CAUSATION AND CONCEPTION IN AMERICAN INVENTORSHIP*

DAN L. BURK†

ABSTRACT

Increasing use of machine learning or "artificial intelligence" (AI) software systems in technical innovation has led some to speculate that perhaps machines might be considered inventors under patent law. While U.S. patent doctrine decisively precludes such a bizarre and counterproductive result, the speculation leads to a more fruitful inquiry about the role of causation in the law of inventorship. U.S. law has almost entirely disregarded causation in determining inventorship, with very few exceptions, some of which are surprising. In this essay, I examine those exceptions to inventive causality, the role they play in determining inventorship, and their effect in excluding consideration of mechanical inventors under current law.

INTRODUCTION

Machine learning systems are now routinely employed in the generation of technical innovation across a wide range of fields, including electronics, biotechnology, and mechanics.[1] Such pattern recognition or statistical optimization technologies fall under the general category of "artificial intelligence" or "AI" and are commonly referred to as such, although they involve no indicia of general intelligence whatsoever.[2] But given their capacity for generating novel outputs based on patterns developed from massive data sets, often well beyond human ability to manipulate such data, every indication is that these AI systems will find

† Chancellor's Professor and Distinguished Professor of Law, University of California, Irvine. The author thanks Mark Lemley for helpful comments on a previous draft of this article.

[1] *See* Iain M. Cockburn, Rebecca Henderson, & Scott Stern, *The Impact of Artificial Intelligence on Innovation: An Exploratory Analysis*, *in* THE ECONOMICS OF ARTIFICIAL INTELLIGENCE 115 (Ajay K. Agrawal, Joshua Gans, & Avi Goldfarb eds., 2019).

[2] *See* M.C. Elish & danah boyd, *Situating Methods in the Magic of Big Data and AI*, 85 COMMC'N MONOGRAPHS 57, 61–63 (2018) (describing the current emphasis on machine learning after the failures of research into "good old fashioned" artificial general intelligence).

wider and more frequent application in the subject matter areas associated with patents.[3]

Some who have a tendency to anthropomorphize and romanticize such machines have suggested that AI software devices that generate novel technical outputs are engaged in "inventing" as if they were human, and should be recognized on patents as inventors in the legal sense of that term.[4] Indeed, there has been a concerted effort by proponents of this approach to file patent applications in a variety of jurisdictions, asserting that a machine is the inventor of the claimed subject matter.[5] Courts and administrators around the world who have reviewed such applications have overwhelmingly rejected them, repeatedly holding that their organic statutory or treaty authority extends patent inventorship only to human applicants.[6] For some, this raises the question whether, if AI-generated devices are precluded from patenting, a human possessing or overseeing

[3] Specifically, new and useful processes, machines, compositions of matter, and articles of manufacture. *See* 35 U.S.C. § 101 (listing the subject matter eligible for patents).

[4] In fact, an extensive research literature documents the propensity of nearly *everyone* – including computer scientists who are thoroughly familiar with their technology – to fallaciously attribute human attributes to machines. *See* Deborah G. Johnson & Mario Verdicchio, *AI, agency and responsibility: the VW fraud case and beyond*, 34 AI & SOC'Y 639, 645 (2019); Kate Darling, *Who's Johnny? Anthropomorphic Framing in Human-Robot Interaction, Integration, and Policy*, *in* ROBOT ETHICS 2.0: FROM AUTONOMOUS CARS TO ARTIFICIAL INTELLIGENCE 173 (Patrick Lin, Keith Abney & Ryan Jenkins eds., 2017); Diane Proudfoot, *Anthropomorphism and AI: Turing's Much Misunderstood Imitation Game*, 175 ARTIFICIAL INTELLIGENCE 950, 951 (2011).

[5] *See* Andreas Engel, *Can a Patent Be Granted for an AI-Generated Invention?*, 69 *GRUR INT'L* 1123 (2020) (describing attempts to apply for a patent in asserting a machine as inventor); Imogen Ireland & Jason Lohr, *"DABUS": The AI Topic that Patent Lawyers Should be Monitoring*, 287 MANAGING INTELL. PROP. 23 (2020) (same).

[6] *See, e.g.*, Thaler v. Vidal 43 F.4th 1207 (Fed. Cir. 2022) (upholding rejection of patent application naming a machine as inventor in the United States); Thaler v. Comptroller General of Patents Trade Marks And Designs [2021] EWCA (Civ) 1374, [2022] Bus LR 375 (Eng.) (upholding rejection of patent application naming a machine as inventor in the United Kingdom); J 0008/20 (Designation of inventor/DABUS) (EPO Bd. App. Dec. 21, 2021) (upholding rejection of patent application naming a machine as inventor in the European Patent Office). The sole exception to date of this global consensus is the patent registration system in South Africa, which does not examine patent applications, and so issued a patent to a machine as inventor without meaningful review. *See Meshandren Naidoo & Christian E. Mammen, Guest Post: DABUS Gains Traction: South Africa Becomes First Country to Recognize AI-Invented Patent*, PATENTLY-O *(Aug. 4, 2021),* https:// patentlyo.com/patent/2021/08/traction-recognize-invented.html.

the AI in question could be named on an application as the beneficial claimant.[7] Some commentators have couched this in terms of seeking the "literal inventor" or "true inventor" of a patented invention, differentiating between a human who might be named on the application and the device that generated the claimed process or device.[8]

Inquiries of this sort might be considered "academic" in both the negative and positive senses of that term. In its negative sense, "academic" connotes intellectual exercises that are conceptually rarified, pragmatically fruitless, and divorced from real-world application. Imagining robotic inventorship for current technology certainly fits that definition. But "academic" may also connote intellectually challenging and stimulating queries worthy of intense study. And in this latter sense of the term, ruminations on AI inventions may surpass the irrelevance or triviality implied in the former sense. Academic hypotheticals and thought experiments, although factually fabulous, may generate insights into more practical problems, and an academic inquiry into AI may similarly lead us to a better understanding of what we mean by invention and inventorship.

In particular, I have suggested in previous work that one potentially fruitful line of inquiry into AI-generated inventions allows us to consider the role of causation in various parts of patent law.[9] The role of causation in patent law is generally undertheorized and underappreciated, such that a better understanding could illuminate several important patent doctrines.[10] Having said that, the role of causation in the American law of inventorship seems a bit of a dead end, as it is dramatically truncated by the valorization of the mental work of inventorship.[11] American patents are in effect premised on a transcendent ideal approaching that of Platonic forms.[12] Yet, even though causation has

---

[7] *See* David L. Schwartz & Max Rogers, *Inventorless Inventions? The Constitutional Conundrum of AI-Produced Inventions*, 35 HARV. J. L. & TECH. 531, 565 (2022).

[8] *Id.*

[9] Dan L. Burk, *AI Patents and the Self-Assembling Machine,* 105 MINN. L. REV. HEADNOTES 301, 317–18 (2021).

[10] Some first steps may be found in Amy Landers, *Proximate Cause and Patent Law*, 25 B.U. J. SCI. &TECH. L. 330 (2019) and Dmitry Karshtedt, *Causal Responsibility and Patent Infringement*, 70 VAND. L. REV. 565 (2017).

[11] Burk, *supra* note 11, at 321.

[12] *See* Stephen Watt, *Introduction* in REPUBLIC vii, xiv– xv (John Llewellyn Davies & David James Vaughn trans., Wordsworth Editions rev. ed. 1997) (reviewing Plato's theory of idealized forms). Perhaps unsurprisingly, this is also the case for patent's cousin system of copyright. *See* Dan L. Burk, *Method and Madness in Copyright Law*, 2007 UTAH L. REV. 587, 616 (noting that copyright's requirement of original expression appears to stand outside the causal order of the universe.)

a diminished role in the law concerning inventorship, I will suggest here that it is not altogether absent, and will point out three inventorship circumstances where the law deems causation relevant.

I therefore begin with a brief review and illustration of the law regarding inventorship, showing why non-human devices are wholly excluded from the category of inventors in U.S. patent law. This very straightforward, almost trivial conclusion provides an opportunity to examine the more interesting question of causation in American inventorship. Although the law on inventorship largely disregards questions of conceptual causation, I show that causation does in fact matter for inventorship in three discrete areas, including a somewhat surprising application in the doctrine of patent eligibility. I conclude with some observations as to why the three areas I identify might sensibly be treated differently than the law of inventorship more generally.

I. HUMANS AND THEIR TOOLS

Much of the impetus for discussions around machine inventorship seems to be based upon the misimpression that the machines act "autonomously" or independently in performing their functions.[13] This concept is only sustainable by excluding from consideration the multitude of human interactions and support that makes the AI's functions possible. We could also say that my dishwashing machine acts "autonomously," cleaning dishes without my intervention, even when I am physically absent from the site of operation. We can only say that, of course, if we ignore my loading and unloading the racks, filling the detergent chambers, setting the washing program, and starting the machine – not to mention ignoring the vast supply chain of manufacturers, retailers, installers, and repair personnel who make the machine's few moments of apparent autonomy possible. The same is unquestionably true for AI systems; they are entirely dependent on a host of human interactions in order to operate.[14]

But the converse is also true. Although machines never operate independent of human interaction, it is at the same time exceedingly rare for humans to operate independent of supporting technology. Recognizing this pervasive interdependence allows us to realize that humans are by nature cyborgs, extending their natural capabilities by means of technological prostheses: eyeglasses, bicycles, screwdrivers, circular

---

[13] Burk, *supra* note 11, at 318–19 (addressing the fallacy of AI autonomy).
[14] Carys Craig & Ian Kerr, *The Death of the AI Author*, 52 OTTAWA L. REV. 35, 69 (2021) ("Indeed, it is not an exaggeration to say that AI outputs often represent the work of several villages of humans.").

saws, microscopes, colorimeters, centrifuges, fractionation columns.[15] A screwdriver or wrench extends the capabilities of the human hand; a microscope or colorimeter extends the capabilities of the human eye; a calculator or statistical software package extends the calculative capabilities of the human mind. Machine learning systems similarly extend human pattern recognition capabilities in extracting correlations from massively large data sets.[16] And whatever kinds of tools we are considering, it is now routine for such tools to be tools that are automated and programmed to operate without direct oversight, or even in the physical absence of their users. This is true of machine learning software as well.

We may therefore observe that human work, especially in technical areas, is *always* a collaboration among human and non-human actors.[17] Innovation rarely occurs unmediated by a variety of tools, including highly automated implements. This suggests that when considering innovative technical developments, whatever we take to be the meaning of terms like "literal inventor" or "true inventor," it cannot possibly be a device somehow divorced from human participation; no such immaculate technology exists. Neither is it likely that a human inventor eschewed all tools in reducing an invention to practice (presumably by constructing the invention with only her bare hands). Neither such meaning for the term "inventor" is likely or even plausible. And, as we shall see, certainly no such meaning is suggested under the law of inventorship.

II. CONSIDERING CAUSAL PROXIMITY

However, with increasing technical mediation of the inventive process, we might wonder whether tools come inappositely between the human actor and the ultimate output. The human actor may be increasingly proximately removed from the work, and we might ask whether there is a degree of causal remoteness at which we would no

---

[15] Clive Lawson, *Technology and the Extension of Human Capabilities*, 40 J. THEORY SOC. BEHAV. 207 (2010); *see also* Donna Haraway, *The Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century*, *in* SIMIANS, CYBORGS, AND WOMEN: THE REINVENTION OF NATURE 149, 150 (1991) (adopting the concept of "cyborg" to reject rigid boundaries between human and machine or nature and culture).

[16] *See* Adrian Mackenzie, *The production of prediction: What does machine learning want?*, 18 EUR. J. CULTURAL STUD. 429, 435 (2015); Luciana Parisi, *Critical Computation: Digital Automata and General Artificial Thinking*, 36 THEORY CULTURE & SOC'Y 89, 90–92 (2019).

[17] *See* Bruno Latour (aka Jim Johnson), *Mixing Humans and Nonhumans Together: The Sociology of a Door-Closer*, 35 SOC. PROBS. 298, 305 (1988).

longer ascribe the inventive output to the human. This is certainly the case when distinguishing among contributing human actors; the involvement of a given contributor may be so remote as to no longer be considered a proximate cause of the inventive outcome. For example, financing of research is critical to inventive outcomes and is typically a causal necessity for innovative work to occur, but we generally do not ascribe the invention, or award the patent, to the banker or venture capitalist who paid for the research. It may similarly be that human initiation of invention becomes at some point causally overshadowed by other intervening non-human actors.

In this light, we consider the following set of inventive scenarios:

1) Jane uses a wrench to assemble a novel and nonobvious machine.
2) Jane builds a remote manipulator arm or "waldo" that she employs from a distance to handle a wrench, so as to assemble a novel and nonobvious machine.
3) Jane programs the remote manipulator arm to execute a series of defined steps, thus deploying the wrench to assemble the novel and nonobvious machine while she is away performing other tasks.
4) Jane employs an AI machine learning system to control the robotic manipulator arm; the AI iteratively learns the steps needed to properly assemble the novel and nonobvious machine for which Jane has supplied the parts.
5) Jane employs an AI machine learning system to control the robotic arm; she supplies parts that the AI iteratively learns how to assemble into a novel and nonobvious machine of a design not previously envisioned by Jane.

It is of course possible to construct a variety of additional illustrative scenarios,[18] but this sequence is sufficient for the present purpose. In each case, Jane's inventive activity is mediated by a technical tool, and in every case the material outcome of the tool's action is initiated by Jane. Jane is always the causal first mover. But progressing from the first scenario to the last, Jane's interaction with the material outcome becomes increasingly removed in space, in time, and in physical contact. Stated differently, as we progress from the first to the last scenario, the mediation of the technical apparatus becomes more pronounced, and

[18] As I have previously done to explore the causal requirements in copyright originality. *See* Dan L. Burk, *Thirty-Six Views of Copyright Authorship, by Jackson Pollock*, 58 HOUS. L. REV. 263 (2020).

Jane's causal connection to the material outcome becomes increasingly remote, diluted by intervening technological actions.

Our question here, then, is whether the causal distance between Jane and the inventive result matters to inventorship. In particular, does Jane's participation in the material instantiation of the invention ever become so remote that we would no longer consider her causal initiation to constitute an act of invention of the creative output that is ultimately claimed in a patent? In other words, is there some degree of causal distance at which Jane becomes the equivalent of a financier or director of research whose acts may be a *necessary* causal factor in invention, but never is *sufficient* to merit designation as an inventor?

The key to answering that question is to understand *that American patent doctrine has almost entirely separated the act of invention from the act or acts of material instantiation of the invention.*[19] Under U.S. law, the act of invention is entirely mental work, dubbed "conception," which is bifurcated from the invention's "reduction to practice" as a material object.[20] Each of the scenarios outlining Jane's actions above depicts a version of reduction to practice of an invention, which is to say a version of the invention's material instantiation. Reduction to practice is never considered to be part of the act of invention, which is instead entirely a mental act of comprehension.[21]

Confusion between these elements of patentable invention seems to underly some of the more outlandish recent assertions about AI inventorship. As machine learning has advanced, aspects of research that were once undertaken by human labor are increasingly automated. Some commentators have mistakenly concluded that such activity means the machine is engaging in invention.[22] But the material work of innovation has, as outlined above, *nothing to do with inventorship under U.S. law*.

---

[19] *See* Pfaff v. Wells Elec., Inc., 525 U.S. 55, 60 (1998) ("The primary meaning of the word "invention" in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea. The statute does not contain any express requirement that an invention must be reduced to practice before it can be patented."). Professor Lemley discusses some 19th Century cases that seem to require reduction to practice for a completed invention. *See* Mark A. Lemley, *Ready for Patenting*, 96 B.U. L. REV. 1172, 1174–75 (2016). However, this is clearly no longer the law under *Pfaff* and other precedent.

[20] Sewall v. Walters, 21 F.3d 411, 415 (Fed. Cir. 1994); Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986).

[21] Townsend v. Smith, 36 F.2d 292, 295 (C.C.P.A. 1929).

[22] *See, e.g.*, Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079 (2016).

Conception is the work of the inventor.[23] Reduction to practice, whether done by the inventor herself, by a flock of lab technicians, or by an AI device, is neither necessary nor sufficient for inventorship.[24]

III. INVENTION AND CAUSALITY

Armed with this understanding, we may return to our question of causality. As I have observed in a previous context, the issue of causal proximity in American patent law is rendered almost entirely moot by the emphasis on the mental work of conception.[25] In general, the US law of inventorship has assumed little or no causal relation between conception and reduction to practice. Any tie between inventor and the material practice of invention, to reduction to practice, has been almost entirely severed. There is no requirement that the inventor engage in actually reducing the invention to practice at all.[26] Reduction to practice is necessary to obtain a patent on the invention, but this requirement may be satisfied by "constructive reduction to practice" through a detailed enabling description in the patent application.[27] The claimed invention need never be physically instantiated at any time before or during the lifetime of the patent.[28]

There is similarly no requirement of physical effort or of proximity between the two acts, mental and physical. Work done to instantiate the invention at a remote location, by someone other than the inventor, may satisfy the reduction to practice requirement.[29] The inventor may discover the invention with no work at all, in an unexpected sudden insight or an accidental happenstance.[30] Consequently, there is no labor

---

[23] Invitrogen Corp. v. Clontech Lab'ys, Inc., 429 F.3d 1052, 1063 (Fed. Cir. 2005).

[24] Acromed Corp. v. Sofamor Danek Grp., Inc., 253 F.3d 1371, 1380 (Fed. Cir. 2001); Mattor v. Coolegem, 530 F.2d 1391, 1393 (C.C.P.A. 1976); *see also* Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d, 1456, 1460 (Fed. Cir. 1998) ("[O]ne of ordinary skill in the art who simply reduced the inventor's idea to practice is not necessarily a joint inventor. . . ."); Fina Oil Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997)("The basic exercise of the normal skill expected of one skilled in the art, without an inventive act, also does not make one a joint inventor.").

[25] *See* Burk, *supra* note 11 at 321.

[26] Pfaff v. Wells Elec., Inc., 525 U.S. 55, 66 (1998).

[27] Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986).

[28] Dan L. Burk, *Patent Performativity,* 29 J. INTELL. PROP. L. 280, 307–08 (2022).

[29] *See* Cooper v. Goldfarb, 240 F.3d 1378, 1384–85 (Fed. Cir. 2001); Genentech v. Chiron Corp., 220 F.3d 1345, 1354 (Fed. Cir. 2000).

[30] Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185 (2009).

prerequisite for invention in US patent law – the inventor may work on the invention for fifty years, or for fifteen minutes. The quantum of effort involved in arriving at conception is irrelevant; all that matters is comprehending (and perhaps proving) a complete mental conception. The labor or lack of labor involved in reaching that point goes disregarded.

The disconnection between conception and causation is further seen in the severance of temporal order for inventive processes. There is no required sequence or ordering of conception and reduction to practice in American patent law. Typically we might expect that the inventor will conceive of the invention, and then implement it, reducing it to practice.[31] But this sequence is not essential; sometimes the invention may be implemented before conception occurs.[32] Such "simultaneous conception and reduction to practice" happens routinely in some arts, such as the chemical or biological arts, where a novel and unanticipated molecule may be synthesized or generated via automated processes.[33] Once the molecule is perceived and comprehended, conception occurs, even after it has already been materially instantiated.[34]

Thus, returning to our illustrative series of inventive vignettes above, it does not matter whether Jane personally wields the wrench that constructs the machine or does so from a distance, supervising either mechanical or human intermediaries who construct it. Neither physical activity is considered part of the act of invention, which occurs entirely in Jane's mind. The same is true of the last scenario in which the outcome was unforeseen by Jane until after the invention had been constructed. Once Jane comprehends the invention, completing the mental act of conception, she is an inventor. It does not matter whether the invention is physically constructed before she comprehends it, or after she does so.

Consequently, in every scenario above Jane may qualify as an inventor by virtue of conceiving the invention (and, concomitantly, the technical apparatus *never* qualifies as an inventor because it is incapable of such conception).[35] Jane may conceive before the invention is reduced to practice, or she may conceive after; the temporality of the conception is unimportant to the law. The implementation or reduction to practice may occur under Jane's direct control, or it may occur by automated technical action at a distance. It may occur while Jane is engaged elsewhere, or is asleep, without Jane's oversight. The mechanics may be removed from Jane's conception in space or in time. Indeed, to some extent, the actions

---

[31] Mahurkar v. C.R. Bard, Inc., 79 F.3d 1572, 1578 (Fed. Cir. 1996).
[32] *See* Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1207 (Fed. Cir. 1991).
[33] *See id.* at 1206; Alpert v. Slatin, 305 F.2d 891, 894 (C.C.P.A. 1962).
[34] *See* Burk, *supra* note 11 at 308.
[35] *Id.* at 307.

described in the scenarios are irrelevant to the question of invention, as no degree of involvement in reduction to practice *per se* ever qualifies as invention.[36]

Thus, we are able to clearly answer not only the question as to whether an AI can be an inventor (Answer: "no"), but also the question as to which, if any, of the humans surrounding the generation of an AI invention may be the inventor. Is it the designer of the AI? The programmer? The owner? The operator? The end license user? Under U.S. law, designing the AI that generates inventive output is clearly insufficient to make one an inventor. Plugging the AI into a power source or pressing the "on" switch that activates the AI does not make one an inventor either. Nor will training the AI and setting the parameters for the AI's operation necessarily make one an inventor of the AI's output. The *only act that makes one an inventor under U.S. law is the conception of the invention* as it is thereafter reduced to practice, either actually or constructively. One of the humans surrounding the machine, particularly the user, is likely to be the one to conceive of the AI's output as an invention, as Jane does in our last scenario, and whomever that human is will be the proper patent applicant before the United States Patent Office.[37]

IV. DERIVATION AND CAUSATION

I have now said that causation is almost entirely disregarded in the U.S. law concerning conception, and have shown in some detail the uncoupling of the inventive act from prior or subsequent activities involving the invention as conceived.[38] But there do exist at least three situations in which the causality of conception might be said to have been taken into account in U.S. patent law. In general, these exceptions to the rule have to do with antecedent influences on the act of conception. For example, in our last scenario above, Jane's conception is drawn from the prior reduction to practice of the invention as it is later claimed. In rare cases *unlike* the illustrative scenario, U.S. law takes such prior influences

---

[36] *See supra* notes 21 – 26 and sources cited therein.

[37] *Cf.* Thaler v. Vidal, 43 F.3d 1207, 1210 (2022) (holding that only humans qualify as applicants for U.S. patents).

[38] I note also in passing that other requirements for patenting, such as novelty and non-obviousness, are equally indifferent to conceptive causality. Certainly, a patent applicant who has copied the claimed invention from the prior art will fail novelty and non-obviousness. But if an invention is disclosed in the prior art, or could be conceived by one of ordinary skill from the prior art, it is unpatentable even if the applicant for a patent conceived it entirely independently of any knowledge of the prior art.

– either prior conceptions or prior material instantiation of the invention – into account in determining inventorship.

The first of these situations is well-known, which is the prohibition on claiming a conception of an invention that a patent applicant is alleged to have appropriated or "derived" from another, previous inventor.[39] Derivation of conception has historically disqualified an applicant from asserting inventorship or claiming that invention in a patent application. Under the previous, now superseded American "first to invent" statutory framework, a patent applicant was precluded from receiving a patent if "he did not himself invent the subject matter sought to be patented."[40] This brief provision lacked temporal or geographic restrictions, signaling that not only domestic derivation, but foreign derivation of any vintage was disqualifying.[41] Under the former statute, acts of derivation constituted a type of party-specific prior art that barred patenting by the deriver.[42] Derivation required proof of a complete conception of the invention by another and an enabling communication of the conception to the deriver.[43]

Although the current statute does not incorporate a definition of derivation, it makes reference to derivation, presumptively incorporating the definition from the previous statute and the interpretation of that definition.[44] In general, where Congress carries such a term forward from the previous version of the statute, we assume that it retains its former meaning unless Congress indicates otherwise.[45] Under the current statute, derivation remains grounds to negate the novelty of a patent application, preventing the patent from issuing to the deriver.[46] The statute explicitly provides for derivation claims to be brought in proceedings either in

[39] Oddzon Prod., Inc. v. Just Toys, Inc., 122 F.3d 1396, 1401 (Fed. Cir. 1997).
[40] 35 U.S.C. § 102(f).
[41] *Ex parte* Andresen, 212 U.S.P.Q. 100, 102 (Bd. App. 1981) ("The site of derivation need not be in this country to bar a deriver from patenting that subject matter."); P. J. Federico, *Commentary on the New Patent Act*, 75 J. PAT. & TRADEMARK OFF. SOC'Y 161, 184-85 (1993).
[42] Price v. Symsek, 988 F.2d 1187, 1190 (Fed. Cir. 1993).
[43] Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1576 (Fed. Cir. 1997).
[44] Joshua D. Sarnoff, *Derivation and Prior Art Problems with the New Patent Act*, 2011 PATENTLY-O PATENT L.J. 12, 14– 15.
[45] *See* Helsinn Healthcare S.A. v. Teva Pharm. USA, Inc., 139 U.S. 628, 633-34 (2019) ("[W]e presume that when Congress reenacted the same language in the AIA, it adopted the earlier judicial construction of that phrase.")
[46] 35 U.S.C. § 102(b)(2)(A); Robert P. Merges, *Priority and Novelty Under the AIA*, 27 BERKELEY TECH. L.J. 1023, 1033 (2012).

federal court[47] or before a board in the Patent Office.[48] But such claims are procedurally limited to a one-year period after the publication of a patent application or issue of the patent in question; after the statutory period, the formal derivation claim becomes unavailable.[49] Thus derivation is currently procedurally restricted, but still a viable concern.

A claim of derivation requires us to consider the antecedent origins of conception in a way that is typically disregarded for inventorship. Oskar Liivak has pointed out that the derivation provisions of the patent statute effectively impose a requirement of originality on patent law.[50] Here we speak of originality in the sense most often discussed in copyright, where the subject matter of the statute must *originate* with the individual to whom the rights are assigned.[51] In patent law, we might say that the conception must originate with the "true inventor." Copied or derivative conception is excluded from inventorship.[52] To be sure, the deriver undoubtedly has a conception of the invention in the sense of forming in the mind an operative model of the invention as it is to be reduced to practice – this is what allows him to constructively reduce the invention to practice in an illegitimate patent application. But because the deriver's mental concept has its origin from another prior conceiver, it does not constitute an inventive conception.[53]

When considered in terms of causality, the derivation situation differs from other situations of inventorship in that we care *where* a conception of a claimed invention originated, and so care *how* it came to be claimed in a patent application. Conceptions, meaning detailed comprehension of the invention, of course occur routinely wherever an invention is disclosed, in a patent or otherwise–conception of this routine sort will occur in the mind of any person of ordinary skill who receives enabling information about the invention, including by reading a patent. But disclosure of such a derived conception in a patent application triggers a causal inquiry. Because a derived comprehension of the invention does not originate with the deriver, the deriver is not a proximate cause of an *inventive* conception.

---

[47] 35 U.S.C. § 291.
[48] 35 U.S.C. § 135.
[49] Sarnoff, *supra* note 46 at 13–14.
[50] Oskar Liivak, *The Forgotten Originality Requirement: A Constitutional Hurdle for Gene Patents*, 87 J. PAT. & TRADEMARK OFF. SOC'Y 261, 265 (2005).
[51] Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991).
[52] Solvay S.A. v. Honeywell Int'l Inc., 622 F.3d 1367, 1377–78 (Fed. Cir. 2010).
[53] *Id.* at 1377 ("[O]riginality is, nevertheless, inherent to the notion of conception.").

Since disclosure in a patent application constitutes constructive reduction to practice, this is also to say that in this instance we may care about the causal connection between conception and reduction to practice. We might say that a deriver is an improper cause of an actual or constructive reduction to practice, in effect intervening in or disrupting the causal relationship between original inventive conception and the disclosure of the invention in a patent application. If anyone is to file an application, it is to be the original conceiver of the claimed invention. Patent law thus requires a direct causal chain between original conception and patent disclosure; downstream conceptions in the causal chain do not qualify for inventorship.

V. CAUSALITY AND JOINT INVENTORSHIP

A second circumstance in which inventive causality may matter lies between the paradigms we have discussed of sole inventorship and illegitimate derivation. Our investigation so far largely assumes a single inventor, but it is well understood that most innovation now occurs in groups or teams, so that multiple people likely contribute to the development of an invention, raising the possibility of joint inventors.[54] This possibility somewhat modifies the paradigm for conception. Although conception is still the crux of inventorship under U.S. law, a joint inventor need not personally originate the complete conception of the invention. Instead, it is possible for an innovator to be considered a joint inventor by contributing to the conception of at least one claim in a patent application.[55] General suggestions or background contributions are not sufficient to become a joint inventor.[56] The contribution must be significant to the specific elements or limitations of the invention.[57]

It has been suggested that even if AIs lack the capacity to conceive, they might be considered in some sense joint inventors if they "contribute" to the conception of an invention by a human.[58] A moment's reflection reveals the absurdity of this position – many devices "contribute" in some fashion to the conception of an invention, supplying data or input that facilitates or enables the conception of an invention. But scintillation counters, laboratory scales, and statistical software packages are clearly not joint inventors. Neither are machine learning systems. Rather, the law contemplates a very particular type of "contribution" to the conception of at least one claim in order to qualify for joint

[54] Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709 (2012).
[55] 35 U.S.C. § 116(a).
[56] Garret Corp. v. United States, 422 F.2d 874, 881 (Ct. Cl. 1970).
[57] Fina Oil Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997).
[58] *See* Dennis Crouch, *A.I.Nventor*, PATENTLY-O (September 19, 2022) https://patentlyo.com/patent/2022/09/i-am-individual.html.

inventorship.[59] Not just any kind of input into the formulation of a conception will do.

Specifically, the contribution needed to become a joint inventor requires deliberative cognition and awareness. This conclusion is amply supported by case law. The Federal Circuit has repeatedly held that joint invention requires collaboration and concerted effort.[60] The joint inventors must be aware of one another's contributions, intending to contribute to the shared direction of inventive outcome.[61] This requires "open lines of communication in temporal proximity" to the inventive effort.[62] A joint inventor must also at some time have a conception of the combined inventive contributions.[63] Machine learning systems (and other automated or non-automated devices) are not collaborative, aware, or capable of intent of any kind. No iteration of Jane's inventive activity in the scenarios above, whether with the consciously manipulated waldo or the automated AI controller, constitutes collaboration that would qualify as "joint inventorship" with her devices.

Even for sentient co-inventors, not just any contribution toward conception constitutes joint inventorship, even when the contribution is substantial and essential to development of the invention. Take for example the case of Marlo Brown, an amateur veterinarian caring for sick cats, who collected data and hypothesized that a previously unknown virus was disabling the animals' immune systems.[64] She supplied this information to a professional research team that subsequently isolated and characterized Feline Immunodeficiency Virus (FIV).[65] The researchers patented several biological inventions related to the virus, over which Ms. Brown later sued, asserting that she should be named a co-inventor.[66] But Ms. Brown's careful work in gathering observational data and formulating

---

[59] Ethicon, Inc. v. United States Surgical Corp., 135 F.3d, 1456, 1460 (Fed. Cir. 1998) ("One who simply provides the inventor with well-known principles or explains the state of the art without ever having 'a firm and definite idea' of the claimed combination as a whole does not qualify as a joint inventor.").

[60] Dana-Farber Cancer Inst., Inc. v. Ono Pharm. Co., Ltd., 964 F.3d 1365, 1372 (Fed. Cir. 2020); Eli Lilly & Co. v. Aradigm Corp, 376 F.3d 1352, 1359 (Fed. Cir. 2004).

[61] *Eli Lilly*, 376 F.3d at 1359; Kimberly-Clark Corp. v. Proctor & Gamble, 973 F.2d 911, 917 (Fed. Cir. 1992).

[62] *Eli Lilly*, 376 F.3d at 1359.

[63] *Ethicon*, 135 F.3d at 1460 (holding that a contributing joint inventor must have "a firm and definite idea of the claimed combination as a whole").

[64] Brown v. Regents of Univ. of Cal., 866 F. Supp. 439 (N.D. Cal.) *appeal dismissed*, 47 F.3d 1179 (Fed. Cir. 1994).

[65] *Id.* at 440.

[66] *Id.* at 440–41.

a correct hypothesis did nothing to secure recognition as an inventor or even as a joint inventor, as she had not contributed to the mental formulation of the characteristics of the virus as claimed in the patent.[67]

As in the discussion above considering derivation, the law of joint inventor contributions can be regarded as a matter of inventive causation. The cases on joint inventorship establish a requirement of minimum proximate causation that is narrower and more stringent than actual causation. Acknowledging necessary, partial, but substantial causal relationships necessitates more complex considerations than those found in the routine law on conception or derivation. In contrast to the law on sole inventorship, joint invention requirements of substantiality, proximity, and intent serve not only to ensure the contribution is a necessary cause but also facilitate evidentiary proof of causal antecedence.

Taking the FIV example, Ms. Brown was unquestionably a cause-in-fact of the FIV patent claims; without her input, the claimed inventions would not have been conceived by the scientific team who filed the patent.[68] But being a necessary cause of conception is not the same as being a proximate cause of conception. Where innovation occurs separately or incrementally, building on or incorporating previous contributions without collaboration, the source of the separate contribution may be an actual cause of the ultimate invention but is not necessarily deemed an inventor. Contributions that are too far removed in space or time from the point of conception of the invention, or which are not expected nor intended to contribute to the conception cannot constitute joint inventorship.

VI. CAUSALITY FOR PRODUCTS OF NATURE

This brings us to a third, perhaps less immediately apparent, doctrinal area in which U.S. patent law cares about the causality of invention. Causal inventive considerations arise with regard to subject matter, specifically, the exclusion of "products of nature" and "laws of nature" from patent-eligible subject matter.[69] These exclusions from patent eligibility do not appear in the statute; they are common-law creations of judicial fiat.[70] Admittedly, neither the statute nor judicial reasoning about excluded subject matter is cast in terms of causation. But

---

[67] *Id.* at 444–45.
[68] *Id.* at 445 (holding that Ms. Brown played a "substantial role" in the discovery of the FIV virus, but not in the conception of the claimed inventions).
[69] *Gottschalk* v. *Benson*, 409 U.S. 63, 67 (1972); *Funk Brothers Seed Co.* v. *Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948).
[70] Alice Corp. v. CLS Bank Int'l, 573 US 208, 216 (2014).

causation is a logical, compelling, and fruitful framing of these subject matter exclusions.[71]

Thus, one way to approach this exclusion from patent eligibility is to categorize the perception of what exists in natural materiality as perhaps constituting conception, but not inventive conception. Humans daily, perhaps hourly, comprehend new objects and processes that are not considered to be inventions – cats, pine trees, rainstorms, rock formations. Detailed mental comprehension of these items and phenomena is routine. But such items, even if newly discovered, are typically characterized as non-inventive because what is perceived and comprehended is not considered to originate with human conception. The mental comprehension of the item may be new, but the item has been previously "reduced to practice" – a term I borrow here advisedly, with some caution – in the material environment. Thus, the subjects of such perception are not considered to originate in human handiwork.

This view of origination is of course fraught with a variety of philosophical, epistemological, and even physiological caveats. We assume that there is a material universe to be perceived and that what is perceived as external is largely or wholly caused by the characteristics of the universe. However, that perception may be altered, amplified, or supplemented by the process of perception itself. The resulting comprehension or conception of the world would – not unlike conception in joint inventorship – then appear to constitute a mélange of influences originating externally and cognitively. To the extent that the external input dominates the resulting comprehension, we regard it as originating externally, with our surroundings, and to be ineligible for patenting.

But the conceptual mix in some cases may favor influences deemed to originate with the perceiver, and conceptions of this type may be patent-eligible. A genetically modified cat or pine tree includes "natural" elements that do not originate in human conception, but to the extent that dominant elements originate in human conception and are reduced to practice by human manipulation, we may consider the result to be human handiwork. To the extent that such conceptions are dominated by elements originating with the perceiver, they may be patent-eligible. Thus, patent-eligible inventions based upon natural phenomena, but not

---

[71] I will note in passing that some other areas of subject matter, such as abstract ideas and mental steps are also excluded from patent-eligible subject matter. *See* Dan L. Burk, *The Curious Incident of the Supreme Court in* Myriad Genetics, 90 NOTRE DAME L. REV. 505. 525 (2014). Intriguingly, these categories – like inventive conception – are centered on cognitive or conceptual formulation of the invention but appear to have less to do with the causality of invention than with the distinctive articulation of invention.

constituting natural phenomena are common and permissible patentable subject matter.

This distinction might be well illustrated by the example of the hook and loop fastener, made famous under the brand name "Velcro."[72] The fastener was invented by George de Mestral, a Swiss engineer who noticed, after he had been out hiking with his dog, the thistle burrs that attached themselves to the animal's fur.[73] Microscopic inspection of the burrs revealed tiny hooks that fastened themselves to the fibrous loops of the dog's fur, and this structure prompted development of patented hook and loop fastening devices made from synthetic materials such as nylon.[74]

Thus, the conception of the invention was prompted by the structures found on plants in the wild. de Mestral could not have patented the burrs themselves (if for some reason he had wanted to) since their specific conception would have been wholly acquired from nature. The general idea or concept of the fastener system was also in a sense "derived" from nature, if we were to use that term very loosely. Certainly, de Mestral did not derive the invention from the thistles in the formal sense, as derivation requires a prior conception and communication of that conception to the deriver[75] – and thistles (like computer systems) cannot conceive of anything. And even though the hook and loop fastening concept and structure originated with the alpine flora, it would be fairly ridiculous to designate the burrs and thistles of the Swiss wilds as the "true inventors" of Velcro-style fasteners.[76] Neither were the thistles in any formal sense "joint inventors," despite having made a substantial contribution to the invention's conception, as thistles (like computer systems) have no intent to communicate or to collaborate on the invention.[77]

A more sensible framework may be to regard the relative contributions to an invention such as Velcro fasteners as a matter of causality. de Mestral was prompted to fashion hook and loop fasteners by the structure of the alpine burrs; the structure of the burrs became the structure of his device. Unquestionably, the seeds and burrs of the alpine meadows were necessary causal factors to the production of the invention. So, too, perhaps were de Mestral's dog, his engineering training, the

---

72 Ricardo Simpson & Sudhir Sastry, *Biomimetics: Learning from Nature,* 67 FOOD TECH. 116, 116 (2013).
73 HEATHER S. MORRISON, INVENTORS OF EVERYDAY TECHNOLOGY 46–47 (2016).
74 *Id*. at 46–48.
75 *See supra* note 43 and accompanying text.
76 *See supra* note 43 and accompanying text.
77 *See supra* notes 60 – 65 and sources cited therein.

microscope he used, the prior invention and development of nylon polymers, and even the Swiss cultural penchant for mountain hiking. But none of these constitute proximate legal causes of the hook and loop fastener. We trace conception of the invention as claimed only as far back as de Mestral. His re-creation of the fastener system as claimed substantially originated with him.

The same may not be said of a different example, the genetic sequences at issue in the United States Supreme Court's decision *Association for Molecular Pathology v. Myriad Genetics*.[78] There the Court considered patent claims to two types of DNA molecules: a genomic DNA or "gDNA" molecule that had been isolated from human cells, and a complementary DNA or "cDNA" sequence produced in the laboratory through a process called reverse transcription.[79] The Court declared the former type of DNA to be a product of nature, ineligible for patenting, but the latter molecule to be the proper subject matter for a U.S. patent.[80.]

This decision is somewhat puzzling on its face, because when considering the gDNA claims, the Court acknowledged that a molecule of that exact structure would not occur naturally, and was the product of human intervention, but asserted that the informational content of the molecule was derived from nature, rendering it patent ineligible.[81] However, when considering the cDNA sequence, which encompassed the same genetic information as the non-eligible gDNA, the Court declared it to be patent-eligible because its structure was not found in nature.[82] These holdings appear diametrically opposed and have been difficult for commentators and lower courts to reconcile.[83]

This contradictory reasoning might be logically solvable through the lens of causality, although certainly the Court never expressly uses such language in the opinion. The patent eligibility of the two molecules reflects the causal connection between the characteristics of the DNA molecule and the human activity associated with it. Concepts we have already considered from the law of derivation and joint inventorship lend themselves to this analysis. In each case, gDNA and cDNA, the patent applicant conceived and reduced to practice a molecular structure, but the

---

[78] 569 U.S. 576 (2013).
[79] *Id*. at 594–95.
[80] *Id.* at 596.
[81] *Id.* at 595.
[82] *Id.* at 595.
[83] *See* Dan L. Burk, *Beyond Abstraction: Applying the Brakes to Runaway Patent Ineligibility*, 3 J.L. BIOSCIENCES 697 (2016) (reviewing attempts to reconcile the Supreme Court's product of nature holdings.).

derivation – again using this term in a loose rather than in a formal sense – of the two molecules differs, leading to different outcomes for each.

The Court thus endorses patent eligibility for complementary DNA, where there is a close and substantial causal connection between the characteristics of the molecule and human activity. Patent eligibility is disallowed for gDNA where the causal human contribution is insubstantial – the differences in structure from the molecules' natural antecedent are simply an artifact of extraction from the cell, rather than an inventive or substantial contribution to the final product. And, while isolating and providing materials extracted from nature may involve substantial human *effort*, we have already said that effort goes unconsidered in the law of inventorship.[84] It is irrelevant what quantum of labor was invested in the final product. Origination of the molecule might be laborious or serendipitous. What matters instead is the closeness of causal chain between origination of the molecule and its actual or constructive reduction to practice.

We might say then that the outcome in *Myriad* for gDNA rests upon the premise that the discoverer of the molecule is not the proximate cause of the molecule. This formulation sidesteps Professor Liivak's problematic assertion that genes cannot be patent-eligible subject matter because they are "copied" from nature.[85] All human technology is copied from nature, as illustrated by Georg de Mestral, and as the Supreme Court has previously recognized.[86] The limiting factor is not emulation of nature, but the human emulator's causal proximity to the features of the claimed invention. And although proximate cause is a tricky legal metric to assess, courts commonly do so across a wide variety of areas, particularly criminal and tort law.[87] Thus, the means to assess inventive proximity should be readily available as part of the general legal analytical tool kit.[88]

CONCLUSION

With very few exceptions, United States patent law is generally indifferent as to the causality of the conception of an invention. It is clear

---

[84] *See supra* notes 29–30 and accompanying text.
[85] *See* Liivak, *supra* note 52.
[86] *See* Diamond v. Diehr, 450 U.S. 175, 189 n. 12 (1980) ("To accept the analysis proffered by the petitioner would, if carried to its extreme, make all inventions unpatentable, because all inventions can be reduced to underlying principles of nature which, once known, make their implementation obvious.").
[87] *See* Burk, *supra* note 20 at 267–68 (discussing the general tools for assessing proximate cause).
[88] *Id.*

that there cannot be too much distance between the invention claimed in a patent application and the inventor named on the application. At the far end of causality, current doctrine cannot and will not assign inventorship to someone who has no causal relationship to the invention whatsoever – a random stranger off the street whose name is added to the application (perhaps even without their knowledge) is not eligible. Individuals who supply attenuated inputs to invention, or who merely create the necessary environment for invention, are similarly precluded from inventorship – the owner of the building where the claimed invention is conceived or reduced to practice, the investor who supplies the financing and materials essential to the invention, even the director or supervisor of the laboratory who supports and encourages the work of invention are all ineligible under American law to be included on the application. Devices that supply inputs to invention are manifestly ineligible.

Instead, where conception of an invention originates with a patent applicant, which is to say where there is a direct and proximate connection between the applicant's conception and the patent claims, other adjacent antecedent and consequent causality is largely ignored. The circumstances for inventive conception may be intentional, accidental, laborious, instantaneous, discontinuous, or serendipitous – such circumstances are as a matter of inventorship disregarded. So long as conception occurs, the conceiver is an inventor. Conception may sometimes be difficult to prove; as with any legally relevant mental state it requires external evidence of an internal cognitive condition.[89] But as a rule for inventorship, the criterion is relatively simple and straightforward.

It is also generally consonant with the purposes and policies most often advanced for patenting. Patents are typically explained as exclusive rights awarded in order to foster investment in innovation.[90] Alternatively (though relatedly), patents may be justified as incentives to publicly disclose useful technical information.[91] Either of these rationales will often best be advanced by a fairly simple rule that assigns the rights quickly and easily. On this view, it may be more important to award property rights early and rapidly, expecting they will change hands later, so that little or nothing would be gained by complex, nuanced, and gradated standards attempting to trace the origins of an inventor's inspiration.[92] Similarly, if patent law favors early disclosure of new

---

[89] Price v. Symesk, 988 F.2d 1187, 1194–95 (Fed. Cir. 1993).
[90] Dan L. Burk, *The Law and Economics of Intellectual Property: In Search of First Principles,* 8 ANN. REV. L & SOC. SCI. 397, 407 (2012).
[91] *Id.* at 404–05.
[92] For example, complex and nuanced gradation is the approach for determining authorship in copyright, which arguably produces little advantage. *See generally*

information, simple rules may speed such disclosure to the public. Indeed, simpler and faster awarding of patents was one of the purposes of the United States Congress in moving from a complex schema awarding patents to the first inventor to a (somewhat) simpler rule of awarding patents to the first qualified inventor to apply.[93]

This leaves the question as to why the three exceptions I have identified here depart from the usual rule disregarding causality. I suggest that these departures are again generally consonant with the purposes for patent law reviewed just above, and that the limited recognition of conceptive causality furthers those goals. This is readily apparent in the instance of derivation. Patent law encourages public transfer of information at an early stage, but if derivation were allowable, early disclosures could be penalized by loss of rights to misappropriation. The law of patent derivation may thus be justified as a deterrent against excessive secrecy or security, much as the law of trade secrecy is justified – if the law allowed derivation of inventions, first conceivers would need to take measures to guard their ideas against misappropriation.[94] Without the derivation prohibition, early inventive disclosures could be hampered, delayed, or discouraged.

Similarly, patent law, instead of offering "all or nothing" incentives, typically attempts to encourage incremental and supplemental innovation.[95] Thus, rewarding joint contributions to inventorship would fall into line with patent policy generally, while awarding rights only to the conceiver of the full invention could penalize or deter desirable subsidiary contributions to the invention. Failure to recognize conceptive contributions could in effect encourage "partial derivation" of joint development, deterring incremental improvements, again creating

---

Burk, *supra* note 18 (attempting to trace the causality expectations in copyright authorship). Some commentators have opined that patent law encourages filing applications too quickly. *See* Lemley, *supra* note 21 at 1179; Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65 (2009).

93 *See* Dan L. Burk, *From 'First to Invent' to 'First to File' – Changing Lanes in U.S. Patent Procedure?*, 42 IIC – INT'L. REV. INT. PROP. & COMPETITION L. 627 (2011) (explaining the switching costs of moving to the simpler "first to file" regime); *see also Robert* P. *Merges*, *Priority and Novelty under the AIA*, 27 BERKELEY TECH. L.J. 1023, 1024 (2012) (characterizing the revised patent statute as having a "somewhat" simpler structure).

94 *Cf.* David D. Friedman et al., *Some Economics of Trade Secret Law*, 5 J. ECON. PERSPECTIVES 61, 67 (1991) (arguing that trade secrecy avoids inefficient investments in actual secrecy).

95 Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEXAS L. REV. 989 (1997).

counterproductive secrecy incentives. Consequently, relaxing the general rule against considering causality could further patent purposes.

Although less apparent, a similar rationale may be applied to the third exception, for subject matter encompassing laws and products of nature, where the exception to conceptive causality serves to mediate conception among otherwise disparate inventors. The Supreme Court has often characterized this exclusion from patent eligibility as a rule to preserve access to fundamental, common resources that all inventors need in order to innovate.[96] The subject matter exclusions are said by the Court to preclude one discoverer from "preempting" multiple downstream innovations.[97] Failure to recognize the primacy of such discoveries may in some cases lead to first-mover secrecy.[98] However, such secrecy is on average likely to be short-lived; in the absence of patent exclusivity, common principles from materiality can typically be independently re-discovered by anyone.[99] Derivation seems to be concerned with appropriating an invention from someone else; patent eligibility seems to be concerned with appropriating it from everyone else. Incentives to build on common knowledge are thus facilitated by prohibiting claims derived primarily from common knowledge.

Of course, the price of such concessions to the simple rule of conception is the reintroduction of some degree of complexity, but only in the restricted circumstances of misappropriation or collaboration.[100] However, the scope of these exceptions is limited by the causal parameters I have described above. In each case, causation separates wholly or partially original claims from those wholly or partially drawn from impermissible antecedent sources. Thus, causality provides proximity limits on the costs of the exceptions; to paraphrase Judge Andrew's famous observation on causation: accounting for convenience, policy, and a rough sense of justice, the law declines to trace the series of events related to conception beyond a certain point.[101] Proximity rules such as direct communication of derived conception, intentional and substantial

---

[96] *See* Katherine J. Strandburg, *Much Ado About Preemption*, 50 HOUS. L. REV. 563, 571 (2012).
[97] Alice Corp. v. CLS Bank Int'l, 573 US 208, 216 (2014).
[98] *See* Dan L. Burk*, Patents as Data Aggregators in Personalized Medicine*, 212 BOSTON U.J. SCI. & TECH. L. 233, 245–47 (2015) (discussing patents in genetic molecules as a deterrent to secrecy).
[99] Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 490-91 (1974).
[100] *Cf.* Carol Rose, *Crystals and Mud in Property Law*, 40 STANFORD L. REV 577 (1988) (describing the intermixture of nuanced legal standards with bright-line rules).
[101] Palsgraf v. Long Island Railroad Co., 248 N.Y. 339, 352 (Andrews, J., dissenting).

contributions to joint conception, and predominance of downstream origination all winnow the circumstances under which causal inquiries become more complex. Consequently, even when taken into account, causality serves to limit its own role in American inventorship.