

ATYPICAL INVENTIONS

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Patent law is constantly evolving to accommodate advances in science and technology. But, for a variety of reasons, some aspects of patent doctrine have not evolved over time leading to a growing disconnect between the patent system and certain technical communities. Particularly vulnerable to the ill effects of this disconnect are “atypical” inventions, which this Article defines as those in which either (1) a technical aspect of the invention or the inventive process does not conform to an established legal standard in patent law or (2) the technical underpinnings of the invention depart from well-established scientific paradigms. An example of the former is an invention which occurs by accident; an example of the latter is an invention which seems incredible in light of contemporary knowledge in the relevant field. Since these inventions often spark a paradigm shift in scientific and technological understanding, they have a high likelihood of stimulating significant creative activity and ultimately promoting the patent system’s overarching goal to promote scientific and technological progress. Thus, this Article argues that the patent system should evolve to better accommodate these inventions.

INTRODUCTION	2058
I. ACCIDENTAL INVENTIONS	2063
A. <i>The Inadequacies of the Current Invention Standard</i>	2063
1. The Pathway to Invention	2063
2. Unpredictability	2064
B. <i>Pinpointing Invention</i>	2066

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1.	Navigating the Current Framework	2066
2.	Problems	2069
a.	Conception	2069
b.	Reduction to Practice	2070
c.	Priority Issues	2070
C.	<i>An Alternative Approach</i>	2071
1.	Rethinking Invention Completeness	2071
2.	Policy Considerations	2075
a.	Tradeoffs	2075
b.	On Disclosure and Follow-on Innovation.....	2076
II.	INCREDIBLE INVENTIONS	2078
A.	<i>Assessing Credibility</i>	2078
1.	Red Flags in the Patent Office.....	2078
2.	Examining Incredible Inventions	2079
B.	<i>Limits of the Current Paradigm</i>	2081
1.	Proof Problems	2081
2.	The Credibility Lag in Science	2081
3.	Subjective Bias	2084
C.	<i>Refocusing the Inquiry</i>	2087
1.	Normative Thoughts	2087
2.	Alternative Screening Tools	2088
CONCLUSION	2090

[C]reativity, in the form of ideas, innovations, and inventions, has replaced gold, colonies, and raw materials as the new wealth of nations.¹

INTRODUCTION

Patent law is one of the most dynamic areas of the law because it must respond as the nature of the invention landscape changes to reflect advances in science and technology.² That being said, patent

¹ FRED WARSHOFKY, *THE PATENT WARS* 3 (1994).

² A famous example is the removal of judicially imposed limitations on patent-eligible subject matter. See *Diamond v. Chakrabarty*, 447 U.S. 303, 310 (1980) (holding that live, genetically engineered microorganisms are patentable); Rebecca S. Eisenberg, *The Story of Diamond v. Chakrabarty: Technological Change and the Subject Matter Boundaries of the Patent System*, in *INTELLECTUAL PROPERTY STORIES* 327, 327–57 (Jane C. Ginsburg & Rochelle Cooper Dreyfuss eds., 2006) (providing commentary). This responsiveness is not surprising because “any law[s] purporting to provide a regulatory foundation for innovation must be able to account for both the broad range of technologies and the rapid pace of [technological] change.” R. Polk Wagner, *Of Patents and Path Dependency: A Comment on Burk and Lemley*, 18 *BERKELEY TECH. L.J.* 1341, 1344 (2003).

law functions as a one-size-fits-all system in that all inventions—irrespective of technological field—must satisfy the same statutory patentability criteria.³ Thus, patent law evolves incrementally through individual judicial decisions where courts apply the technologically neutral provisions of the patent statute differently to different technologies.⁴ This framework in theory allows the patent system “to adapt flexibly to both old and new technologies, encompassing ‘anything under the sun that is made by man.’”⁵

Yet there is a disconnect between the patent system and science and technology. Part of the problem stems from the inability of law to evolve fast enough to keep pace with technological advances:

[The legal system] must run to catch up, and the moment it catches up, it falls behind again. The simple truth is that law evolves through a slow, incremental, and deliberative process In contrast, technology evolves as quickly as the human mind allows. The result is an increasingly wider “guidance gap”—the space between the new technology and the old law.⁶

3 The conditions for patentability are found in Title 35 of the U.S. Code. Briefly, the claimed invention must be useful (§ 101), novel (§ 102), nonobvious (§ 103), and directed to patentable subject matter (§ 101). In addition, § 112 paragraph 1 requires that the application adequately describe, enable, and set forth the best mode of carrying out the invention, and § 112 paragraph 2 requires that the application conclude with claims which delineate the invention with particularity. Congress enacted the current statute in 1952. *See* Patent Act of July 19, 1952, Pub. L. No. 82-593, 66 Stat. 792 (codified as amended at 35 U.S.C. §§ 100–376 (2006)).

4 *See* Dan L. Burk & Mark A. Lemley, *The Patent Crisis and How the Courts Can Solve It* 59–65 (2009); *see also* John F. Duffy, *The Federal Circuit in the Shadow of the Solicitor General*, 78 GEO. WASH. L. REV. 518, 544 (2010) (explaining that patent law “has traditionally had a common law feel to it” because the courts receive little guidance from statutory sources); Paul R. Michel, *The Challenge Ahead: Increasing Predictability in Federal Circuit Jurisprudence for the New Century*, 43 AM. U. L. REV. 1231, 1243–44 (1994) (noting that the general nature of the 1952 Patent Act requires the U.S. Court of Appeals for the Federal Circuit to “unavoidably fill[] in gaps and develop[] fine points”); Craig Allen Nard, *Legal Forms and the Common Law of Patents*, 90 B.U. L. REV. 51, 53 (2010) (noting that the common law is “the dominant legal force in the development of U.S. patent law”).

5 Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1576 (2003) (quoting *Chakrabarty*, 447 U.S. at 309). *But see* ADAM B. JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS* 203 (2004) (criticizing the one-size-fits-all regime and asking “whether we should have one set of patent rules that govern all inventions, or whether the system can be [improved] by tailoring patent rules to the specific attributes of different technologies”); Peter S. Menell, *A Method for Reforming the Patent System*, 13 MICH. TELECOMM. & TECH. L. REV. 487, 489–90 (2007) (arguing that a one-size-fits-all system leads to suboptimal levels of patent protection).

6 EDWARD LEE LAMOUREUX ET AL., *INTELLECTUAL PROPERTY LAW AND INTERACTIVE MEDIA* 8 (2009); *cf.* Earl Warren, *Science and the Law: Change and the Constitution*, 12 J.

This problem has become even more acute in recent years as technology evolves at an ever-increasing pace.⁷

But even if a gap is inevitable, three obstacles in the development of patent jurisprudence have exacerbated it. First, it took the courts a long time to realize that patent doctrines which emerged during the Industrial Age were incompatible with chemical and pharmaceutical inventions.⁸ Even as inventions from these experimental fields began to dominate the invention landscape, the courts continued to treat them as “a child (or orphan) of mechanical patent law.”⁹ Second, non-technically trained judges struggle to adjudicate patent cases involving technologically complex subject matter.¹⁰ This problem arose nearly a century ago¹¹ and shows no signs of abating.¹² Third,

PUB. L. 3, 5 (1963) (explaining that the development of science and technology and law do not advance hand in hand because “[t]he law lags behind until crisis stirs it into action.”).

7 See Oskar Liivak, *Maintaining Competition in Copying: Narrowing the Scope of Gene Patents*, 41 U.C. DAVIS L. REV. 177, 179 (2007) (“As technology advances with an ever-quickenning pace, is patent law agile enough to keep up?”); Joel Reidenberg, Professor, Fordham Law Sch., Remarks at the Fordham Intellectual Property, Media & Entertainment Law Journal Symposium (Nov. 16, 2007), in *Panel I: Patent Reform: Can the Law Keep Pace with Technology?*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 1025, 1027 (2008) (asking if continued developments in patent law can keep pace with developing technologies).

8 For instance, before World War II most inventions were electrical or mechanical in nature. As chemical and pharmaceutical inventions began to dominate the post-war invention landscape, the U.S. Patent and Trademark Office (PTO) and the courts tried to fit them into the mold of electrical-mechanical inventions. See John Hoxie, *A Patent Attorney's View*, 47 J. PAT. OFF. SOC'Y 630, 636 (1965); William D. Noonan, *Patenting Medical Technology*, 11 J. LEGAL MED. 263, 263–69 (1990) (describing how the courts developed a bias against patent applications involving biological systems and pharmaceutical compounds).

9 Paul H. Eggert, *Uses, New Uses and Chemical Patents—A Proposal*, 51 J. PAT. OFF. SOC'Y 768, 783 (1969); see also Hoxie, *supra* note 8, at 636 (explaining the judiciary's reluctance to rethink their interpretation the patent statutes when faced with newer technologies). “This shoehorning [often] led to nonsensical outcomes” Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919, 947–48 (2011).

10 “It is an almost universal complaint of patent lawyers that they have to plead before judges who have no training in the technical aspects of the case, and no adequate way of learning” NORBERT WIENER, *INVENTION* 134 (1993); see also James F. Holderman, *Judicial Patent Specialization: A View from the Trial Bench*, 2002 U. ILL. J.L. TECH. & POL'Y 425, 428–32 (describing the challenges faced by generalist judges in patent cases).

11 See, e.g., *Parke-Davis & Co. v. H.K. Mulford Co.*, 189 F. 95, 115 (C.C.S.D.N.Y. 1911) (“I [must call] attention to the extraordinary condition of the law which makes it possible for a man without any knowledge of even the rudiments of chemistry to pass upon [patent matters] . . . for only a trained chemist is really capable of passing upon such facts”), *aff'd in part, rev'd in part on other grounds*, 196 F. 496 (2d Cir.

the courts might be reluctant to develop and modernize the common law in order to promote stability and predictability in patent law.¹³ Together, these obstacles have contributed to the judiciary's development of what Professors John Duffy and Craig Nard describe as "an isolated and sterile jurisprudence that is increasingly disconnected from the technological communities affected by patent law."¹⁴

1912); *In re Perrigo*, 48 F.2d 965, 966 (C.C.P.A. 1931) (observing that the applicant's disclosure was so complex that if the court "reverse[d] the experts [in the PTO] and grant[ed] the patent sought, it would be a 'leap in the dark'"). The U.S. Court of Customs and Patent Appeals (C.C.P.A.) was a predecessor to the Federal Circuit. The Federal Courts Improvement Act of 1982 abolished the C.C.P.A. See Pub. L. No. 97-164, 96 Stat. 25 (codified as amended in scattered sections of 28 U.S.C.). Soon after its creation, the Federal Circuit adopted the C.C.P.A. decisional law as binding precedent. See *S. Corp. v. United States*, 690 F.2d 1368, 1370 (Fed. Cir. 1982) (en banc).

12 See Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1197 (2002) ("Even the Federal Circuit, which does not suffer nearly so much from these limitations, is not in a position to fully understand all of the science it encounters." (footnotes omitted)); Kimberly A. Moore, *Forum Shopping in Patent Cases: Does Geographic Choice Affect Innovation?*, 79 N.C. L. REV. 889, 932-34 (2001) (suggesting that specialized patent trial courts would develop expertise in patent law and increase accuracy in resolving patent disputes); Arti K. Rai, *Engaging Facts and Policy: A Multi-Institutional Approach to Patent System Reform*, 103 COLUM. L. REV. 1035, 1068-69 (2003) (describing the technical limitations of Federal Circuit judges and their staff).

13 Cf. Rochelle Cooper Dreyfuss, *In Search of Institutional Identity: The Federal Circuit Comes of Age*, 23 BERKELEY TECH. L.J. 787, 827 (2008) (arguing that the Federal Circuit has made great strides in "making patent law more determinate," but that it has struggled "to keep patent law responsive to changing technological facts and emerging national interests"); Peter Yun-hyoung Lee, *Inverting the Logic of Scientific Discovery: Applying Common Law Patentable Subject Matter Doctrine to Constrain Patents on Biotechnology Research Tools*, 19 HARV. J.L. & TECH. 79, 109 (2005) ("As time and science move forward, the law struggles to keep pace while, at the same time, resisting change in order to maintain stability." (citation omitted)); see also FED. TRADE COMM'N, TO PROMOTE INNOVATION ch. 6, at 15 & n.90 (2003) (exploring additional criticisms).

14 Craig Allen Nard & John F. Duffy, *Rethinking Patent Law's Uniformity Principle*, 101 NW. U. L. REV. 1619, 1620-21 (2007); see also Rochelle Dreyfuss, *Pathological Patenting: The PTO as Cause or Cure*, 104 MICH. L. REV. 1559, 1569 (2006) (arguing that the restructuring of the scientific enterprise and the problems posed by technological change should have led to major developments in patent jurisprudence); Senator Orrin G. Hatch, Keynote Address at The Federal Circuit: The National Appellate Court Celebration and Introspective Symposium (Mar. 18, 2009), in 78 GEO. WASH. L. REV. 513, 514 (2010) (arguing that the patent system has not been able to keep up with innovation because while "[t]he courts have interpreted the law in the light of change, [] that piecemeal process has left areas of the law unclear and out of balance—leaving some important, unresolved gaps"); Wagner, *supra* note 2, at 1344 ("To bind the patent law to the technological assumptions of an earlier era, or to the maturity of any particular technology, would be exceedingly foolish.").

Particularly vulnerable to the ill effects of this disconnect are atypical inventions, which this Article defines as those in which either (1) a technical aspect of the invention or the inventive process does not conform to an established legal standard in patent law or (2) the technical underpinnings of the invention depart from well-established scientific paradigms. An example of the former is an invention which occurs by accident; an example of the latter is an invention which seems incredible in light of contemporary knowledge in the relevant field.

Two characteristics set atypical inventions apart from others. First, they are often revolutionary, meaning that the claimed product or process is radically different from what came before.¹⁵ Sometimes these inventions can spark what the great historian and philosopher of science Thomas Kuhn described as a “paradigm shift” in scientific and technological understanding.¹⁶ Second, atypical inventions often represent a significant technological leap forward. This can take the form of achieving what was previously thought unachievable or transforming a complex process into a simple one. Both paradigm shifts and technological leaps can unleash the creative potential of the human mind which, in turn, can create new possibilities¹⁷ and provide the creative fuel for more inventive activity.¹⁸

This Article argues that certain established legal standards should change to better accommodate atypical inventions. The proposal would not only represent a significant step forward in resolving the law-technology disconnect but also help fulfill broader goals of patent policy.¹⁹

The balance of this Article proceeds as follows. Part I explores a structural bias in current patent doctrine against accidental inventions. After explaining how the status quo can jeopardize the patent rights of one who invents by accident, this Part proposes an alternative

15 See Michael Hertz, *Invention*, in 2 ENCYCLOPEDIA OF CREATIVITY 95, 95 (Mark A. Runco & Steven R. Pritzker eds., 1999).

16 THOMAS S. KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* 66–67, 97–98 (1962). Ultimately the new paradigm becomes the norm unless and until it is too displaced. *Id.* at 151.

17 “To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.” ALBERT EINSTEIN & LEOPOLD INFELD, *THE EVOLUTION OF PHYSICS* 92 (1938).

18 See EVAN I. SCHWARTZ, *JUICE* 11–28 (2004).

19 See *Eldred v. Ashcroft*, 537 U.S. 186, 223 (2003) (Stevens, J., dissenting) (noting that this constitutional command is the “ultimate purpose” of the patent system); *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 511 (1917) (“[T]he primary purpose of our patent laws . . . is ‘to promote the progress of science and useful arts.’” (quoting U.S. CONST. art. I, § 8, cl. 8)).

framework which resolves that problem and fulfills broader goals of patent policy. Part II shows how one who seeks to patent a seemingly impossible invention can face insurmountable patentability hurdles. Although there is a need to ferret out truly inoperable inventions, this Part argues that the subjective nature of the current framework can exclude inventions with real technical merit. This Part solves this problem by setting forth a new paradigm rooted in objective, technical factors. Aside from being more consistent with broader goals of the patent system, implementing the new paradigm would allow patent law to remain on the cutting edge of technology.

I. ACCIDENTAL INVENTIONS²⁰

Accidental inventions are atypical because technical aspects of the inventive process do not conform to the substantive law of invention. This Part explains why and illustrates how inventors who invent by accident can be unjustly deprived of patents.

A. *The Inadequacies of the Current Invention Standard*

1. The Pathway to Invention

An invention can come into being in two different ways: by plan or by accident. Planned inventions arise when the inventor formulates a mental picture of the thing which is ultimately patented and then reduces the thing to practice. By contrast, accidental inventions arise through serendipity, meaning that the inventor makes something that was initially unsought.²¹ The key difference between the two paths is that in the latter, the inventor can only form a mental picture of the thing which is ultimately patented after it is made.

Perhaps it is not immediately apparent why the pathway to invention should matter. Inasmuch as patentability is concerned, the path to invention is irrelevant because patent law is more concerned with the thing to be patented rather than the path to the thing or the acumen of the person who made it.²² As Professor William Robinson

²⁰ Portions of this Part draw from my previous work on unplanned inventions. See Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185 (2009).

²¹ The eminent sociologist Robert K. Merton traces the term to the great eighteenth-century author Horace Walpole, who, in reference to the fairy tale *The Three Princes of Serendip*, wrote to a friend that these princes were “always making discoveries, by accidents and sagacity, of things which they were not in quest of.” ROBERT K. MERTON & ELINOR BARBER, *THE TRAVELS AND ADVENTURES OF SERENDIPITY* 2 (2004).

²² See *Eames v. Andrews (The Driven-Well Cases)*, 122 U.S. 40, 56 (1887) (explaining that an inventor’s ignorance of scientific principles is immaterial as long as the patent’s disclosure sets forth the “thing” to be done so that it can be reproduced);

wrote in his influential treatise on patent law, “[t]he law draws no distinction between those operations of the creative faculties which manifest themselves in long-continued study and experiment, and those which reach their end by sudden intuition or apparent accident.”²³ It is well settled that “the path that leads an inventor to the invention is expressly made irrelevant to patentability by statute.”²⁴

On the other hand, the pathway to invention can affect when an invention is invented for patent-obtaining purposes. It is a bedrock principle of patent law that the inventive process has two elements: conception and reduction to practice.²⁵ Since conception cannot occur until the inventor formulates “a definite and permanent idea of the complete and operative invention,”²⁶ accidental discoveries, at least at the moment of the serendipitous event, lack conception.²⁷ As discussed below, this idiosyncrasy can be problematic given the importance of the timing of the conception step in establishing patent rights.²⁸

2. Unpredictability

The reason why accidental discoveries fail to mesh with the substantive law of invention is an artifact of the law-technology disconnect.²⁹ Since most inventions were predominately mechanical or electrical in nature during the formative years of patent doctrine, the

Radiator Specialty Co. v. Buhot, 39 F.2d 373, 376 (3d Cir. 1930) (“It is with the inventive concept, the thing achieved, not with the manner of its achievement or the quality of the mind which gave it birth, that the patent law concerns itself.”); Earle v. Sawyer, 8 F. Cas. 254, 256 (C.C.D. Mass. 1825) (No. 4247) (“It is of no consequence, whether the thing be simple or complicated; whether it be by accident, or by long, laborious thought . . . that it is first done [because the] law looks to the fact, and not to the process by which it is accomplished.”).

23 1 WILLIAM C. ROBINSON, *THE LAW OF PATENTS FOR USEFUL INVENTIONS* 126 & n.1 (Boston, Little, Brown, & Co. 1890) (citing *Crane v. Price*, (1842) 134 Eng. Rep. 239 (Ct. Com. Pl.) 249 (“For if the invention be new and useful to the public, it is not material whether it is the result of long experiments and profound research, or whether of some sudden and lucky thought, or of mere accidental discovery.”)).

24 *Life Techs., Inc. v. Clontech Labs., Inc.*, 224 F.3d 1320, 1325 (Fed. Cir. 2000) (citing 35 U.S.C. § 103(a) (2000)).

25 See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986); 1 ROBINSON, *supra* note 23, at 116 (“[T]he inventive act in reality consists of two acts; one mental, the conception of an idea; the other manual, the reduction of that idea to practice.”).

26 *Hybritech*, 802 F.2d at 1376 (quoting 1 ROBINSON, *supra* note 23, at 532) (internal quotation marks omitted).

27 See *infra* Part I.B.

28 See *infra* Part I.B.2.

29 See *supra* notes 6–9 and accompanying text.

current conception-based invention standard reflects the foreseeability and coherency which often characterizes such predictable technologies.³⁰

By contrast, the pathway to invention is fundamentally different in experimental sciences like chemistry because results are often uncertain and unexpected. One must often engage in trial and error to figure out what works and what does not.³¹ It is in these unpredictable fields where accidental discovery is a common and widely acknowledged path to invention.³² Teflon³³ and SuperGlue³⁴ are just a few examples of substances that emerged from accidental or unexpected findings in the laboratory. This Article will focus on chemical inventions because of their pervasiveness in accidental discovery and the significant challenges that they have posed for the courts over the past half-century.

Even within the field of chemistry there are various types of accidental discoveries. For example, a scientist may accidentally discover a new use for a previously known compound (e.g., LSD, nitroglycerin).³⁵ This Article does not explore these types of accidents. Rather, it focuses on the scenario where a reaction ($A+B$) yields an accidental, unknown product (X) rather than the expected product (C):

30 The experimental sciences are regarded as “unpredictable” because one often cannot predict if a reaction protocol that works for one embodiment will work for others. See *infra* note 87 and accompanying text. On the other hand, inventions in applied technologies like electrical and mechanical engineering are often regarded as “predictable” because they are rooted in well-defined, predictable factors. *In re Vaeck*, 947 F.2d 488, 496 (Fed. Cir. 1991). For a deeper exploration of the predictable-unpredictable dichotomy, see Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 136–54 (2008).

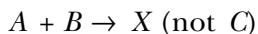
31 See Seymore, *supra* note 30, at 137–39.

32 See JOHN JEWKES ET AL., *THE SOURCES OF INVENTION* 63 (2d ed. 1969).

33 Tetrafluoroethylene Polymers, U.S. Patent No. 2,230,654 (filed July 1, 1939). Roy J. Plunkett accidentally made the substance at DuPont in 1938. See FRAN CAPO, *IT HAPPENED IN NEW JERSEY* 161–62 (2004). Plunkett’s original target was a new Freon compound made from tetrafluoroethylene gas. See ALAN G. ROBINSON & SAM STERN, *CORPORATE CREATIVITY* 176 (1997). Rather, the tetrafluoroethylene gas spontaneously polymerized, which, until then, had been thought impossible. *Id.* at 176–77.

34 See Alcohol-Catalyzed α -Cyanoacrylate Adhesive Compositions, U.S. Patent No. 2,768,109 (filed June 2, 1954). Eastman Kodak scientist Harry Coover synthesized cyanoacrylate with the aim of making optically clear plastic for precision gunsights. Coover discovered that the new substance was too sticky and “stuck to everything, almost instantly.” Harry W. Coover, *Discovery of Superglue Shows Power of Pursuing the Unexplained*, RES. TECH. MGMT., Sept.–Oct. 2000, at 36, 36.

35 See Hugo Kubinyi, *Chance Favors the Prepared Mind—From Serendipity to Rational Drug Design*, 19 J. RECEPTOR & SIGNAL TRANSDUCTION RES. 15, 18–19 (1999).



Two features of this type of accidental discovery are worth noting. First, sometimes the accident occurs not because of the inventor's misconception about *C*, but rather because of less-than-perfect experimental conditions. Several Nobel Prize-winning accidental discoveries occurred because of impurities in one of the starting materials (*A* or *B*) or in a reaction vessel.³⁶ Second, *X*'s discovery can trigger a paradigm shift in scientific thinking; particularly if *X* was inconceivable, appeared theoretically impossible, or was extremely difficult to prepare at the time of the serendipitous event.³⁷ The corollary is that at a given moment in time, sometimes *X* can come to light only through serendipity.

B. *Pinpointing Invention*

1. Navigating the Current Framework

The inventive process has two steps: conception and reduction to practice. In the chemical context, the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit") has held that the conception of a chemical compound requires knowledge of both the structure of the compound and an operative method of making it.³⁸ An inventor can satisfy reduction to practice in two ways: actually, by building and testing a physical embodiment of the claimed invention;³⁹ or constructively, by filing a patent application, which contains a disclosure that

36 Key examples include the accidental discoveries of the synthetic dye indigo (1905 Nobel Prize in Chemistry) and crown ethers (1987 Nobel Prize in Chemistry). One commentator observes that impurities have played such a major role in important discoveries "that one wonders whether our modern, highly purified reagents have eliminated one fertile source of new chemistry." Peter E. Childs, *Chemistry and Chance: Part 1*, CHEMISTRY ACTION!, (Oct. 1, 1997), <http://www.ul.ie/~childsp/CinA/issue50/chance.html>. Of course, the result (*X*) did not become reproducible until the scientists recognized the impurity. *See id.*

37 A famous example is the accidental discovery in 1985 of buckminsterfullerene, a remarkably stable cluster of sixty carbon atoms resembling a geodesic dome. *See* Harold W. Kroto et al., *C₆₀: Buckminsterfullerene*, 318 NATURE 162, 162-63 (1985); E. Osawa, *The Evolution of the Football Structure for the C₆₀ Molecule: A Retrospective*, in THE FULLERENES 1, 5-6 (H.W. Kroto & D.R.M. Walton eds., 1993) (recounting how the researchers initially thought that the synthesis "was almost impossible to realize"). This discovery won the 1996 Nobel Prize in Chemistry.

38 *See* Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1229 (Fed. Cir. 1994) (citing *Oka v. Youssefyeh*, 849 F.2d 581, 583 (Fed. Cir. 1988)).

39 *See* Cooper v. Goldfarb, 154 F.3d 1321, 1327 (Fed. Cir. 1998). An embodiment is a physical manifestation of an invention (like a chemical compound or a widget) described in a patent application or patent. *See* ROBERT PATRICK MERGES, PATENT LAW AND POLICY 11 (2d ed. 1992).

presumptively enables a person having ordinary skill in the art (PHOSITA)⁴⁰ to make and use the invention.⁴¹

The intricacies of this framework are important because in the United States, the first to invent is entitled to the patent.⁴² While the filing date of the patent application is presumptively the date of invention, an inventor can establish an earlier date—as far back as the date of conception—with adequate proof.⁴³ This is done to overcome or exclude a prior art reference⁴⁴ in patent prosecution,⁴⁵ to avoid a potentially invalidating prior art reference in litigation,⁴⁶ or to defeat

40 The PHOSITA is a hypothetical construct of patent law akin to the reasonably prudent person in torts. See *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987) (comparing the PHOSITA to the “‘reasonable man’ and other ghosts in the law”). Factors relevant to constructing the PHOSITA in a particular technical field include the sophistication of the technology, the educational level of the inventor, the educational level of active workers in the field, the types of problems encountered in the art, prior art solutions to those problems, and the rapidity with which innovations are made. See *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 697 (Fed. Cir. 1983).

41 See *Kawai v. Metlesics*, 480 F.2d 880, 886 (C.C.P.A. 1973). A constructive reduction to practice presumptively satisfies the disclosure requirements of 35 U.S.C. § 112 paragraph 1 (2006). See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986); see also *infra* note 67 (describing the Court’s holding in *Pfaff v. Wells Electronics, Inc.*, 525 U.S. 55, 67 (1998), that § 102(b) does not require an actual reduction to practice).

42 See 35 U.S.C. § 102(g) (2006) (giving the first inventor superior rights over others so long as the inventor has “not abandoned, suppressed, or concealed” the invention).

43 See *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed. Cir. 1996). For example, the inventor can obtain an earlier invention date by showing that it was physically made before the filing date. *Id.*

44 Prior art is defined in § 102 as documents (like issued patents and printed publications), knowledge, and activities which disclose earlier-developed technology. Prior art falls into two main categories: (1) the “novelty” provisions, § 102(a), (e), and (g), which depend on the invention date, and (2) the “loss-of-right” provisions of § 102(b), which depend on the applicant’s filing date.

45 Patent prosecution describes the process by which an inventor, usually through the help of an attorney, files an application with the PTO for examination. See generally JANICE M. MUELLER, *PATENT LAW* 42–63 (3d ed. 2009) (discussing Supreme Court’s holding that § 102(b) does not require an actual reduction to practice before an invention can be patented).

46 See *Mahurkar*, 79 F.3d at 1576–77 (explaining that once the alleged infringer has presented prior art that anticipates the claims, the patentee has the burden to offer evidence showing he invented the subject matter before the publication date of the prior art document). Patent litigation focuses on issued patents. A patentee whose rights have been infringed can compel an accused infringer to stop the infringing activity and pay for damages arising from the infringement that has already occurred. See MUELLER, *supra* note 45, at 325–31.

another party's claim to the invention.⁴⁷ Thus, the precise timing of inventive events can be important.

While navigating through this framework can be cumbersome for planned inventions, for accidental discoveries its formalistic application is theoretically untenable, unrealistic, and can produce unfavorable or absurd results for the serendipper. To understand why and help focus the discussion that follows, consider the following hypothetical example tracing the steps of an accidental invention.⁴⁸

On Day One, a scientist conducts what is expected to be a straightforward synthesis of a known organic compound, *C*. The scientist predicts that mixing *A* (a colorless liquid) with a pinch of *B* (iron chloride, an off-white powder added to speed up the reaction)⁴⁹ will yield *C* (also a colorless liquid). Although no one has previously reported preparing *C* by this route, knowledge in the field suggests that it should work. Accordingly, the scientist adds *A* and *B* to a flask and begins stirring the mixture. A few hours later, the scientist returns to the lab and finds that an unexpected bright orange powder, *X*, has settled to the bottom of the flask! The orange color indicates that *X* contains iron. At this point, the scientist immediately begins to isolate and purify *X*, which takes the remainder of the day. On Day Two, the scientist begins structure elucidation. The first test reveals that *X* is an aromatic compound, indicating that it will be unusually stable. Other tests throughout the day support this preliminary structural assignment. Yet, since a metal (iron) is involved, the scientist cannot make a definitive structure determination until obtaining an X-ray analysis of the compound. On Day Three, the X-ray data con-

47 Patent rights are only awarded to the first inventor. See 35 U.S.C. § 102(g) (barring issuance of a patent when another inventor has made the invention before the applicant). When two parties claim the same invention, a PTO tribunal known as the Board of Patent Appeals and Interferences institutes an "interference" proceeding to determine priority (i.e., which party is entitled to a patent). See *infra* note 59.

48 This hypothetical example is very loosely based on ferrocene, the discovery and characterization of which led to the 1973 Nobel Prize in Chemistry. The researchers set out to make an organic compound (a colorless liquid) but instead recovered an orange powder of "remarkable stability." See T.J. Kealy & P.L. Pauson, *A New Type of Organo-Iron Compound*, 168 *NATURE* 1039, 1040 (1951); see also Peter L. Pauson, *Ferrocene—How It All Began*, 637–39 *J. ORGANOMETALLIC CHEMISTRY* 3, 3–6 (2001) (discussing the discovery of ferrocene). Ferrocene is the first and best-known example of a metallocene which, in simple terms, describes a metal atom encapsulated between two aromatic rings. Its discovery and characterization spawned the rapid growth of organometallic chemistry in the second half of the twentieth century.

49 *B* is called a catalyst. These are substances (often metals) which speed up a reaction. Catalysts are typically recovered upon the completion of the reaction. See *ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY* 90 (James Trefil ed., 2001).

firm *X*'s structure: it is indeed an iron-containing aromatic compound. Next, the scientist repeats the synthesis and obtains the same result, *X*, on Day Four. Diligent testing over the next few weeks shows that *X* and its derivatives are useful in polymers, catalysis, and electrochemistry. In light of this utility, the scientist decides to file a patent application.⁵⁰

2. Problems

a. Conception

The current invention framework is ill equipped to handle this scenario. Precisely when did conception occur? Clearly, it is impossible for conception to exist at the moment of the serendipitous event because, at that point, the inventor does not yet know the specific chemical structure of *X*.⁵¹ Indeed, applying the current framework to this chronology suggests that *X* cannot be “invented” until later.⁵²

Pinpointing conception is tricky.⁵³ It appears that the earliest date that the scientist had an idea of *X*'s structure was on Day Two. By this point, the scientist clearly had a complete mental picture of *X* and could define *X* by its method of preparation as well as by its physical and chemical properties.⁵⁴ Thus, on Day Two, the scientist could sufficiently distinguish *X* from other compounds.⁵⁵ Although one could argue that this idea did not become “definite and permanent” until the X-ray data arrived on Day Three, these data did not alter the specificity of the scientist's idea.⁵⁶ In sum, under the current law, it appears that Day Two is the earliest possible date of conception.

50 One cannot obtain a patent on a compound merely because it is novel; it must also be useful. See *Brenner v. Manson*, 383 U.S. 519, 534–35 (1966). Utility is determined as of the applicant's filing date. See *In re Brana*, 51 F.3d 1560, 1567 n.19 (Fed. Cir. 1995).

51 See *supra* note 36 and accompanying text.

52 For a rare exception, see *infra* note 58, discussing the doctrine of simultaneous conception and reduction to practice.

53 See *Technitrol, Inc. v. United States*, 440 F.2d 1362, 1369 (Ct. Cl. 1971) (describing conception as “a pivotal if somewhat nebulous notion in patent law”); Douglas Lichtman et al., *Strategic Disclosure in the Patent System*, 53 VAND. L. REV. 2175, 2186 (2000) (referring to conception as “a technical concept”).

54 See *Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1206 (Fed. Cir. 1991) (explaining that conception of a chemical compound is lacking until the inventor “[is] able to define it so as to distinguish it from other materials, and to describe how to obtain it” (citing *Oka v. Youssefeyeh*, 849 F.2d 581, 583 (Fed. Cir. 1988))); *supra* note 36 and accompanying text.

55 See *supra* note 38.

56 See *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1229 (Fed. Cir. 1994) (noting that subsequent experimentation that reveals uncertainty as to the

b. Reduction to Practice

An actual reduction to practice probably did not occur until Day Four even though *X* was physically isolated on Day One. Under the current framework, the initial accident on Day One cannot serve as a reduction to practice because at that time the scientist did not contemporaneously recognize and appreciate *X*'s structure.⁵⁷ Recall that this did not happen until at least Day Two. Thus, it appears that the actual reduction to practice occurred on Day Four when the experiment was repeated.⁵⁸ This is absurd because it suggests that unexpected discoveries require at least two sets of experiments to establish an actual reduction to practice: the initial accident that leads to conception and a following experiment to reduce the conceived idea to practice. One would think that making the compound once in the form that is subsequently claimed should be sufficient to establish an actual reduction to practice.

c. Priority Issues

How might this time lag affect the scientist's patent rights? It can become important if the scientist has to prove the date of invention in order to avoid patent-defeating prior art or to prevail in a contest with

chemical's specific structure or identity can undermine conception and render it incomplete).

⁵⁷ See *Estee Lauder Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 593 (Fed. Cir. 1997) (explaining that conception and reduction to practice cannot be established retroactively because there must be contemporaneous recognition and appreciation of the invention).

⁵⁸ This reasoning is in accord with the general rule under the conception-reduction to practice framework that "[r]eduction to practice follows conception." *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1578 (Fed. Cir. 1996). There is a narrow exception known as the doctrine of simultaneous conception and reduction to practice (SCRTP). See *Smith v. Bousquet*, 111 F.2d 157, 159 (C.C.P.A. 1940) (establishing the doctrine). SCRTP arises in the rare instance where an inventor cannot formulate a complete picture of the invention until "reduc[ing] the invention to practice through a successful experiment." *Burroughs Wellcome*, 40 F.3d at 1229; cf. *Alpert v. Slatin*, 305 F.2d 891, 894 (C.C.P.A. 1962) (explaining that the doctrine is reserved for "a residuum of cases where results at each step do not follow as anticipated, but are achieved empirically by what amounts to trial and error"). For an example of the doctrine's application, see *Amgen*, 927 F.2d at 1206, which held that for an invention claiming a purified DNA sequence for encoding a protein, conception did not occur until after the fragment had been isolated and characterized. In sum, SCRTP arises when actual experimentation (which is also sufficient to fulfill the requirements of reduction to practice) is necessary to supply the knowledge to complete conception. See 2 R. CARL MOY, *MOY'S WALKER ON PATENTS* § 8:54 (4th ed. 2007). Turning to the hypothetical example used in the text, since it is clear that one could have formulated a mental picture of *X* before engaging in experimentation, SCRTP need not apply.

another inventor over the right to claim *X*. To illustrate the latter, consider the following hypothetical. Assume that while the scientist's patent application for *X* is pending in the U.S. Patent and Trademark Office (PTO), the examiner becomes aware of an application filed by another party who also claims *X*. To determine which party is entitled to the patent, the examiner declares an interference.⁵⁹ During the proceeding the other party submits evidence that establishes its conception of *X* on Day One followed by reasonable diligence toward a constructive reduction to practice.⁶⁰ Since the scientist cannot establish an earlier date of conception, the other party wins even though it filed its application last and never actually reduced *X* to practice! This unfortunate outcome reflects a structural bias in current patent doctrine against accidental inventions.

C. *An Alternative Approach*

1. Rethinking Invention Completeness

It is time for the patent system to adopt an invention paradigm that better accommodates accidental discoveries.⁶¹ One possibility is to dispel the notion that every invention must begin with conception. An alternative approach would allow the moment of the serendipitous

59 See 35 U.S.C. § 135 (2006). The Board of Patent Appeals and Interferences determines which party is entitled to a patent. See *supra* note 47. The party that first reduced the invention to practice usually wins; however, a party that was "first to conceive the invention but last to reduce it to practice" (either actively or constructively) will win if that party "demonstrates reasonable diligence [toward] reduction to practice." *Cooper v. Goldfarb*, 240 F.3d 1378, 1382 (Fed. Cir. 2001) (citing § 102(g)).

60 See *Sletzing v. Lincoln*, 410 F.2d 808, 810 (C.C.P.A. 1969) (exemplifying the rule in a chemical example); *Hull v. Davenport*, 90 F.2d 103, 105 (C.C.P.A. 1937) (articulating the rule). Preparation of the patent application can count as reasonable diligence toward a constructive reduction to practice. See *Bey v. Kollonitsch*, 806 F.2d 1024, 1027–28 (Fed. Cir. 1986).

61 There is little doubt that the current patent laws value mental activity over physical activity. See *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 60 (1998) ("[T]he word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."); *Burroughs Wellcome*, 40 F.3d at 1227 ("Conception is the touchstone of inventorship . . ."); Dan L. Burk, *Feminism and Dualism in Intellectual Property*, 15 AM U. J. GENDER SOC. POL'Y & L. 183, 192–93 (2007) ("[P]atent law elevate[s] mental effort over physical effort, conceptual production over material production [The physical] portions of the creative process are excluded, invisible, [and] unrecognized. This version of creative effort effectively . . . attribute[s] the entirety of creative production to a particular, discrete act of creative vision.").

event to serve as the invention date as long as the isolation of *X* is coupled with reasonable diligence toward elucidating its structure.⁶²

The theoretical underpinnings for it already exist in case law. The relevant cases wrestle with the extent to which an invention must be developed before pre-filing commercialization activity bars its patentability. The on-sale provision of § 102(b) of the Patent Act bars patentability if the invention was on sale more than a year before filing.⁶³ It serves to strike a balance between an inventor's need for adequate time after the sales activity to assess the value of a potential patent and the needs of the public, who may have come to believe that the invention is now in the public domain.⁶⁴ A key question is when does an invention reach the stage at which the on-sale bar attaches. The Supreme Court resolved this question more than a decade ago in *Pfaff v. Wells Electronics, Inc.*,⁶⁵ when it decided whether a written purchase order for mechanical sockets not physically made before the critical date was sufficient to have placed the invention "on sale."⁶⁶ The Court held that the invention must be "ready for patenting"⁶⁷ to trigger the one-year clock; a condition that is satisfied "by proof of reduction to practice before the critical date; or by proof that prior to the critical date the inventor had prepared drawings or other descriptions of the invention that were sufficiently specific to enable a [PHOSITA] to practice [it]."⁶⁸

62 Returning to the hypothetical, under this alternative framework *X* became a patentable invention on Day One because the serendipper began reasonable diligence toward structure elucidation immediately after isolation and purification of the compound.

63 A patent is invalid if "the invention was . . . on sale in this country, more than one year prior to the date of the application for patent in the United States." § 102(b).

64 See *King Instrument Corp. v. Otari Corp.*, 767 F.2d 853, 860 (Fed. Cir. 1985) (discussing the underlying policies of the on-sale bar).

65 525 U.S. 55 (1998).

66 See *id.* at 57–60. The "critical date" is the date "one year before the date on which the patent application was filed." *Monon Corp. v. Stoughton Trailers, Inc.*, 23 F.3d 1253, 1257 (Fed. Cir. 2001). So, for example, if an inventor filed an application on April 19, 1982, the critical date for § 102(b) purposes is April 19, 1981. If a triggering event occurred before the earlier date, the inventor (and for that matter, anyone else) has lost the right to a patent. See *Pfaff*, 525 U.S. at 57–58.

67 *Pfaff*, 525 U.S. at 67. The Court explained that § 102(b) does not require an actual reduction to practice before an invention can be patented. See *id.* at 60 ("[T]he word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea.").

68 *Id.* at 67–68. Applying this condition to the facts, the *Pfaff* Court decided that the patent at issue was invalid because the inventor had "prepared detailed engineer-

What is more important for present purposes is that after *Pfaff*, the Federal Circuit held that proof of conception is not required for an invention to be ready for patenting if it is physically made and sold in its claimed form.⁶⁹ The key case on point is *Abbott Laboratories v. Geneva Pharmaceuticals, Inc.*,⁷⁰ in which the Federal Circuit affirmed a summary judgment of invalidity because Abbott's claimed drug was offered for sale more than a year before filing.⁷¹ The parties did not dispute that a third party had sold the specifically claimed Form IV of the drug more than a year before Abbott's filing date. Yet, Abbott argued that the sale was not for the patented invention because the parties did not know at the time of the sale that the material sold contained Form IV. In rejecting Abbott's contention that there can be no on-sale bar unless conception of the invention has been proven, the Federal Circuit held that there was no requirement that the parties understand the details of what was sold.⁷² According to the court, the mere fact that the material was sold was conclusive and obviated any need for inquiry into conception.⁷³ Thus, "[t]he Federal Circuit held . . . that the invention had been reduced to practice even though it had yet to be conceived."⁷⁴

Abbott's lesson is that if the invention sold or offered for sale is physically made in the form that is subsequently claimed, it is suffi-

ing drawings that described the design, the dimensions, and the materials to be used in making the socket." *Id.* at 58, 68–69.

69 *See* *Abbott Labs. v. Geneva Pharms., Inc.*, 182 F.3d 1315, 1318 (Fed. Cir. 1999) ("We disagree that proof of conception was required. The fact that the claimed material was sold under circumstances in which no question existed that it was useful means that it was reduced to practice."); *Scaltech Inc. v. Retec/Tetra, L.L.C.*, 178 F.3d 1378, 1383–84 (Fed. Cir. 1999) ("Nor is there a requirement that [the patentee] must have recognized the significance of these limitations at the time of offer. If the [material] offered for sale . . . possessed each of the claim limitations, then [it] was on sale, whether or not the seller recognized that his [material] possessed the claimed characteristics." (citations omitted)).

70 182 F.3d 1315 (Fed. Cir. 1999).

71 *See id.* at 1318–19.

72 *Id.* at 1319 ("If a product that is offered for sale inherently possesses each of the limitations of the claims, then the invention is on sale, whether or not the parties to the transaction recognize that the product possesses the claimed characteristics.").

73 *See id.* at 1318–19. *But see* Timothy R. Holbrook, *The More Things Change, the More They Stay the Same: Implications of Pfaff v. Wells Electronics, Inc. and the Quest for Predictability in the On-Sale Bar*, 15 BERKELEY TECH. L.J. 933, 958 n.142 (2000) (arguing that the court rigidly applied *Pfaff* and adopted a strict interpretation of reduction to practice). But the on-sale bar may not be triggered if additional development of the invention occurs after the offer for sale because it might indicate that the invention was not complete. *See* *Space Sys./Loral, Inc. v. Lockheed Martin Corp.*, 271 F.3d 1076, 1080–81 (Fed. Cir. 2001) (citing *Pfaff*, 525 U.S. at 68 n.14).

74 Holbrook, *supra* note 73, at 958 n.142.

ciently complete and ready for patenting for § 102(b) purposes even if the inventor does not know all of its characteristics or have a complete mental picture of it. Although this is an unlikely scenario for predictable inventions like the mechanical socket at issue in *Pfaff*, it can arise in chemistry and other unpredictable fields which are prone to accidental discovery.⁷⁵

Given that conception is not required for § 102(b) purposes, it is hard to understand why it must be required for patent-obtaining purposes. Turning back to the hypothetical, if the substance obtained at the time of the accident, X, is the form that will be claimed, the serendipitous event, supported with adequate proof,⁷⁶ should be sufficient to establish an invention date for priority purposes even though the inventor's precise knowledge of the structure comes shortly thereafter. Put somewhat differently, when the initial accident is followed by reasonable diligence toward structure elucidation, the events are so connected "that they are substantially one continuous act."⁷⁷ Thus, there should be symmetry between invention completeness for patent-defeating purposes and for patent-obtaining purposes.⁷⁸

75 See *supra* Part I.A.2; *infra* notes 87–88 and accompanying text.

76 A witnessed or signed inventor's notebook, as well as other documentary and physical evidence generated in the laboratory, can serve as sufficient evidence of reduction to practice. See *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1169–70 (Fed. Cir. 2006).

77 Cf. *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed. Cir. 1996) ("[T]he person 'who first conceives . . . may date his patentable invention back to the time of its conception, if he connects the conception with its reduction to practice by reasonable diligence on his part, so that they are substantially one continuous act.'" (quoting *Christie v. Seybold*, 55 F. 69, 76 (6th Cir. 1893))).

78 In discussing *Abbott* and related cases, two commentators contend that "the determining factor appears to be that the public has already benefited from the presence of the claimed invention in the prior art, even though it may not have been aware of the invention itself." Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 379 (2005). But they point out that priority cases are distinguishable because (in accord with Federal Circuit jurisprudence) the ability to describe the compound in detail is required to show possession. See *id.* at 394. Accordingly, they argue that an asymmetry makes sense as a policy matter because "an inherent but unappreciated prior use that benefits the public will not qualify for a patent, but it will prevent others from later patenting the invention being used." *Id.* While public benefit can explain the outcome in *Abbott*, returning to the hypothetical, knowledge of X's structure at the time of the accident should be the sine qua non for showing possession on Day One, particularly since structural details are diligently obtained shortly thereafter.

2. Policy Considerations

a. Tradeoffs

One potential criticism of this approach is that it rewards discovery at the expense of other goals of the patent system. For example, returning to the priority contest presented above, one could argue that awarding priority to the party that first conceived of *X*'s structure (but never actually reduced it to practice) is proper because it fosters rigorous investigation, encourages early disclosure, and promotes efficient investment in innovation.⁷⁹

Yet the broad *ex ante* incentives for invention and early disclosure can also thwart innovation.⁸⁰ For example, returning to the priority contest discussed above, if the party awarded priority to *X* lacks the capacity or interest in either actually reducing it to practice themselves or licensing the patent to other innovators who might conduct further research (which could lead to a commercial product), then the end result might be a hangup or holdout.⁸¹ Clearly the party that won the patent race is probably not the best or most efficient user of the technology.⁸²

79 See John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 472 (2004) ("By allowing a patent to occur before firms commit the bulk of the expenditures necessary to develop the invention, the prospect system reduces wasteful expenditures on duplication and thus makes the process of investing in innovation more efficient."); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 267–70 (1977) (arguing that broad patents should be granted for technological "prospects" at an early stage of research and development); Dana Rohrabacher & Paul Crilly, *The Case for a Strong Patent System*, 8 HARV. J.L. & TECH. 263, 271 (1995) (arguing that the ability to obtain patent protection at the early stages of the inventive process is necessary to maintain the incentive for the investment of venture capital in research and development).

80 See Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621, 659–61 (2010).

81 See Clarisa Long, *Proprietary Rights and Why Initial Allocations Matter*, 49 EMORY L.J. 823, 824–27 (2000). While it is true that the losing party (or other innovators) can obtain an improvement patent for *X*, a novel and nonobvious variant of *X*, the holder of this (narrower) patent cannot practice *X* without a license from the holder of the (broader) patent to *X*. See Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 860–61 (1990) (describing "dominant" and "subservient" patents). For the sake of completeness, it is also true that the holder of the patent to *X* cannot practice *X* without a license. See *id.* at 861 n.96. ("Where one patent is an improvement on another patent, 'neither of the two patentees can lawfully use the invention of the other without the other's consent.'" (quoting *Cantrell v. Wallick*, 117 U.S. 689, 694 (1886))).

82 See Long, *supra* note 81, at 823.

b. On Disclosure and Follow-on Innovation

An oft-touted justification for the patent system is that society receives some benefit from the invention's disclosure in exchange for the patentee's right to exclude. But all too often the public gets the short end of the stick in this so-called patent bargain.⁸³ Accidental inventions, however, hold up their end of the bargain in two significant ways. First, since *X* is always physically reduced to practice before filing of the patent application, the patent document will invariably provide comprehensive technical details about *X*,⁸⁴ which, in turn, will substantially contribute to the public storehouse of knowledge.⁸⁵ This point is very important because one major criticism of patents is that they "seldom teach enough so that someone can actually go out and actually [practice] the invention without some additional work."⁸⁶ And in experimental fields like chemistry where results are often unpredictable and unexpected,⁸⁷ there is a real danger that claimed embodiments which are inadequately described either cannot be made or may require unduly extensive experimentation.⁸⁸

83 See Seymore, *supra* note 30, at 143–54 (identifying problems with the current disclosure standard).

84 This will include experimental details about how to make and characterize *X*, which would be akin to the technical information one would find in a research journal. Yet it is possible, as the hypothetical example illustrates, that the scientist will need to engage in additional, postaccident experimentation to satisfy other patentability requirements. For example, see *supra* note 50 and accompanying text.

85 See *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 481 (1974) (explaining that when the information disclosed in a patent becomes publicly available it adds to the "general store of knowledge" and assumedly will stimulate ideas and the eventual development of further significant advances in the art); *Graham v. John Deere Co.*, 383 U.S. 1, 6 (1966) (noting that adding to knowledge is required by the Intellectual Property Clause of the Constitution, U.S. CONST. art. I, § 8, cl. 8).

86 Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2024–25 (2005) (citation omitted). This is true, at least in part, because an inventor need not create a working embodiment or engage in any experimentation before obtaining the patent. Rather, an inventor can describe an invention with fictitious, constructed examples (which is entirely consistent with the doctrine of constructive reduction to practice). See Seymore, *supra* note 30, at 143–45.

87 See *Eisai Co. v. Dr. Reddy's Labs., Ltd.*, 533 F.3d 1353, 1359 (Fed. Cir. 2008); see also *Singh v. Brake*, 317 F.3d 1334, 1344 (Fed. Cir. 2003) ("[R]eplacing a single functional group on a chemical compound can often have highly unpredictable results.").

88 See *In re Brana*, 51 F.3d 1560, 1566 n.17 (Fed. Cir. 1995) ("In the field of chemistry generally there may be times when the well-known unpredictability of chemical reactions will alone be enough to create a reasonable doubt as to the accuracy of a particular broad statement put forward as enabling support for a claim." (quoting *In re Marzocchi*, 439 F.2d 220, 223 (C.C.P.A. 1971))); Seymore, *supra* note 30, at 138.

The danger of inadequate disclosure is essentially absent for accidental inventions because they are actually made. The resulting patents, often replete with working examples, are technically robust documents which provide a specific and useful teaching.⁸⁹ Given that disclosure is the principal benefit that the public receives in exchange for the patentee's right to exclude,⁹⁰ the knowledge that comes from an accidental discovery is precisely the type that the patent system should want to fill the shelves of the public storehouse.⁹¹

Second, the accidental discovery of *X* often leads to significant follow-on innovation. The invented subject matter often involves the "things that make everyday living more convenient, pleasant, healthy, or interesting."⁹² Innovators will direct research and development efforts toward second-generation products, which will hopefully be significant improvements over *X* itself.

The underlying science surrounding the accidental discovery is often new and exciting. Scientific principles and laws that were seemingly well understood and settled are suddenly thrust wide open when *X* is discovered.⁹³ History shows that *X* is often something that the scientific community once thought was theoretically impossible to make or, at the very least, incredibly difficult to prepare. But the accident opens new frontiers for exploration. After the initial bewilderment, the accident tends to spawn two types of inquiry: basic research, which seeks to elucidate mechanistic and structural details; and applied research, which seeks to stretch the boundaries of *X* by tweaking the concept to make improvements that are even more valuable than *X* itself. And, of course, innovators will seek to obtain patent protection for these improvements as well as for the methods of making and using them.

89 See Seymore, *supra* note 80, at 653–55.

90 The Court often describes disclosure as the quid pro quo for the inventor's right to exclude. See, e.g., *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 63 (1998) ("[T]he patent system represents a carefully crafted bargain that encourages both the creation and the public disclosure of new and useful advances in technology, in return for an exclusive monopoly for a limited period of time.").

91 See *supra* note 85 and accompanying text.

92 ROYSTON M. ROBERTS, *SERENDIPITY*, at ix (1989).

93 A serendipitous event "involves a wild leap outside the limits of what was until that moment supposed, and thereby enables science to advance into domains of understanding that were not previously imagined." JOHN ZIMAN, *REAL SCIENCE* 217 (2000) (footnote omitted).

II. INCREDIBLE INVENTIONS⁹⁴

A. *Assessing Credibility*

1. Red Flags in the Patent Office

The quest to achieve incredible results has long provided creative fuel for inventors.⁹⁵ Yet inventors who purport to have made technological breakthroughs often face skepticism and disbelief. Indeed, applications disclosing perpetual motion machines, cold fusion processes, and other inventions that either challenge well-established scientific principles or simply appear impossible on their face raise red flags in the PTO.⁹⁶

The oft-cited statutory basis for rejecting these applications is § 101 of the Patent Act, which only permits patents for “useful” inventions.⁹⁷ In patent law, an invention is not useful if it cannot operate to produce the intended result.⁹⁸ The test for operability is whether a PHOSITA⁹⁹ has reason to doubt the objective truth of the applicant’s assertions.¹⁰⁰

While the operability requirement of § 101 serves a laudable gatekeeping function, it has drawbacks. First, elucidating what a PHOSITA would believe may devolve into a subjective judgment about the subject matter. At some point this may lead the PTO and the courts to develop a bias toward unpatentability with inventions

94 This Part forms the preliminary piece of a larger project exploring the patentability of seemingly impossible inventions.

95 See *supra* notes 17–18 and accompanying text.

96 For example, when an applicant claims a perpetual motion machine, the examiner can request a working model. See U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 608.03 (8th ed. 2001, rev. 2008) [hereinafter MPEP]. This is an exception to the general rule that an applicant need not actually reduce an invention to practice before obtaining a patent. See *supra* notes 39–41 and accompanying text.

97 35 U.S.C. § 101 (2006) (“Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter . . . may obtain a patent . . .”).

98 See *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1358 (Fed. Cir. 1999) (“The utility requirement of 35 U.S.C. § 101 mandates that any patentable invention be useful and, accordingly, the subject matter of the claim must be operable.”); *Newman v. Quigg*, 877 F.2d 1575, 1581 (Fed. Cir. 1989) (“[A] device lacks utility [if] . . . it does not operate to produce what [the inventor] claims [that] it does.” (quoting *Newman v. Quigg*, 681 F. Supp. 16, 23 (D.D.C. 1988))).

99 The PHOSITA is defined *supra* note 40.

100 The PTO can establish reasonable doubt if the applicant’s disclosure “suggest[s] an inherently unbelievable undertaking or involve[s] implausible scientific principles.” *In re Cortright*, 165 F.3d 1353, 1357 (Fed. Cir. 1999) (alterations in original) (quoting *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995)).

emerging from new, poorly understood, and paradigm-shifting technologies as well as those from fields with a poor track record of success as the most vulnerable. Second, since the PTO and the courts are probably unaware of what is happening at the cutting edge of science and technology, what happens if the impossible becomes possible? History reveals that the PTO and the courts will continue to deny patents under § 101 for a long time thereafter. This lag is unsettling since “the very purpose of the patent system is to encourage [the] attainment of previously unachievable results.”¹⁰¹

2. Examining Incredible Inventions

The PTO undertakes a two-step analysis to gauge operability. First, the examiner must construe the relevant claims in the patent application to precisely define the invention to be tested for compliance with § 101.¹⁰² Second, if it appears that the invention cannot operate to produce the intended results, the examiner must assess credibility by asking if a PHOSITA would believe what the applicant has asserted. If the answer is no, the invention is unpatentable under § 101 for lack of utility and under § 112 paragraph 1 for lack of enablement.¹⁰³ This dual rejection makes sense because an applicant cannot possibly enable a PHOSITA to practice an invention that does not work.¹⁰⁴

Next, an evidentiary burden-shifting process begins. The applicant’s disclosure initially enjoys a presumption of truth, meaning that the examiner must initially presume that the invention can operate to produce the intended result.¹⁰⁵ But if examination suggests that a PHOSITA would reasonably doubt the objective truth of the applicant’s assertions, the examiner must establish a *prima facie* case of unpatentability by coming forward with factual evidence of non-

101 *In re Ferens*, 417 F.2d 1072, 1074 (C.C.P.A. 1969).

102 *See Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 956 (Fed. Cir. 1983). During examination, the examiner must give claim terms their broadest reasonable interpretation as they would be understood by a PHOSITA yet consistent with the applicant’s disclosure. *See In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

103 An applicant must enable a PHOSITA to make and use the claimed invention without undue experimentation. 35 U.S.C. § 112 para. 1 (2006).

104 *See In re Ziegler*, 992 F.2d 1197, 1200–01 (Fed. Cir. 1993) (“The how to use prong of section 112 incorporates as a matter of law the requirement of 35 U.S.C. § 101 If the application fails as a matter of fact to satisfy 35 U.S.C. § 101, then the application also fails as a matter of law to enable [a PHOSITA] to use the invention under 35 U.S.C. § 112.” (citations omitted)).

105 *See In re Cortright*, 165 F.3d at 1357.

credibility.¹⁰⁶ If the examiner cannot adduce the evidence, the PTO must issue a patent if the applicant satisfies the other requirements for patentability.¹⁰⁷

If the examiner establishes a prima facie case of inoperability, the applicant can either attack it¹⁰⁸ or rebut it with persuasive arguments or additional evidence sufficient to convince a PHOSITA to accept the applicant's assertions as true.¹⁰⁹ Though the burden of production may continue to shift as each side presents new evidence,¹¹⁰ the ultimate burden of persuasion rests with the examiner.¹¹¹

Whether an invention is operable under § 101 is a question of fact.¹¹² An invention rejected for inoperability under § 101 also faces rejection for lack of enablement under § 112 paragraph 1 because the applicant cannot teach a PHOSITA how to use something that does not work.¹¹³ Whether a disclosure is enabling is a "legal conclusion based on underlying factual inquiries."¹¹⁴

106 *In re Gaubert*, 524 F.2d 1222, 1224–25 (C.C.P.A. 1975). Evidentiary sources may include peer-reviewed materials, non-peer-reviewed materials, anecdotal information, information from related technologies, and logic. *See In re Dash*, 118 F. App'x 488, 491 (Fed. Cir. 2004).

107 *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

108 An applicant can likely mount a successful attack if the examiner produces no (or insufficient) documentary evidence to support a finding of inoperability; contends that the invention is crude or inferior; or compels the inventor to explain precisely how or why an invention works. *See Diamond Rubber Co. v. Consol. Rubber Tire Co.*, 220 U.S. 428, 435–36 (1911) (explaining that an inventor need not understand the scientific principles underlying the invention); *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001) (explaining that with respect to core facts, the PTO cannot simply draw conclusions as to what is common knowledge without concrete evidentiary support); *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 960 n.12 (Fed. Cir. 1986) ("It is possible for an invention to be less effective than existing devices but nevertheless meet the statutory criteria for patentability."); MPEP, *supra* note 96, § 2107.02 (encouraging examiners to provide documentary evidence whenever possible).

109 *See In re Swartz*, 232 F.3d 862, 864 (Fed. Cir. 2000) (per curiam). *But see In re Novak*, 306 F.2d 924, 928 (C.C.P.A. 1962) (noting that rebuttal evidence is unnecessary if a PHOSITA would obviously accept the applicant's allegations as true).

110 When the applicant submits rebuttal evidence, the examiner must "start over" and "consider all of the evidence anew." *In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984).

111 Absent any other grounds of unpatentability, the applicant is entitled to the patent. *See In re Oetiker*, 977 F.2d at 1445.

112 *See Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 956 (Fed. Cir. 1983).

113 *See cases cited supra* notes 103–104 and accompanying text.

114 *In re Swartz*, 232 F.3d at 863. On appeal, the Federal Circuit reviews a finding of (in)operability and the factual issues underlying enablement deferentially. *In re Gartside*, 203 F.3d 1305, 1315 (Fed. Cir. 2000) (explaining that for appeals from the

B. *Limits of the Current Paradigm*

1. Proof Problems

Gauging operability is easiest when the applicant can point to actual experimental data or a working model to prove that the invention works.¹¹⁵ But unlike the rules of mainstream science, which “require actual performance of every experimental detail” as a prerequisite for publication, in patent law an inventor only needs to provide sufficient technical information to teach a PHOSITA how to practice the invention without undue experimentation.¹¹⁶ This means that an applicant usually does not need to actually reduce an invention to practice or produce a physical embodiment of it in order to obtain a patent.¹¹⁷

The key challenge for the PTO is gauging operability without actual proof. Aside from cases involving perpetual motion machines, where there is a working model requirement,¹¹⁸ the PTO allows applicants to choose their own way of establishing operability when the examiner questions it.¹¹⁹

2. The Credibility Lag in Science

The PTO can establish reasonable doubt if the applicant’s assertions suggest an “inherently unbelievable undertaking,”¹²⁰ “involve implausible scientific principles,”¹²¹ appear to “run [] counter to what would be believed would happen by the [PHOSITA],”¹²² or emerge from fields riddled with fraud or from which “little of a successful nature has been developed.”¹²³ In each situation, the examiner must

PTO, the court reviews legal conclusions de novo and factual findings for substantial evidence).

115 *Cf.* Seymore, *supra* note 80, at 652–53 (advocating a working example requirement for complex technologies which would, among other things, simplify the enablement analysis).

116 *See* Hoffmann-La Roche, Inc. v. Promega Corp., 323 F.3d 1354, 1377 (Fed. Cir. 2003) (Newman, J., dissenting).

117 *See supra* note 41 and accompanying text.

118 To begin, the patent statute permits the examiner to request a working model of an invention. *See* 35 U.S.C. § 114 (2006) (“The Director may require the applicant to furnish a model of convenient size to exhibit advantageously the several parts of his invention.”). However, the PTO rarely invokes the requirement unless the invention involves perpetual motion. *See supra* note 96.

119 *See* MPEP, *supra* note 96, at § 608.03.

120 *In re* Jolles, 628 F.2d 1322, 1327 (C.C.P.A. 1980).

121 *In re* Brana, 51 F.3d 1560, 1566 (Fed. Cir. 1995).

122 *In re* Pottier, 376 F.2d 328, 330 (C.C.P.A. 1967) (citation omitted).

123 *In re* Gazave, 379 F.2d 973, 978 (C.C.P.A. 1967) (citation omitted).

turn to mainstream science to determine if the applicant's assertions are (in)credible in light of contemporary knowledge in the field. Thus, credibility in mainstream science and operability in patent law are tightly linked.

At this point it is necessary to briefly explain how mainstream science assesses credibility. It occurs primarily through the legitimization process known as peer review.¹²⁴ The ultimate publication decision¹²⁵ serves as a “knowledge filter” where the journal editors and reviewers act as the gatekeepers.¹²⁶ Through “organized skepticism,”¹²⁷ the gatekeepers carry out their mission “[t]o promote original ideas, valuable approaches, or new methods and to reject the mediocre ones.”¹²⁸

Peer review, however, has serious drawbacks that can affect patent law.¹²⁹ The major one is that the peer review process can delay, hinder, or block the dissemination of novel ideas.¹³⁰ Quantitative studies and anecdotal sources reveal that reviewers resist change.¹³¹ They will

124 See HENRY H. BAUER, *SCIENTIFIC LITERACY AND THE MYTH OF THE SCIENTIFIC METHOD* 44–48 (1992). The mechanics of peer review typically works as follows. First, the researcher submits the work to a journal. Second, the editor sends it to one or more reviewers knowledgeable about the problem to judge its merit (uniqueness, methodology, adequacy of research design, and potential contribution to the field). Third, the editor makes a final publication decision. See Peter Hernon & Candy Schwartz, *Peer Review Revisited*, 28 *LIBR. & INFO. SCI. RES.* 1, 1 (2006).

125 See *supra* note 124.

126 See FREDERICK GRINNELL, *EVERYDAY PRACTICE OF SCIENCE* 75 (2009) (noting that a scientist with a new research claim must “get by the gatekeepers”).

127 ZIMAN, *supra* note 93, at 246.

128 Juan Miguel Campanario, *Have Referees Rejected Some of the Most-Cited Articles of All Times?*, 47 *J. AM. SOC'Y INFO. SCI.* 302, 302 (1996).

129 Relatedly, peer review has been the subject of considerable criticism from those within and outside of mainstream science. See, e.g., ELIEZER GEISLER, *THE METRICS OF SCIENCE AND TECHNOLOGY* 234 (2000) (collecting criticisms); Campanario, *supra* note 128, at 302 (arguing that peer review hinders good science); Rustum Roy & James R. Ashburn, *The Perils of Peer Review*, 414 *NATURE* 393, 393–94 (2001) (same).

130 See Raymond E. Spier, *Peer Review and Innovation*, 8 *SCI. & ENGINEERING ETHICS* 99, 102 (2002). For stories and examples of delayed recognition, see Bernard Barber, *Resistance by Scientists to Scientific Discovery*, 134 *SCIENCE* 596, 597–602 (1961), providing examples dating back to the nineteenth century; David F. Horrobin, *The Philosophical Basis of Peer Review and the Suppression of Innovation*, 263 *J. AM. MED. ASS'N* 1438, 1440–41 (1990), providing eighteen examples; and Moti Nissani, *The Plight of the Obscure Innovator in Science: A Few Reflections on Campanario's Note*, 25 *SOC. STUD. SCI.* 165, 171–76 (1995), supplying forty-seven examples.

131 As one scientist argues, “[It] is not permissible . . . to write or say something which contradicts the shared paradigm, and expect it to be tolerated . . . because the shared paradigm, a necessary frame of reference in normal scientific communication, would be undermined.” Ivor Catt, *The Rise and Fall of Bodies of Knowledge*, 12 *INFO.*

often reject anything that clashes with then-existing ideas and generally accepted theories.¹³² Many other factors enter into a reviewer's calculus, including: conservatism,¹³³ bias,¹³⁴ jealousy,¹³⁵ fears of offending the science establishment,¹³⁶ an overwhelming interest in quality control,¹³⁷ and the inability to recognize brilliance.¹³⁸ In sum, whether and when the credibility gate opens is highly subjective and idiosyncratic.

The major downside of this credibility lag for the inventor is that it can compromise patent rights. Patent procurement is highly time sensitive. To illustrate, consider an inventor who files a patent application disclosing a seemingly impossible invention at time *T*. The examiner will turn to mainstream science to determine if the applicant's assertions are (in)credible in light of contemporary knowledge

SCIENTIST 137, 138–39 (1978), *reprinted in* IVOR CATT, *THE CATT ANOMALY* app. 1, at 31, 33 (2d ed. 2001), *available at* <http://www.ivorcatt.com/28anom.htm>. Often it is better for a scientist to “stop[] producing new, and perhaps unsettling, ideas” because “[r]ewriting or extending the best work of others, or one's best pieces . . . could be easier, more rewarding, and more acceptable.” Graciela Chichilnisky, *Response*, in *REJECTED* 56, 67 (George B. Shepherd ed., 1995).

132 See DAVID SHATZ, *PEER REVIEW* 10 (2004); *see also* Chichilnisky, *supra* note 131, at 57 (“In my experience, the more innovative and interesting the paper, the more likely it is to be rejected . . .”).

133 See DARYL E. CHUBIN & EDWARD J. HACKETT, *PEERLESS SCIENCE* 90 (1990) (arguing that journal peer review works against innovation and reinforces scientific dogma); GREGORY N. DERRY, *WHAT SCIENCE IS AND HOW IT WORKS* 138 (1999) (“Very innovative ideas and unexpected results tend to get selectively filtered out, making peer review a force for conservatism in science.”); KUHN, *supra* note 16, at 64–65 (explaining that resistance to change will be strong and long-lasting when a new claim challenges well-accepted paradigms).

134 See SHATZ, *supra* note 132, at 45–48 (explaining how bias operates in peer review).

135 One commentator argues that many reviewers “are against innovation unless it is *their* innovation” because “[i]nnovation from others may . . . diminish [] the importance of the scientist's own work.” Horrobin, *supra* note 130, at 1441.

136 See STEVE FULLER, *SCIENCE* 65 (1997) (explaining that since each scientific discipline has a few gatekeepers who pass judgment on everyone else, offending one “can be disastrous, much like failure to pay protection money to the local mafia boss”).

137 See Horrobin, *supra* note 130, at 1438 (“Quality control is one means of achieving an end, but it is not the end itself.”); *id.* at 1439 (arguing that any marginal improvement gained in research quality from rejecting a manuscript is no gain at all if it is done at the expense of innovation).

138 See David F. Horrobin, *Peer Review: A Philosophically Faulty Concept Which Is Proving Disastrous for Science*, 5 *BEHAV. & BRAIN SCI.* 217, 218 (1982) (arguing that since brilliance is rare, a less-than-brilliant reviewer probably would not recognize it and reject the claim), *reprinted in* *PEER COMMENTARY ON PEER REVIEW* 33, 34 (Stevan Harnad ed. 1982).

in the field.¹³⁹ If the gatekeepers do not credit the finding until time L , the applicant will face an inevitable rejection. Importantly, refiling at or beyond time L is often not a viable option because things have happened which probably have compromised patent rights.¹⁴⁰

3. Subjective Bias

The history of science teaches that what was impossible yesterday may be possible today.¹⁴¹ Precisely when the impossible becomes possible depends on several factors, including the nature of the technology, the rate at which knowledge grows within a particular field, ingenuity, and serendipity.¹⁴² Yet regardless of when this moment occurs, it can still take years for mainstream science to credit the claim.¹⁴³

There is a similar credibility lag in patent law. Particularly susceptible to it are inventions emerging from nascent technologies; fields in rapid change, in a primitive stage of development, or in the midst of a technological renaissance; and quests which have a poor track record of success.¹⁴⁴ Nevertheless, there will be some lag whenever the PTO looks to mainstream science to determine if the applicant's assertions are credible in light of contemporary knowledge because any lag that exists in mainstream science will unavoidably pass through to the patent system.

139 See *supra* Part II.B.2.

140 For example, the Patent Act contains the loss-of-right provision discussed earlier, § 102(b), which precludes patentability for the inventor's own conduct. See 35 U.S.C. § 102(b) (2006). Particularly relevant here is that an inventor who discloses the invention in a printed publication (including a published patent application) more than one year before filing cannot obtain a patent. In the context of the hypothetical, this means that the application filed at time T can defeat patentability at time L . See *In re Katz*, 687 F.2d 450, 454 (C.C.P.A. 1982).

141 See CEES J. HAMELINK, *THE TECHNOLOGY GAMBLE*, at x (1988) (“[T]he future cannot be seen as the linear extension of the past and it is essential to believe that what was impossible yesterday is tomorrow’s possibility!”); H. LEE MARTIN, *TECHONOMICS* 89 (2006) (“[W]hat was impossible yesterday . . . becomes possible today and commonplace tomorrow.”).

142 See, e.g., LESLIE ALAN HORVITZ, *EUREKA!* 1–10 (2002) (exploring various factors).

143 See *supra* Part II.B.1.

144 See, e.g., *In re Swartz*, 232 F.3d 862 (Fed. Cir. 2000) (per curiam) (generating energy with “cold fusion”); *Newman v. Quigg*, 877 F.2d 1575 (Fed. Cir. 1989) (claiming a perpetual motion machine); *Fregeau v. Mossinghoff*, 776 F.2d 1034 (Fed. Cir. 1985) (using a magnetic field to alter the taste of food); *In re Eltgroth*, 419 F.2d 918 (C.C.P.A. 1970) (claiming a method for controlling the aging process); *In re Ruskin*, 354 F.2d 395 (C.C.P.A. 1966) (increasing the energy output of fossil fuels through exposure to a magnetic field).

Yet, the patent system exacerbates and protracts any artifactual lag stemming from mainstream science. Structural and substantive aspects of patent examination cause a technological lag. Given the technical nature of the examiner's job, one might expect this individual to know exactly what is happening at the forefront of theory and experiment. This is typically not the case because the examiner is not an active researcher.¹⁴⁵ The incentive structure of the PTO combined with the examiner's time pressures and production goals afford little, if any, time for professional development.¹⁴⁶ These realities essentially divorce examiners from the frontlines of science.¹⁴⁷ The same is true, perhaps even more so, for the judges who hear patent cases.¹⁴⁸ Consequently, patent law inevitably lags a step or two behind the cutting edge of science and technology.

Compounding this is evidence of bias against seemingly impossible inventions. History reveals that the PTO and the courts have approached seemingly impossible claims with skepticism for the sake of the public good. As the argument goes, there is a belief (albeit an incorrect one) among the public and potential investors that the government never issues patents on inoperable inventions.¹⁴⁹ So strict

145 See David Hricik, *Aerial Boundaries: The Duty of Candor as a Limitation on the Duty of Patent Practitioners to Advocate for Maximum Patent Coverage*, 44 S. TEX. L. REV. 205, 224–29 (2002) (explaining that examiners do not have research laboratories and have limited access to pertinent technical information).

146 See Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 944–45 (2004) (discussing biased procedures at the PTO which favor hasty examiner analysis and skewed incentives); Arti K. Rai, *Growing Pains in the Administrative State: The Patent Office's Troubled Quest for Managerial Control*, 157 U. PA. L. REV. 2051, 2063–67 (2009) (describing examiner compensation and incentives). The amount of time the PTO allots for an examiner to dispose of a case depends on factors like seniority and the technology involved. See U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-08-527T, U.S. PATENT AND TRADEMARK OFFICE: HIRING EFFORTS ARE NOT SUFFICIENT TO REDUCE THE PATENT APPLICATION BACKLOG 7 (2008), available at <http://www.gao.gov/new.items/d08527t.pdf> (discussing production goals).

147 For thoughts on how this technology gap affects patent examination, see JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE* 161 (2008), suggesting that the examiners' unfamiliarity with new technologies and lack of knowledge may hurt patent examination quality; and John R. Allison & Ronald J. Mann, *The Disputed Quality of Software Patents*, 85 WASH. U. L. REV. 297, 314 (2007), contending that "patent examiners unfamiliar with a cutting-edge technology like software may be less capable of assessing the quality of the disclosure or of the innovation than they are in technological areas with which they are more familiar".

148 See *supra* notes 10–12 and accompanying text.

149 See Daniel C. Rislove, Comment, *A Case Study of Inoperable Inventions: Why Is the USPTO Patenting Pseudoscience?*, 2006 WIS. L. REV. 1275, 1280.

policing of incredible claims protects both the public from potentially harmful products that do not work as claimed and potential investors from patentees who might seek to defraud them.¹⁵⁰ Judge Giles Rich agreed, arguing that “it is against public policy to place the oblique imprimatur of the Government via the patent grant on incredible or misleading unproven assertions.”¹⁵¹ So elucidating what a PHOSITA would believe can possibly devolve into a subjective judgment about the subject matter. Thus, for some quests, the PTO and the courts may develop a bias against patentability.

History shows, however, that technical merit and good science can ultimately triumph over skepticism and subjective bias. Perhaps the best example is the quest to treat cancer. For most of the twentieth century, the PTO and the courts took the position that it was

150 See *id.* For example, there was a time when the PTO and several judges believed that clinical evidence or FDA approval should have been a prerequisite for patenting drugs which appeared unsafe or risky. Compare *In re Hartop*, 311 F.2d 249, 261 (C.C.P.A. 1962) (Smith, J., concurring) (criticizing the PTO’s position that it was carrying out its “statutory duty” when it required proof of “safety and effectiveness in man”), with *id.* at 263–66 (Worley, C.J., dissenting) (agreeing with the PTO that Congress intended for it to work cooperatively with other agencies to ensure safety and effectiveness). Now it is clear that drug safety is not the PTO’s responsibility. See *Scott v. Finney*, 34 F.3d 1058, 1063–64 (Fed. Cir. 1994) (explaining that § 101 and other provisions of the patent statutes do not establish safety as a patentability criterion); *In re Anthony*, 414 F.2d 1383, 1395 (C.C.P.A. 1969) (same); see also *In re Sichert*, 566 F.2d 1154, 1160 (C.C.P.A. 1977) (noting that a minimal level of safety will satisfy § 101).

151 *In re Citron*, 325 F.2d 248, 253 (C.C.P.A. 1963); cf. *Isenstead v. Watson*, 157 F. Supp. 7, 9 (D.D.C. 1957) (contenting that the patent grant “gives a kind of official imprimatur to the [invention] in question on which as a moral matter some members of the public are likely to rely”). The fear is that some might view the patent grant, albeit improperly, as the government’s endorsement of the technology. See Cynthia M. Ho, *Splicing Morality and Patent Law: Issues Arising from Mixing Mice and Men*, 2 WASH. U. J.L. & POL’Y 247, 253 n.29 (2000) (noting that issuing patents covering controversial technologies might be viewed as a government endorsement of it); Timothy R. Holbrook, *The Expressive Impact of Patents*, 84 WASH. U. L. REV. 573, 599–600 (2006) (explaining that governments may choose to deny patents on certain inventions in order to eliminate the signal of perceived endorsement or encouragement). Relatedly, it is also true that “a [patentee] may advertise its patent to convince gullible consumers that a patent represents the government’s endorsement or imprimatur that the advertised product is actually effective.” Christopher R. Leslie, *Patents of Damocles*, 83 IND. L.J. 133, 144 (2008). For a view contrary to *Citron* and *Isenstead*, see *In re Hartop*, 311 F.2d at 263, stating, “[T]he issuance of a patent is not in fact an ‘imprimatur’ as to the safety and effectiveness [A patent] is no guarantee of anything The public, therefore, is in no way protected either by the granting or withholding of a patent.”

impossible to do so successfully.¹⁵² Applicants claiming an effective treatment faced a formidable (if not insurmountable) patentability hurdle because the C.C.P.A. allowed the PTO to demand substantiating evidence from the applicant.¹⁵³ But, the situation finally changed in 1980 when the court determined that successfully treating cancer is not inherently unbelievable.¹⁵⁴ Fifteen years later, the Federal Circuit put the issue to rest when it stated that treating cancer with chemical compounds “does not suggest an inherently unbelievable undertaking or involve implausible scientific principles” because “[m]odern science has previously identified numerous successful chemotherapeutic agents.”¹⁵⁵ Similar stories abound for inventions initially (but wrongly) miscategorized by the PTO and the courts as impossible.

C. Refocusing the Inquiry

1. Normative Thoughts

As a normative matter, the current framework is unsettling for at least three reasons. First, science has evolved to a point where “the levels of *complexity* and *specialization* make it nearly impossible for [anyone]—who is not intimately familiar with the activity—to effectively and credibly evaluate it and its outcomes.”¹⁵⁶ Second, given that operability is an objective question (an invention either works or it does not), an applicant who presents a meritorious claim should not face rejection because of subjective credibility assessments. Third, credibility lags prevent the patent system from sitting at the cutting edge of technology,¹⁵⁷ a place where patent protection is often crucial.¹⁵⁸

152 See, e.g., *In re Citron*, 325 F.2d at 253 (explaining that an effective cure for cancer appeared to be incredible in light of knowledge in the art); *Ex parte Moore*, 128 U.S.P.Q. (BNA) 8, 9–10 (Pat. Off. Bd. App. 1960) (determining that any suggestion that the claimed compounds could treat cancer was incredible and misleading).

153 See *In re Citron*, 325 F.2d at 253 (determining that this was an appropriate standard for an invention “of as much public importance as is the effective treatment of cancer”); *In re Novak*, 306 F.2d 924, 928 (C.C.P.A. 1962).

154 See *In re Jolles*, 628 F.2d 1322, 1327–28 (C.C.P.A. 1980) (reversing a rejection for a drug claiming to effectively induce remission in leukemia patients).

155 *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995). As to the issue of heightened proof for therapeutics, the court has noted that requiring evidence such as FDA approval to satisfy § 101 could “eliminat[e] an incentive to pursue, through research and development, potential cures in many crucial areas such as the treatment of cancer.” *Id.* at 1568.

156 GEISLER, *supra* note 129, at 219.

157 See also *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150–51 (1989) (noting that the patent system seeks to incentivize inventors who in turn provide the public with new and useful advances in technology); COMM. ON INTELLECTUAL PROPERTY RIGHTS IN THE KNOWLEDGE-BASED ECON., NAT’L RESEARCH COUNCIL, A PAT-

2. Alternative Screening Tools

It is time to consider alternative approaches for screening out truly impossible inventions. One possibility would be to employ the enablement requirement of § 112 paragraph 1. It is well suited to perform this task because enablement and operability are closely related.¹⁵⁹ Aside from policing claim scope,¹⁶⁰ it ensures that a PHOSITA can actually make and use what the applicant discloses.¹⁶¹ Operability and enablement both help to safeguard the technical integrity of issued patents by screening out inventions that cannot work.¹⁶²

ENT SYSTEM FOR THE 21ST CENTURY 41 (Stephen A. Merrill et al. eds., 2004) (explaining that accommodating new technologies is crucial for innovation); cf. Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CALIF. L. REV. 803, 876 (1988) (arguing that the patent system should not employ a patentability test which compromises its primary goal to promote technological progress).

158 See, e.g., Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 Nw. U. L. REV. 1495, 1504–05 (2001) (suggesting that a firm may obtain a patent to “stake their claim” in an area of technology to signal to investors and competitors that it operates at the cutting edge); Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 647–49 (2002) (arguing that firms obtain patents to show their R&D acumen or technological capacity).

159 See *supra* notes 103–05 and accompanying text.

160 See *O’Reilly v. Morse*, 56 U.S. (15 How.) 62, 121 (1853) (explaining that a patentee “can lawfully claim only what he has invented and described, and if he claims more his patent is void”); *Nat’l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999) (explaining that the purpose of the enablement requirement is to “ensure [] that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of the claims”). The scope of enablement is the sum of what is taught in the written description plus what is known by a PHOSITA “without undue experimentation.” See *id.*

161 See *Bayer AG v. Schein Pharms., Inc.*, 301 F.3d 1306, 1314 (Fed. Cir. 2002) (“The enablement requirement ensures . . . ‘that a specification shall disclose an invention in such a manner as will enable one skilled in the art to make and utilize it.’” (quoting *In re Gay*, 309 F.2d 769, 772 (C.C.P.A. 1962))).

162 As the Federal Circuit recently explained:

Enablement is closely related to the requirement for utility . . . , [which] prevents mere ideas from being patented. As we noted [previously], “[p]atent protection is granted in return for an enabling disclosure of an invention, not for vague intimations of general ideas that may or may not be workable. . . . Tossing out the mere germ of an idea does not constitute enabling disclosure.”

In re ‘318 Patent Infringement Litig., 583 F.3d 1317, 1323–24 (Fed. Cir. 2009) (fourth and fifth alterations in original) (quoting *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997)).

More importantly, the enablement analysis is rooted in objective, technical factors. This lies in contrast to the subjective credibility assessments that lie at the heart of the § 101 operability paradigm. Analytically, this means that the decisionmaker can use technical factors like claim breadth and the substantive content of the applicant's disclosure to achieve the same ends as the current operability regime without its pitfalls.

There is some decisional law which supports the proposition that if the case for nonenablement is very strong, that is a sufficient basis to deny patentability notwithstanding deficiencies under § 101. In *In re Speas*,¹⁶³ the applicant sought to claim

any and all devices and systems which operate in such a manner as to violate the [S]econd [L]aw of [T]hermodynamics as it is currently understood and accepted as inviolable by a majority of the worldwide scientific community, and any and all devices and systems which are adapted for converting thermal energy into other energy forms by contacting a heat source without the necessity of also contacting a thermal medium of lower temperature.¹⁶⁴

It is important to note two points about these claims. First, the “any and all” claim language immediately raises enablement concerns due to its potentially limitless breadth.¹⁶⁵ Second, any device that could continuously convert heat completely to work without any additional energy input would violate the Second Law of Thermodynamics.¹⁶⁶ A closer look at the applicant's description of the invention reveals, however, that the disclosed device does not do so because it actually draws in thermal energy from the surroundings.¹⁶⁷

The examiner rejected the claim independently under § 112 paragraph 1 and § 101, respectively, after determining that (1) the

163 273 F. App'x 945 (Fed. Cir. 2008) (per curiam) (nonprecedential).

164 *Id.* at 946 (internal quotation marks omitted).

165 See *In re Wright*, 999 F.2d 1557, 1561–62 (Fed. Cir. 1993) (holding that the applicant failed to enable a claim covering “any and all live, non-pathogenic vaccines, and processes for making such vaccines”).

166 The Second Law of Thermodynamics states that it is impossible to convert heat completely to work without some energy loss. See R.K. RAJPUT, *ENGINEERING THERMODYNAMICS* 232 (3d ed. 2010). A machine that could do so would be 100% efficient. Such machines are referred to as perpetual motion machines of the second kind. See *id.* Curiously, the term “perpetual motion” does not appear either in the PTO documents or in the Federal Circuit opinion.

167 See *In re Speas*, 273 F. App'x at 946 (“Thus, the movement of the ferrofluid imparts mechanical energy upon the wheel. Speas claims that because this ferrofluid is moved and adds energy to the paddle wheel ‘without input into the system other than ambient thermal energy,’ it is proof that the [S]econd [L]aw of [T]hermodynamics is not inviolate—an object of the invention.”).

enablement provided was not commensurate with the claim scope sought and (2) the invention could not achieve the intended result.¹⁶⁸ The Board explicitly affirmed each rejection.¹⁶⁹ Although the PTO argued both issues in its appeal brief to the Federal Circuit, it contended that the court could resolve the case solely on enablement grounds with no need to reach the § 101 issue.¹⁷⁰ This argument makes sense because if the disclosed device did not violate the Second Law of Thermodynamics, it was nonenabled.

The Federal Circuit adopted this reasoning and affirmed on nonenablement grounds. The court held that the Board's rejection was supported by substantial evidence because the applicant's "particularly broad" and "limitless" claim was not enabled by a description which was commensurately broad in its teaching.¹⁷¹ The important point is that it was possible to screen out this invention solely based on (a lack of) technical merit, thereby avoiding any need to engage in a credibility assessment.¹⁷²

CONCLUSION

Inventions which arise through unexpected discoveries and those which purport to have achieved the impossible perform a special role in science and technology because breakthroughs can lead to a paradigm shift in thinking and novel approaches to problem solving. For patent law, these inventions have a high likelihood of stimulating significant creative activity and ultimately promoting its overarching goal to promote scientific and technological progress. Thus, the patent system suffers when these inventions fall victim to the ill effects of the disconnect between it and science and technology. The widespread interest in patent reform makes now an ideal time to reformulate patent doctrines to better accommodate the technical communities that it serves.

168 See *id.* at 945–46; Brief for Appellee Director of the United States Patent and Trademark Office at 7–8, *In re Speas*, 273 F. App'x 945 (No. 2008-1076) [hereinafter Brief for Appellee].

169 See Brief for Appellee, *supra* note 168, at 9–10.

170 See *id.* at 18.

171 See *In re Speas*, 273 F. App'x at 946.

172 In his commentary on *In re Speas*, Professor Crouch reached a similar conclusion: "Although this type of case is fun to read, it also provides an interesting lesson—that [there are] tools to reject inadequate patent applications on their merits without resorting to broad exclusions of particular subject matter." Dennis Crouch, *CAFC Rejects Patent on Invention to Overcome the Second Law of Thermodynamics*, PATENTLY-O (May 1, 2008, 2:32 PM), <http://www.patentlyo.com/patent/2008/05/cafc-rejects-pa.html>.