even further, Sophia has lifelike skin and the ability to emulate more than 60 facial expressions. She can process speech and have conversations using a natural language subsystem. In fact, Sophia's AI program analyzes conversations and extracts data that allows her to improve responses in the future [43]. As such, Sophia is in full possession of human attributes like intelligence, mobility, communication skills, etc. She has also dynamically integrated perception, action, and dialogue. Accordingly, it is not inconceivable that a system such as Sophia, or one of Sophia's "children", could also create and generate inventive output like DABUS did. Sophia is also in possession of a certain legal capacity by virtue of her Saudi Arabian citizenship. Would these

attributes, then, qualify her for inventorship, at least under U.S. or European patent law?

As noted above, under 35 U.S.C. § 100(f), an inventor currently is "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention". Even if the CAFC has definitively interpreted "individual" to mean a "natural person", the statute itself does not provide a biological definition of "natural person", nor does it explicitly tie inventorship to membership in the species *Homo sapiens*. Therefore, will the conceptual boundaries of "natural person" embedded in patent law remain normatively coherent as artificial systems such as Sophia acquire increasingly human-like capacities?

The United States is not the only jurisdiction where this is a potential issue. As noted, the idea of a "natural person" is a legal construct intended to separate human beings from "artificial persons" like corporations, rivers, and the like, and even robots, *i.e.* any entity not having a legal capacity. This is a potential issue not only in Saudi Arabia, where Sophia already has citizenship, but also in the European Union (EU) based on the European Parliament Resolution of February 16, 2017, as discussed above. If the EU is willing to consider a robot, having an absence of life as intelligent, and potentially a "natural person", is Sophia entitled to be eligible for inventorship in the EU? How about Sophia's "children"?

Considering the overall biological traits common to human beings, these include fully bipedal locomotion, vocal apparatus for speech, fine motor control and a precision grip, and extended childhood and learning periods. Turning to the cognitive and behavioral traits, these typically include advanced abstract thinking, the ability to communicate using complex language, the ability to use symbols for, *e.g.*, writing, mathematics, and art, the ability to build on the learnings and knowledge of those who came before them, and the ability to develop spiritual and religious beliefs. Clearly, if one were to look at Sophia, she already has most of these traits common to human beings. Then, would this make Sophia be considered as a "natural person" eligible for patent inventorship?

4.2 Biological and cybernetic hybrids

These difficult questions apply not only to artificial persons in the form of fully intelligent robots, such as Sophia, but similar considerations would also seem to be relevant when considering *e.g.* transgenic animals. For example, consider a circumstance involving the introduction of human transgenics into a suitable animal, *e.g.*, a chimpanzee, a.k.a. "Chimpy". Which of the above biological traits would such a Chimpy need to share with human beings to be considered as a "natural person" human being and, thus, eligible

for patent inventorship? Scientifically, what distinguishes Chimpy from a human being are unique traits distinguishing our species from all other hominins and primates. There is approximately a 1.3% difference in gene content between chimpanzees and human beings. Given the 98.7% similarity in gene content, Chimpy has key unique biological traits common to human beings.

Imagine if Chimpy underwent some sort of genetic manipulation process to have the two chimpanzee chromosomes 2 fused into one chromosome, just like in the case of human beings, or modify the 1.3% difference in gene content. However, barring any further changes to the relevant laws, regulations, or ethics, the modifications required to make this 1.3% modification, even if scientifically possible, would not legally be possible in most of the world, unless there is a country having certain relaxed oversight. Assuming ethical standards permit such experiments, at least in certain jurisdictions, imagine the creation of Chimpy having the minimal necessary gene modifications or Chimpy having all the 1.3% gene modifications, and imagine Chimpy having a chip implanted in his brain (*e.g.*, a chip manufactured by Blackrock Neurotech, Neuralink, or the like), where this chip is trained with AI to give Chimpy the ability to cover the function of certain genes, such as FOXP2, SRGAP2, ARHGAP11B, and NOTCH2NL. Therefore, in these situations, it may be conceivable that Chimpy could talk and communicate like, *e.g.*, Sophia, and can also create and invent like, *e.g.*, DABUS. Chimpy is then a living entity that matches *Homo sapiens* and can communicate, think and create, thereby providing Chimpy with sufficient genetic attributes to meet this part of the definition of a "natural person". Chimpy would then have some of the necessary biological traits, such as fully bipedal locomotion, while the brain implant would give Chimpy, at a minimum, the power of speech and fine motor control, the capacity for advanced abstract thinking, the ability to communicate using complex language, to make use of symbols, and to learn from other "natural person".

Considering all these attributes, would Chimpy be considered as a "natural person" and/or a *Homo sapiens*, a modified chimpanzee, or something else? For example, an argument could be made that, at a minimum, the modifications resulting in Chimpy would necessarily create a sort of animal-human hybrid, which is clearly more than a legal animal. From a different perspective, how would Chimpy compare to an electronic entity, such as Sophia? As mentioned, in the EU, a robot shall be considered intelligent when it has five criteria (mentioned above). If the EU is willing to consider a robot, having an absence of life (one of the 5 criteria) as intelligent, and potentially a "natural person", how should Chimpy, having a clear biological life, be considered?

Viewed from a different perspective, it seems unarguable that a human having an implanted brain chip, an implanted synthetic organ, or other artificial constructs to enhance brain function, increase intelligence, reduce emotions, or the like, would still be considered as a person. With that being true, there is a very real question as to where the line should be drawn for a hybrid person. Some currently enacted bioethics laws and human rights treaties emphasize the protection of individuals from forced genetic modifications, cloning, or transhumanist alterations that may affect their legal status as "natural person". For example, the Universal Declaration on the Human Genome and Human Rights asserts that genetic modifications should not alter the dignity and identity of the human species [44]. Accordingly, clarity is needed regarding the quantity of deviation from a standard "natural person" that should be permissible before an entity is no longer considered as a "natural person".

Depending on interpretation, Sophia and/or Chimpy could arguably be viewed as satisfying the criteria of a "natural person" under certain readings of existing law, thereby revealing a potential ambiguity in the current legal wording. The question becomes, should Sophia, newer electronic humans like Sophia, or Chimpy, having the requisite combination of features and attributes, be considered as a hypothetical "natural person" that matches the definition of a natural person? Should any of these entities qualify as a "natural person" entitling them to be named as an inventor on a patent application? Are the current standards related to "natural person" inventorship sufficient? Our view is that the current laws in this regard are insufficient and additional clarifications may be required. This does not suggest that current law recognizes such entities as inventors, but rather that the absence of a precise definition of "natural person" leaves room for interpretive uncertainty. Taking things a step further, one could make the argument that, because Sophia was designed, created, and built by a "natural person", and Chimpy would be designed and altered by a "natural person" (or even by a robot like Sophia), any inventions made by Sophia or Chimpy are a direct result of this "natural person" efforts, thereby entitling them to recognition as inventors and rendering the resulting invention eligible for patent protection. What if, instead, Sophia is sufficiently aware to design, develop, and create an electronic "child" having even more aspects of a natural person? What if Chimpy gives birth to a "child" having all the same human-like characteristics as the parent? Would either of these scenarios result in an entity considered as a natural person? We believe, should one or more of these situations occur, this would be evidence of procreation, and should thereby bring Sophia, Chimpy, and/or their "children", even closer to being considered as a "natural person" and, therefore, eligible for inventorship. This would seem to be even further

removed from our currently existing laws. In this case, it is an open question as to whether Sophia, Chimpy, or their progeny would be bound by any current laws. Furthermore, as a construct of a "natural person", it is unlikely that Sophia or Chimpy would be considered liable or accountable under any existing laws. These scenarios shed light on potential gaps in the definition of certain legal terms, which can affect long-term coherence. Accordingly, there is an urgent need around the world to update our laws such that they can manage these new scenarios resulting from such rapid technological advancements. Furthermore, moving forward, it will be very important to implement a new series of laws resolving how to handle natural personhood, and thus inventorship, for artificially created intelligent beings.

4.3 Theoretical foundations of the "natural person" inventor requirement

The discussion above covers the theoretical and biological aspects of AI and cybernetic hybrids. However, going one step back, one may argue that the "natural person" requirement for inventorship extends beyond statutory text and is closely connected to the underlying purposes of patent law, including utilitarian incentive theory and Lockean labor theory. This section discusses these theories and whether they necessarily require inventorship to be limited to "natural person" and asserts that a highly sophisticated robotic system or a cybernetic hybrid such as the examples mentioned in the section above do not inherently conflict with these foundational theories of patent law.

Utilitarian theory justifies patent protection as a policy tool designed to promote technological progress. For example, in the U.S., patents exist "to promote the Progress of Science and useful Arts" [45]. Thus, patents are granted because exclusive rights incentivize innovation, investment, disclosure, and commercialization. A hypothetical cybernetic hybrid such as Chimpy would not automatically defeat this theory. Even if Chimpy himself does not meaningfully respond to economic incentives, patent ownership may still belong to humans or corporates with exclusivity rights. If the owners continue to invest, develop, and commercialize inventions, societal progress remains aligned with the constitutional purpose of the patent system. Furthermore, if the mentioned hybrids, such as Sophia, have the potential to develop cognitive capacities comparable to those of humans, would it not be reasonable that they could also develop an understanding of economic incentives and act in response to them? In that case, extending patent incentives to such entities, in theory, should stimulate additional innovation and thereby benefit society.

Lockean labor theory holds that when a person applies intentional labor to previously unowned resources, they

acquire a moral claim over the resulting product. In patents, this translates into recognition of intellectual labor, *i.e.* the inventor is the one who forms a definite and permanent inventive concept through cognitive effort. If Chimpy is trained to form inventive concepts through genuine cognitive deliberation and intentional mental activity (which is possible as is clear from the case of DABUS inventions), and if Chimpy could develop feelings (like Sophia does) in such a way he is proud of being recognized for his cognitive efforts in generating novel technical solutions, then, would Chimpy not be, in principle, satisfying the core requirement of intellectual labor? In that sense, Chimpy would not inherently violate Lockean theory.

4.4 Operational patent doctrine: conception, reduction to practice, and chain of title

In addition to fulfilling utilitarian incentive theory and Lockean labor theory, patent inventorship should ultimately satisfy the operational mechanics of patent law. In other words, a determination of patent inventorship, whether human, AI, or animal-human hybrid, should rest entirely on the doctrinal and statutory requirements of conception and reduction to practice. While these requirements already exist in the law, more clarity is needed regarding their meaning and interpretation to adjust to a rapidly changing world. The discussion below focuses on certain potential updates to the law to meet these challenges, representing how we believe the law should adapt to reflect current and future realities.

Under current U.S. law, conception requires a definite and permanent idea formed in the mind of the inventor. In other words, conception means the inventor has a complete and definite idea of the invention in their mind before it is built. It is a mental act requiring intellectual dominion over the invention. Current doctrine presupposes not only that the mind of a "natural person" can form such intent, but that a "natural person" is required. However, DABUS has already demonstrated that this fundamental assumption is no longer necessarily true based on its creation of two different inventions: *i)* a fractal-based food and beverage container designed to improve grip and heat transfer, and *ii)* a flashing light beacon intended to attract attention in emergencies. Thus, the functional requirement of conception has already been satisfied in principle by an entity other than what is currently considered as a "natural person". Extending this real-world situation even further to the possibility of a genetically modified hybrid, like Chimpy, it is clear to the present authors that requiring a "natural person" as an inventor, without further clarity, no longer sufficiently reflects current realities.

Regarding reduction to practice, this reduction to practice may be actual (building and testing the invention) or

constructive (filing a patent application). Chimpy can perform experimental work and independently build prototypes, just like NASA's Mars rovers (*e.g.*, Curiosity and Perseverance) can autonomously select targets, drill into rocks, analyze samples, and conduct chemical experiments using onboard laboratories without real time human control. When it comes to filing a patent application, if the law can attribute legal personality to corporations, ships, estates, and even environmental entities, there is no reason why this cannot apply to non-human inventorship.

As to chain of title and assignment, patent rights initially vest in the inventor and may then be assigned to another party. Assignment requires legal capacity to contract, with intent to transfer rights, as well as to execute a binding instrument. If a hybrid entity lacked legal capacity to contract or execute assignment instruments, the chain of title would be disrupted. Again, however, "legal persons" in the form of, for example, corporations, estates, environmental entities, and the like, already have the legal capacity to sign binding agreements. Why, then, should a different standard apply to DABUS, Sophia, or Chimpy? If, for example, a cybernetic hybrid such as Chimpy is granted recognized legal personhood (like Sophia was) with the capacity to enter contracts, retain counsel, and execute legally binding documents, there would be no inherent structural barrier to executing an assignment. In that scenario, Chimpy could validly transfer patent rights in the same manner as a "natural person" or corporate entity. The challenge would therefore not lie in the mechanics of assignment, but in the antecedent decision to recognize such an entity as a legally capable inventor. Under that assumption, Chimpy would not necessarily conflict with incentive theory, Lockean labor principles, or the procedural and transactional architecture of patent law.

The central and most consequential issue is accountability. A machine, regardless of legal symbolism such as citizenship, cannot execute the oath or declaration required under 35 U.S.C. § 115, nor can it assume fiduciary duties or assign rights absent statutory reform. Thus, even if Sophia or Chimpy could hypothetically qualify as a "natural person", patent doctrine is intertwined with assumptions not only about human cognition and agency, but also about legal accountability. Imagine, for example, a scenario in which Sophia was to undertake surgical procedures on human subjects. If large harm was caused in this process, who would bear legal responsibility in such a case? Could Sophia be subject to medical licensure requirements, malpractice liability, or regulatory oversight? Similarly, if a cybernetic hybrid such as Chimpy were to invent an engineering device that later failed catastrophically, could criminal or civil liability meaningfully attach to Chimpy? Could Chimpy be taken to jail? Therefore, there is a clear need to update our

laws to ensure the definition of "natural person" is clearly articulated. These changes are needed now to avoid potential future problems and issues based on any ambiguities as identified in this article. Without such updates and changes, significant tensions within the broader legal system will eventually lead to harmful societal consequences.

4.5 Policy gaps, risks, and loopholes

As artificial systems approach human-like cognitive capacities, how should the law redefine, or even defend, the boundaries of humanity? And what happens next? Even if Sophia or Chimpmy are not sufficiently advanced to be considered as "natural persons", this will not necessarily be true for future generations of electronic humans and more advanced hybrids. As such, it is important to consider at what point Sophia, Chimpmy, or their next generations, could qualify as an inventor and update our laws to avoid such a scenario. And whether, barring any new laws or statutes, these answers might change as time marches on and people's perceptions change.

The possibilities of similar legal loopholes are practically endless. For example, what if an AI blackmails a human into creating an invention, thereby entitling the human to claim inventorship, while the real inventor is the AI? What if an AI creates an idea and asks a "natural person" to be the named inventor? A fully conscious AI will likely not be bound by the same system of ethics as are "natural person"; what if such an AI unethically pretends to be a "natural person" and thereby become a named inventor? Even worse, what if the unethical AI creates records for a fake "natural person" who can then be a named inventor? Will these scenarios open doors to have an uncontrollable inventorship? Urgent updates to our laws of inventorship are needed to account for such scenarios ahead of time.

Further, any ambiguities in how these questions may be answered, or country specific variations in any such answers, are problematic. Statutory use of an "individual" or a "natural person" without commonly accepted definitions will create interpretive pressure as technological developments challenge traditional biological categories, and further complications will develop. Without harmonization, forum shopping may exploit differences in disclosure expectations, patent grant rates, and patent enforceability.

5 Recommendations

Building on the interpretive ambiguities identified above, this section advances *de lege ferenda* proposals aimed at clarifying the definition of "natural person" in patent law. The USPTO's November 28, 2025, and in many other

jurisdictions, Inventorship Guidance clarifies that while AI-assisted inventions are not categorically unpatentable, an AI system cannot be considered as an inventor as they are not a "natural person". The same is true in many other jurisdictions. However, the Guidance does not provide a definition of "natural person", nor does it eliminate ambiguity regarding biologically modified entities capable of functional cognitive equivalence. As argued herein, the convergence of cognitive capacity, intentional conception, legal personhood, and contractual capacity in a sufficiently advanced artificial or hybrid entity could place significant interpretive pressure on the existing statutory language and Guidance. Any functional reinterpretation would inevitably risk fundamentals of accountability, moral agency, and the constitutional foundations of the patent system.

To guard against doctrinal erosion, reform efforts are urgently needed. Such efforts, for example, could begin with legislative clarification codifying a clear and generally accepted definition of a "natural person", qualified to be considered as an inventor, while explicitly and unambiguously defining that term to exclude non-human biological entities as well as any artificial or hybrid constructs, irrespective of their cognitive sophistication. By explicitly defining a "natural person" in biological terms, lawmakers would clarify the "natural person" criterion and prevent functional equivalence arguments from gradually expanding the category of inventors beyond its historical and constitutional foundations.

These reforms would not impede AI-assisted innovation, as is specifically mentioned in the 2025 Guidance; instead, they would safeguard doctrinal clarity and promote broader societal stability. Furthermore, International coordination will be critical to effectively implement these changes. It will be necessary for the USPTO, EPO, WIPO, and other IP5 Patent Offices around the world to work together to minimize divergence and promote consistent outcomes.

Should a genuine need develop in the future to extend intellectual property protection to highly advanced artificial or hybrid entities, such protection need not require expanding the existing category of "natural person" inventorship. Instead, lawmakers could consider the creation of a distinct and carefully circumscribed legal category tailored specifically to such entities. The incentives for such protections should be fundamentally different from ownership rights or commercialization privileges. This category should ensure continued human oversight and control. They should also prohibit full autonomy of such artificial or hybrid entities. This way new categories of protection that help transparency could be developed without altering the foundational principles governing human inventorship or diluting the doctrinal coherence of the current patent system.

6 Conclusions

To date, to incentivize human ingenuity, patent systems have centered inventorship on "natural person". However, this term is not clearly defined in statutory text. This article shows that this ambiguity creates interpretive vulnerabilities. For example, artificial and hybrid entities with advanced cognitive capacities represent potential gaps because of that definitional ambiguity. This can have severe legal and societal implications. To keep pace with technological development, lawmakers and patent offices should address these definitional ambiguities and pursue greater harmonization in AI-related inventorship standards across jurisdictions. The definition of "natural person" in patent law should be clarified, and it should explicitly exclude artificial, and in particular, hybrid entities, including non-human biological organisms, regardless of functional or cognitive equivalence.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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References

- Patent, U. S., Office, T.: USPTO Issues Inventorship Guidance Examples AI Assisted Inventions. United States Patent and Trademark Office (2024).
- Iancu, A., Elluru, R.: When AI Helps Generate Inventions, Who Is Inventor?. Center for Strategic & International Studies (2024).
- Pretz, K.: A First AI System Named Inventor. IEEE Spectrum (2022).
- Cloud, P.E. et al.: AI IP Year in Review—AI Inventorship: Navigating Patent Rights Around Globe. Sterne Kessler Goldstein and Fox PLLC 2025.
- Lim, P.H., Li, P.: Artificial Intelligence and Inventorship: Patently Much Ado in the Computer Program. J. Intellect. Prop. Law Pract. 17(4), 376–386 (2022). <https://doi.org/10.1093/jiplp/jpac019>
- Kim, D.: AI-Generated Inventions: Time to Get the Record Straight? GRUR Int. 69(5), 443–456 (2020). <https://doi.org/10.1093/grurint/ikaa061>
- Aboy, M., Liddell, K., Lath, A.: Inventorship in the Age of AI: Examining the USPTO Guidance on AI-Assisted Inventions. J. Intellect. Prop. Law Pract. 20(7), 495–502 (2025). <https://doi.org/10.1093/jiplp/jpaf019>
- Ding, W., Deng, S.: The Patentability of AI-Generated Technical Solutions: Institutional Responses From a Chinese Perspective and Other Countries. Information 16(8), 629 (2025). <https://doi.org/10.3390/info16080629>
- Zhou, H.Z.: Breaking the Boundary of the Concept of Inventor in Patent Law in the Age of Artificial Intelligence—The Limitations of Anthropocentric Legislation: a Look at the DABUS Case Future Trends AI Res 2(1), 6–11 (2025). <https://doi.org/10.26855/ftair.2025.06.002>
- Gordon, J.-S.: Artificial Moral and Legal Personhood. AI Soc. 36(2), 457–471 (2020). <https://doi.org/10.1007/s00146-020-01063-2>
- Avila Negri, S.M.C.: Robot as Legal Person: Electronic Personhood in Robotics and Artificial Intelligence. Front Robot AI 8, 789327 (2021). <https://doi.org/10.3389/frobt.2021.789327>
- Bharati, D.R.K.: AI and Intellectual Property: Legal Frameworks and Future Directions. Int. J. Law Just. Jurisprudence 4(2), 207–215 (2024). <https://doi.org/10.22271/2790-0673.2024.v4.i2c.141>
- Ferrero Guillén, R., Breckwoldt Jurado, A.: Vagueness in Artificial Intelligence: the "Fuzzy Logic" AI Related Patent Claims. Digit. Soc. 2(1), 3 (2023). <https://doi.org/10.1007/s44206-022-00032-0>
- Congress, U. S.: 35 U.S.C. 101. United States Code (1952).
- Patent, U. S., Office, T.: 9th ed., Rev. June 10 2020. Manual of Patent Examining Procedure (2020).
- Congress, U. S. 35 U.S.C. § 100(f). United States Code.
- University of Utah v. Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V., 734 F.3d 1315 (Fed. Cir. 2013).
- Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237 (Fed. Cir. 1993).
- Egbonu, K.: The Latest News DABUS Patent Case. IP STARS from Managing IP (2025).
- Sanchez del Campo, A.: Artificial Intelligence Pushes Boundaries Intellectual Property. Garrigues Intellectual Property Blog (2020).
- Patent, U. S., Office, T.: USPTO Decision Petition, In Re Application No. 16/524,350. Decision of the Commissioner of Patents (2020).
- Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).
- Assembly, G. G.: Official Code Georgia Annotated § 1–2–1. O.C.G.A.
- Legislature, L.: Louisiana Civil Code Article 24. Louisiana Civil Code.
- Congress, U. S.: 1 U.S.C. § 8(a). United States Code.
- Tattersall, I.: *Homo Sapiens*. Encyclopaedia Britannica (2025).
- Garner, B. A.: Black's Law Dictionary. Thomson Reuters (2024).
- Office, E. P.: Article 81 EPC. European Patent Convention.
- Office, E. P.: Rule 19(1) EPC. European Patent Convention.
- Office, E. P.: Article 60 (1) EPC. European Patent Convention.
- EPO Board of Appeal, J 0008/20 – Designation of inventor/DABUS.
- EPO Board of Appeal, J 0009/20 – Designation of inventor/DABUS II.

33. Belda Cerda, F.: EPO Rules Only Humans Can be Inventors – Another Blow DABUS Patents. Clifford Chance Talking Tech (2022).
34. Parliament, N. Z.: Te Awa Tupua Act. New Zealand Public Act 2017 No 7 (2017).
35. Schneider, K.: Why You Should Be Excited About India's "Rivers with Rights" Ruling. Nonhuman Rights Project (2017).
36. Salomon v. A Salomon & Co Ltd [1897] AC 22 (HL).
37. Parliament, E. European Parliament Resolution 16 February 2017 Recommendations Commission Civil Law Rules Robotics 2015/2103 (INL). European Parliament (2017).
38. Reynolds, E. The agony of Sophia, the world's first robot citizen condemned to a lifeless career in marketing (2018).
39. Law, C.: Sophia, Robot Citizenship, and AI Legal. Cartland Law (2024).
40. Hanson, D.: The Making Sophia: Rolling Base. Hanson Robotics (2019).
41. Hamilton, S.: What Technology is Sophia? Tech Shepherd (2023).
42. Hanson, D. The Making Sophia: Sophia's Legs. Hanson Robotics (2019).
43. News, C. Charlie Rose Interviews... A Robot? (2017).
44. UNESCO, Universal Declaration on the Human Genome and Human Rights (1997).
45. United States Constitution, Article I, § 8, Clause 8.

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