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The Paradox of 'Abstract Ideas'

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I. INTRODUCTION

An enduring principle of intellectual property law is that one cannot patent an abstract idea. It was true in 1854, when the Supreme Court denied Samuel Morse, inventor of the telegraph, a patent claim that would have covered any means of using electromagnetism to transmit printed messages.[1] It was still true in 2010, when, in the much anticipated *Bilski v. Kappos* case,[2] the Supreme Court held that a method of hedging risks in commodities sales transactions was not patentable subject matter.[3] The abstract ideas exclusion is one of the few categorical limitations of patentable subject matter,[4] and it stands now as an important restraint on the growth of intellectual property rights in business methods and computer programming.[5] Yet, in an important sense, *every* patent claims an abstract idea. The subject matter of a patent is an invention. An invention is a concept—an idea for new technology. What, then, do courts mean when they hold that abstract ideas are ineligible for patenting?

Concurring in *Bilski*, Justice Stevens complained that the majority "never provides a satisfying account of what constitutes an unpatentable abstract idea."[6] Indeed, the 150 years of precedent to which *Bilski* alludes[7] provides no such "satisfying account." The history of the abstract ideas exclusion is one of circular reasoning, vagueness, and obscurity, in part because courts rarely acknowledge the inherently abstract qualities of any patented invention. Adding to the confusion, the deceptively simple proposition that abstract ideas cannot be patented has been used to address a number of interrelated but ultimately distinct concerns. These include (1) whether the invention consists of natural phenomena devoid of novelty

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[1] *See* O'Reilly v. Morse, 56 U.S. (15 How.) 62, 119–20 (1854).

[2] 130 S. Ct. 3218 (2010).

[3] *See id.* at 3231.

[4] Reviewing those limitations, Burk and Lemley call the exclusion of abstract ideas the "most significant" exception. Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1642 (2003).

[5] *See id.* at 1618–22.

[6] *Bilski*, 130 S. Ct. at 3236 (Stevens, J., concurring).

[7] The Court notes that non-textual exceptions to patentable subject matter, including the prohibition on patenting abstract ideas, "have defined the reach of the statute . . . going back 150 years." *Id.* at 3225.

or human agency; (2) whether the invention is so remote from practical application that it lacks utility; (3) whether the property right conferred by a broad claim would be disproportionate to the patentee's contribution to the art; and (4) whether the invention lies in an area of human activity (e.g., business or law) that lacks the tangible characteristics of conventional technology.

Do any or all of these represent the distinguishing characteristics of an "abstract idea"? There is no clear answer—a point vividly illustrated by *In re Ferguson*,[8] a 2009 Federal Circuit case involving a claimed "paradigm" for selling software from a variety of suppliers through a single marketing entity.[9] What the panel majority called "quite literally . . . the paradigmatic abstract idea,"[10] the concurring judge labeled "not at all abstract."[11]

Few issues in patent law are as pressing as the availability of exclusive rights in fields such as biotechnology, computer programming, communications, and business, that stretch the boundaries of technology as traditionally conceived. The consequences are too important to leave to ill-defined gatekeepers. Abstractness is a creature of many forms, and the law could be usefully clarified by distinguishing among them. Moreover, some of the concerns addressed by denying patents to abstract ideas could be addressed through means other than patentable subject matter—means that account for the abstractness that is, to a degree, a characteristic of all patented inventions.

Part II summarizes the basic limitations on patentable subject matter expressed in the language of the Patent Act. Part III examines the emergence in the nineteenth century of the abstract ideas exclusion as a means to ensure that patentees would not monopolize the forces of nature. Courts in this era concentrated on the separation of principle from application—a distinction that endures today. The nineteenth century also gave birth to the cryptic notion that no one can patent an "idea." Part IV considers the role of abstract ideas in the patent cases of the twentieth century, as courts adapted traditional doctrines to the technologies of the information age. Here, courts struggled with mathematical algorithms, computer software, and business methods, at first using the abstract ideas prohibition to restrict patents to more conventional areas of technology, but eventually conceding that the patent system should play a role in the information economy. Part V takes us to the twenty-first century, marked by attempts to scale back the liberal interpretation of patentable subject matter characteristic of the preceding decades. The Federal Circuit, with stricter formulas for identifying patentable subject matter, reasserted the importance of tangibility, only to be

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[8] 558 F.3d 1359 (Fed. Cir. 2009).

[9] *Id.* at 1361.

[10] *Id.* at 1366 (internal quotation marks omitted).

[11] *Id.* at 1367 (Newman, J., concurring). The Federal Circuit's *Bilski* opinion presents a similar contrast, Judge Rader maintaining that "the hedging claim at stake in this appeal is a classic example of abstractness," *In re* Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (Rader, J., dissenting), while Judge Newman concludes that "this is not a fundamental principle or an abstract idea." *Id.* at 995 (Newman, J., dissenting).

reversed by the Supreme Court in *Bilski v. Kappos*.[12] Part VI explores the paradox that dwells in the abstract ideas exclusion, the confusion that stems from its multiple dimensions, and the prospects for a clearer approach.

II. STATUTORY LIMITATIONS

In order to "promote the Progress of . . . [the] useful Arts," the Constitution of the United States allows Congress to secure to inventors, for limited times, the exclusive right to their discoveries.[13] A patentable invention must be new, useful, and non-obvious,[14] and the patent must include a detailed disclosure that enables persons skilled in the art to make and use the invention without undue experimentation.[15] Today, the exclusive rights afforded the patentee include the right to make, use, sell, offer to sell, and import the patented invention.[16] Generally those rights end twenty years after the filing date of the patent application.[17]

"[U]seful Arts" is an eighteenth century term equivalent to "technology."[18] Patents promote advancements in technology by allowing inventors to reap the financial rewards of their endeavors during the period of exclusivity. The promise of reward leads to further investments and risk-taking.[19] Although patents restrict the use of technological achievements during their term, the encouragement of invention has "a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens."[20]

The first Patent Act was that of 1790.[21] Important revisions followed in 1793,[22] 1836,[23] and 1952.[24] One of the most significant changes, introduced in the Act of 1836, is the requirement that the applicant provide claims detailing the

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[12] 130 S. Ct. 3218.

[13] U.S. CONST. art. I, § 8, cl. 8.

[14] *See* 35 U.S.C. § 101 (2006) ("new and useful"); *id.* § 102 (novelty in comparison to prior art); *id.* §103 (nonobviousness).

[15] *Id.* § 112; Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999–1000 (Fed. Cir. 2008) (no "undue experimentation").

[16] *See* 35 U.S.C. § 271.

[17] *Id.* § 154(a)(2).

[18] *See* Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 54 (1949) ("The term 'useful arts' as used in the Constitution . . . is best represented in modern language by the word 'technology.'").

[19] *See* Graham v. John Deere Co., 383 U.S. 1, 9 (1966) ("The patent monopoly was not designed to secure to the inventor his natural right in his discoveries. Rather, it was a reward, an inducement, to bring forth new knowledge.").

[20] Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480 (1974).

[21] Patent Act of 1790, 1 Stat. 109 (1790).

[22] Patent Act of 1793, 1 Stat. 318 (1793).

[23] Patent Act of 1836, 5 Stat. 117 (1836).

[24] The current Patent Act is a revised version of the 1952 Act. *See* Patent Act, 35 U.S.C. §§ 1–376 (2006).

invention covered by the patent.[25] In earlier times, it fell to the more general written description of the invention—today's patent "specification"—to describe and distinguish what it was the patentee had contributed to the art.[26] Now it is the role of the claims to establish the "metes and bounds" of the patented invention.[27] The claims define the invention for purposes of examination and comparison to the prior art, and a court compares the claims to an accused product or process to determine if it infringes.[28]

Each patent act has limited the types of invention eligible for patenting. The act of 1790 defined patentable subject matter as "any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used."[29] The act of 1793 changed the wording somewhat, deleting "engine" and "device," and adding "composition of matter."[30] Little has changed since then, other than the substitution of the word "process" for "art."[31] The current statute reads: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title."[32]

The words used to define patentable subject matter are deliberately broad.[33] The term "machine" embraces "every mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result."[34] "Manufacture" includes any tangible thing made by the

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[25] *See* Patent Act of 1836, 5 Stat. at 119. Today's Patent Act states that the patent must "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112.

[26] The Patent Act of 1793 provides that "every inventor, before he can receive a patent shall . . . deliver a written description of his invention, and of the manner of using, or process of compounding the same, in such full, clear and exact terms, as to distinguish the same from all other things before known . . . ." Patent Act of 1793 § 3.

[27] Kara Tech. Inc. v. Stamps.com Inc., 582 F.3d 1341, 1347 (Fed. Cir. 2009).

[28] *See* Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1335 (Fed. Cir. 2002) (claim language construed, then compared to the prior art); Techsearch, L.L.C. v. Intel Corp., 286 F.3d 1360, 1371 (Fed. Cir. 2002) (infringement determined by construing the claims, then comparing them to the accused product).

[29] Patent Act of 1790,1 Stat. 109, § 1 (1790).

[30] Patent Act of 1793§ 1.

[31] The substitution occurred in the 1952 Patent Act. *See* Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980).

[32] 35 U.S.C. § 101 (2006).

[33] *See Chakrabarty*, 447 U.S. at 308 ("In choosing such expansive terms as 'manufacture' and 'composition of matter,' modified by the comprehensive 'any,' Congress plainly contemplated that the patent laws would be given wide scope.").

[34] Corning v. Burden, 56 U.S. (15 How.) 252, 267 (1854); *see also In re* Nuijten, 500 F.3d 1346, 1355 (Fed. Cir. 2007).

transformation of raw materials.[35] "Composition of matter" covers "all compositions of two or more substances," no matter how they may be united or what form they may take.[36] The term "process" has given courts the most difficulty;[37] but in its ordinary sense it would include any sequence of acts.[38] In the often-quoted words of the Committee Reports accompanying the 1952 Patent Act, the subject matter of patents includes "anything under the sun that is made by man."[39]

The spirit of inclusiveness reflects Thomas Jefferson's view that "ingenuity should receive a liberal encouragement."[40] However, patentable subject matter has never encompassed every sort of discovery one can imagine.[41] Courts have long held that patentable subject matter does not include natural phenomena,[42] natural laws,[43] or abstract ideas.[44] None of these exclusions are now, or ever have been, explicit in the patent statutes. For their origins and evolution, one must look to a series of cases beginning in the mid-nineteenth century.

III. "ABSTRACT IDEAS" IN THE NINETEENTH CENTURY: HARNESSING THE POWERS OF NATURE

Courts have frequently emphasized the difference between manifestations of nature, in which no one may claim property rights, and technological innovations

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[35] *See Chakrabarty*, 447 U.S. at 308; *Nuijten*, 500 F.3d at 1353. In *Nuijten*, the Federal Circuit held that an electrical signal lacks the tangible qualities necessary to make it a manufacture, even though it is produced through human agency. *See id.* at 1356 ("These definitions address 'articles' of 'manufacture' as being tangible articles or commodities. A transient electric or electromagnetic transmission does not fit within that definition.").

[36] *Chakrabarty*, 447 U.S. at 308 (quoting Shell Dev. Co. v. Watson, 149 F. Supp. 279, 280 (D.C. Cir. 1957)) (internal quotation marks omitted).

[37] *See infra* Part III.B.

[38] *See Bilski*,130 S. Ct. at 3228 (discussing the ordinary meaning of "method"). The Patent Act itself defines "process" through tautology: "the term 'process' means process, art or method . . . ." 35 U.S.C. § 100(b) (2006).

[39] S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952); *see also Chakrabarty*, 447 U.S. at 308.

[40] *Chakrabarty*, 447 U.S. at 308 (quoting 5 Writings of Thomas Jefferson 75–76 (H. Washington ed., 1871)).

[41] *See id.* at 309 ("This is not to suggest that § 101 has no limits or that it embraces every discovery.").

[42] *Id.* ("The laws of nature [and] physical phenomena . . . have been held not patentable.").

[43] *Id.*

[44] Diamond v. Diehr, 450 U.S. 175, 185 (1981) ("Excluded from [patent] protection are . . . abstract ideas."); *Chakrabarty*, 447 U.S. at 309.

that are subject to patenting.[45] Nature, in this context, might mean a natural phenomenon, like the magnetic field that envelops the Earth, or a naturally occurring substance, like a mineral rich in iron.[46] Although the Patent Act defines "invention" as "invention or *discovery*,"[47] no one can claim the handiwork of nature—even if, like the iron-rich mineral, it facially qualifies as a composition of matter.[48] On the other hand, one can patent new and useful technology that exploits natural phenomena, like a new compass fashioned from the iron-rich mineral and dependent on the Earth's magnetic field.[49] All inventions consist of natural components.[50] When an inventor transforms or arranges the natural components into something not found in nature, the result may be a patentable invention.

The line between a natural phenomenon and an invention is relatively clear. In the case of natural *principles*, the edges begin to blur. One way to describe or classify natural phenomena is by reference to the principles that create them. We might, for example, describe rainbows as the class of phenomena produced by the laws of refraction under certain environmental conditions. The laws of refraction are, in a sense, as much a part of nature as the rainbows themselves. Like the rainbows, they cannot be claimed as property. Inventions also operate according to natural principles, and the most convenient way to describe an invention may be by referring to those principles. The inventor of a compass, for example, might refer to the natural propensity of magnetized iron to align itself with the Earth's magnetic field. Here disentangling nature and invention is a difficult proposition. In the nineteenth century, courts dealt with the problem by distinguishing between natural principles "in the abstract" and useful applications of those principles.

The following section further examines limitations on patentability. Section A discusses the separation of principles of nature from their technological applications. Section B considers the special case of processes, which lack the concreteness of tangible machines and compositions of matter. Section C examines

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[45] *See, e.g.*, *Diehr*, 450 U.S. at 185; SmithKline Beecham Corp. v. Apotex Corp., 403 F.3d 1331, 1359–60 (Fed. Cir. 2005); Ass'n for Molecular Pathology v. USPTO, 702 F. Supp. 2d 181, 218–19 (S.D.N.Y. 2010).

[46] *Chakrabarty*, 447 U.S. at 309 ("[A] new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter.").

[47] 35 U.S.C. § 100(a) (2006) (emphasis added). The Constitution also refers to the "discoveries" secured to inventors. U.S. CONST. art. I, § 8, cl. 8.

[48] *See Chakrabarty*, 447 U.S. at 309; Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948).

[49] *Diehr*, 450 U.S. at 187 ("It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.").

[50] *See* Merck & Co. v. Olin Mathieson Chem. Corp., 253 F.2d 156, 161–62 (4th Cir. 1958) ("All of the tangible things with which man deals and for which patent protection is granted are products of nature in the sense that nature provides the basic source materials. The 'matter' of which patentable new and useful compositions are composed necessarily includes naturally existing elements and materials.").

the "doctrine of equivalents," which, contrary to the tenet that principles cannot be patented, elevates the principle of the patented invention above the explicit limitations of the claim. Finally, Section D discusses the origins of the puzzling but enduring notion that an "idea" cannot be patented.

A. Principle and Application

Le Roy v. Tatham,[51] decided in 1853, concerned the discovery that pieces of solid lead could be forced to bond tightly under extreme heat and pressure, a technique used by the patentee in the manufacture of lead pipe.[52] Discussing the validity of the patent, the Court began with the proposition that "a principle is not patentable"[53]—a well-established maxim at the time, but one marred by "a want of precision" in the use of the word "principle" by courts and scholars.[54] The Court explained that "[a] principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right."[55] Likewise, no one can claim rights to any "power in nature," such as the power of steam or electricity.[56] Therefore, the property of lead that causes it to adhere under heat and pressure cannot be patented.

On the other hand, a machine that *applies* the powers of nature to useful ends may be patented.[57] The machine must be new,[58] and the patent must extend only to machines that "use the same mechanical power, or one that shall be substantially the same."[59] A patent covering any machine that achieved the same effect, or a patent covering the result of a process, would be invalid.[60] Rights prohibiting others from accomplishing the same ends "by any means whatsoever" would "discourage arts and manufactures, against the avowed policy of the patent laws."[61] In *Le Roy*, the patent-in-suit claimed only the machinery used by the inventor in

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[51] 55 U.S. (14 How.) 156 (1853).

[52] *Id.* at 173.

[53] *Id.* at 175; *see also* Burr v. Duryee, 68 U.S. (1 Wall.) 531, 570 (1864) (finding in the law "no authority to grant a patent for a 'principle' or a 'mode of operation,' or an idea, or any other abstraction").

[54] *Le Roy*, 55 U.S. at 174.

[55] *Id.* at 175.

[56] *Id.*

[57] *Id.*

[58] Although it may be "new" only in the sense that it constitutes a new arrangement of existing parts. *Id.*

[59] *Id.* The Court is less clear on the patentability of a new process, but the same reasoning seems to apply.

[60] *Id.*; *see also* Corning v. Burden, 56 U.S. (15 How.) 252, 268 (1854) ("It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself.").

[61] *Le Roy*, 55 U.S. at 175.

the pipe-making process, and because the machinery itself was not new the patent could not be sustained.[62]

Justice Nelson, writing in dissent, concluded that the patent did not cover only the machinery, but extended to the "employment of the newly-discovered property in the metal, and the practical adaption of it, by these means, to the production of a new result, namely, the manufacture of wrought pipe out of solid lead."[63] Is a new adaptation of natural property a discovery eligible for a patent? Justice Nelson echoed the majority's distinction between unpatentable principles and practical applications. Quoting *Boulton v. Bull*,[64] an English case concerning Watt's improvements to the steam engine, Nelson linked the application of a principle to its association with physical effects, corporeal substances, and the useful arts: "there can be no patent for a mere principle[,]but for a principle[]so far embodied and connected with corporeal substances as to be in a condition to act, and to produce effects in any art, trade, mystery, or manual occupation, I think there may be a patent."[65] Watt's invention was neither an "abstract notion," nor a "patent for a principle," but instead was a practical means of improving the efficiency of steam engines by insulating the steam vessel and condensing the steam separately.[66] When a principle is thus "turned to account, to a practical object, and applied to a special result," it is no longer a principle in the abstract.[67] Application of the natural properties of lead to the formation of manufactured goods should qualify, in Judge Nelson's view, as a patentable invention.[68]

Another early milestone in the history of patentable subject matter is *O'Reilly v. Morse*.[69] Although Morse had invented the telegraph and the code that bears his name, the eighth claim of his patent reached further—embracing any use of electromagnetism for printing messages over any distance, by any means.[70]

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[62] *Id.* at 176–77.

[63] *Id.* at 183 (Nelson, J., dissenting).

[64] Boulton v. Bull, 2 H. Bl. 463, 126 Eng. Rep. 651 (C.P. 1795).

[65] *Le Roy*, 55 U.S. at 183 (quoting Boulton v. Bull, 2 H. Bl. 463, 495, 126 Eng. Rep. 651, 667) (internal quotation marks omitted).

[66] *Id.*

[67] *Id.* at 185 (citation omitted) (internal quotation marks omitted).

[68] Nelson stressed that one who discovers means to apply a principle to practical ends is "entitled to protection against all other modes of carrying the same principle or property into practice for obtaining the same effect or result"—in this case, any machinery to exploit the same properties of lead. *Id.* at 185. That other machinery might be employed "only shows the beauty and simplicity, and comprehensiveness of the invention." *Id.* at 186 (citation omitted) (internal quotation marks omitted). The means, Nelson wrote, "are but incidental . . . flowing naturally from the original conception." *Id.* at 187. Where the patentee must be limited is in applying the principle to a specific end. "For every other purpose and end, the principle is free for all mankind to use." *Id.*

[69] 56 U.S. (15 How.) 62 (1854).

[70] *Id.* at 112. Morse stated:

Morse's claim reveals the ambiguity in *Le Roy*. Is this a claim to an "effect," or to a practical application of natural forces? The breadth of the claim, and its potential to hinder the work of future inventors, persuaded the majority of the Court to hold it unpatentable. As the Court observed:

> If this claim can be maintained, it matters not by what process or machinery the result is accomplished. For aught that we now know some future inventor, in the onward march of science, may discover a mode of writing or printing at a distance by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. His invention may be less complicated—less liable to get out of order—less expensive in construction, and in its operation. But yet if it is covered by this patent the inventor could not use it, nor the public have the benefit of it without the permission of this patentee.[71]

The Court did not dispute that Morse had invented subject matter he could patent.[72] But he was not entitled to claim *all means* to the same end, even those employing the same natural forces, thereby "shut[ting] the door against inventions of other persons" who might reveal new ways to exploit electromagnetism.[73] One who applies a principle to practical ends must "specif[y] the means he uses," and his patent is limited to those means.[74]

On the other hand, the Court did not dismiss the possibility that, in the proper case, the "means" employed by the patentee might be broadly defined. The Court referred to the English case of *Nielson v. Harford*,[75] concerning Nielson's discovery that a furnace could be made more efficient if the air introduced into the

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> I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specification and claims; the essence of my invention being the use of the motive power of the electric or galvanic current, which I call electro-magnetism, however developed for marking or printing intelligible characters, signs, or letters, at any distances, being a new application of that power of which I claim to be the first inventor or discoverer.

Id. (internal quotation marks omitted).

[71] *Id.* at 113.

[72] As the Court explained:

> [I]t is the high praise of Professor Morse, that he has been able, by a new combination of known powers, of which electro-magnetism is one, to discover a method by which intelligible marks or signs may be printed at a distance. And for the method or process thus discovered, he is entitled to a patent.

Id. at 117–18.

[73] *Id.* at 113.

[74] *Id.* at 119.

[75] (1841) 151 Eng. Rep. 1266 (Exch. of Pleas); 8 Meeson & Welsby 806.

combustion chamber were heated first in a separate vessel. Nielson did not specify the form of the vessel or the manner in which it would be heated, details he considered immaterial.[76] In spite of the breadth of his patent, the English court concluded that Nielson claimed a machine, not a principle. The Court in *Morse* approved that conclusion. Although Nielson could not patent the discovery that hot air promotes ignition,[77] he could patent the use of that principle to improve combustion efficiency by pre-heating the air. This was an effect produced "in greater or less degree" regardless of the heating vessel; "[t]he interposition of a heated receptacle, in any form, was the novelty he invented."[78] In contrast, Morse had not discovered that electromagnetism always served to transmit messages at a distance. Success depended on the machinery.[79]

While *Morse* and *Le Roy* are both instructive, obscurity in the meaning of "principle" persists. Natural forces like electromagnetism, or observed truths about the workings of nature, cannot be patented. Applications of nature to useful ends may be patented if the claims are sufficiently limited. The question is how limited they must be. The more one describes an invention in terms of natural principles, the broader and more generalized the claim becomes. In some cases, like Nielson's, that may be justified, the details of implementation being incidental. In other cases, like Morse's, the claim exceeds the bounds of the inventor's contribution to the art.

B. Arts and Processes

Courts in the same era held that processes are patentable subject matter.[80] Even if a process does not require new machinery, it can still qualify as "a practicable . . . means of producing a beneficial result or effect,"[81] falling on the safe side of the principle/application divide. *Cochrane v. Deener*,[82] for example,

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[76] *See Morse*, 56 U.S. at 115.

[77] *Id.* at 116 ("[B]ecause the discovery of a principle in natural philosophy or physical science, is not patentable.").

[78] *Id.*

[79] *Id.* at 117. Justice Grier took a different view. His dissent characterizes Morse's discovery as the use of electromagnetism to transmit intelligible characters at a distance. This constituted his "whole invention, and nothing more." *Id.* at 134–35 (Grier, J., dissenting). If the "essence" of Morse's invention consisted of "compelling this hitherto useless element" to perform a practical task, how, Grier asked, could it be argued that Morse had claimed "a principle or an abstraction?" *Id.* at 135. As for the breadth of Morse's disputed claim, Grier found that it accurately reflected his discovery and should be limited only if it encompassed subject matter previously known. *Id.*

[80] *See, e.g.*, Corning v. Burden, 56 U.S. (15 How.) 252, 254 (1854).

[81] *Id.* at 268.

[82] 94 U.S. 780 (1877).

concerned a method of separating and grinding middlings to produce a superior flour, a process "not limited to any special arrangement of machinery."[83]

> That a process may be patentable, irrespective of the particular form of the instrumentalities used, cannot be disputed. . . . A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. If new and useful, it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art.[84]

Similarly, the Court in *Tilghman v. Proctor*[85] held that the inventor could patent a method of dissolving oily materials in water under high temperature and pressure, even though the claims left out many details of the method and apparatus.[86] As in *Cochrane*, the Court expressed "no doubt" that a patent could be granted for a process; "[a] manufacturing process is clearly an art, within the meaning of the law."[87] Although the apparatus disclosed in Tilghman's specification was not the best to carry out the method he claimed, the same had been said of Nielson's apparatus.[88] What mattered was that each had invented a practical "means" to achieve a useful result.[89] Where Morse had gone wrong was in claiming "a mere principle," in the form of the "exclusive use of one of the powers of nature for a particular purpose."[90] His was "not a claim of any particular machinery, nor a claim of any particular process for utilizing the power; but a claim of the power itself."[91]

Although, in the end, both machines and processes can serve as means to apply the forces of nature, the patentability of the former was more obvious to the courts of the nineteenth century. "A machine is a concrete thing, consisting of parts, or of certain devices and combination of devices. . . . A machine is not a

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[83] *Id.* at 785.
[84] *Id.* at 787–88.
[85] 102 U.S. 707 (1881).
[86] *Id.* at 723–24.
[87] *Id.* at 722.
[88] *Id.* at 723–24.
[89] *See id.* at 728.
[90] *Id.* at 726.
[91] *Id.* at 726–27. Looking at the majority opinion in *Morse*, one could conclude that it was more about the adequacy of the disclosure than whether the challenged claim was patentable subject matter. *See* Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1346 n.4 (Fed. Cir. 2010) (en banc) (pointing out that *Morse* can be interpreted as a written description case). In *Tilghman*, however, the Court clearly sees *Morse*, like *Le Roy*, as a case about the patentability of an abstract principle. *Tilghman*, 102 U.S. at 707. Some scholars call *Morse* the origin of the abstract ideas exclusion. *See, e.g.*, Burk & Lemley, *supra* note 4, at 1642 ("The rule originated in the case of *O'Reilly v. Morse*.").

principle or an idea."[92] Processes, on the other hand, evoke a number of cryptic statements suggesting that they present a more doubtful case. For example, in *Corning v. Burden*,[93] the Court observed that a process "is usually the result of discovery; a machine, of invention."[94] In *Tilghman*, the Court described a machine as a thing "visible to the eye" and "an object of perpetual observation."[95] In contrast, it called a process "a conception of the mind, seen only by its effects when being executed or performed."[96]

In *Corning*, the Court specifically warned that processes characterized "subjectively or passively as applied to the material operated upon," do not constitute patentable subject matter.[97] Examples include when "we say that a board is undergoing the process of being planed, grain of being ground, iron of being hammered."[98] This echoes the statement in *Le Roy* that one cannot claim as one's invention all means to achieve a particular effect or result. Such a claim is too broad or "abstract."[99] A claim to a machine can suffer that defect (e.g., a claim to any machine that serves to transmit messages).[100] Yet process claims may be more

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[92] Burr v. Duryee, 68 U.S. (1 Wall.) 531, 570 (1864).

[93] 56 U.S. (15 How.) 252 (1854).

[94] *Id.* at 267. The point seems to be that the "invention" of a machine brings, through human ingenuity, a new thing into the world; the "discovery" of a process merely reveals the potential inherent in the machines we already possess. In *The Telephone Cases*, 126 U.S. 1 (1888), the Court drew a similar distinction regarding Alexander Graham Bell's "invention" and "discovery." Electricity, the Court observed, is "one of the forces of nature," but "left to itself, [it] will not do what is wanted." *Id.* at 532. Researchers believed that electricity could be harnessed to transmit the vibrations in the air caused by speech. "Bell discovered that it could be done by gradually changing the intensity of a continuous electric current, so as to make it correspond exactly to the changes in the density of the air caused by the sound of the voice." *Id.* Having discovered the "art," Bell "then devised a way in which these changes of intensity could be made and speech actually transmitted." *Id.* at 532–33. In this instance, "both discovery and invention, in the popular sense of those terms, were involved; discovery in finding the art, and invention in devising the means of making it useful." *Id.* at 533.

[95] *Tilghman*, 102 U.S. at 728.

[96] *Id.* The meaning is uncertain. A process is more transient than a machine; generally one can observe a machine at one's leisure and a process only while it is ongoing. Yet it is odd to say that an industrial process is a "conception of the mind," as though it took place only in the imagination of the observer. That a process is a "conception of the mind" is a conclusion repeated more than a century later in *Parker v. Flook*, 437 U.S. 584, 589 (1978). Because both processes and principles are "conceptions of the mind, seen only by [their] effects when being executed or performed" the line between them is "not always clear." *Id.* (quoting *Tilghman*, 102 U.S. at 728).

[97] 56 U.S. at 268.

[98] *Id.*

[99] *See id.* ("[I]t is well settled that a man cannot have a patent for the function or abstract effect of a machine.").

[100] In *Fuller v. Yentzer*, the Court wrote:

prone to it, simply because the steps of a process are often described as the accomplishment of a series of intermediate goals, as a recipe might direct one to raise the temperature of the oven to 350 degrees, combine the dry ingredients, separate the eggs, and so forth. Each step is an act, but characterized in terms of the effect achieved. In this sense, process claims may be more abstract.

C. The Doctrine of Equivalents

Only ten days after issuing its opinion in *Morse*, the Supreme Court produced another landmark patent decision: *Winans v. Denmead*.[101] The patent at issue claimed a railroad car shaped like the frustum of a cone.[102] The design accommodated heavy loads by distributing their weight, and it facilitated the discharge of cargo through an opening at the bottom of the car.[103] The railroad car charged with infringing the patent was octagonal in cross-section, not circular as the claims required.[104] But because the octagonal shape achieved much of the same benefit, it could still infringe. As the Court explained:

> It is generally true, when a patentee describes a machine, and then claims it as described, that he is understood to intend to claim, and does by law actually cover, not only the precise forms he has described, but all other forms which embody his invention; it being a familiar rule that, to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportions.[105]

In 1853, the Court wrote that "a principle is not patentable;"[106] now, in 1854, it invokes the "familiar rule" that, whatever the claims may specify, copying the "principle" of a patent is enough to infringe.[107] As the Court warned in *Le Roy*, the

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> Patents for a machine will not be sustained if the claim is for a result, the established rule being that the invention, if any, within the meaning of the Patent Act, consists in the means or apparatus by which the result is obtained, and not merely in the mode of operation independent of the mechanical devices employed; nor will a patent be held valid for a principle or for an idea, or any other mere abstraction.

94 U.S. 288, 288 (1877).

[101] 56 U.S. (15 How.) 330 (1854).

[102] *Id.* at 339.

[103] *Id.*

[104] *Id.* at 340.

[105] *Id.* at 342. It is still true today that the substitution of equivalent elements does not avoid infringement of a patent claim, a rule known as the "doctrine of equivalents." *See* Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 40 (1997).

[106] *Le Roy*, 55 U.S. at 175.

[107] *Winans*, 56 U.S. at 342.

word "principle" invites confusion.[108] In *Le Roy*, it meant a principle *in the abstract*—a "fundamental truth," as opposed to a practical design.[109] In *Winans*, "principle" meant the thing that makes the invention work—the way that the invention turns a "fundamental truth" to practical advantage.

Winans, nevertheless, shows the difficulty of striking the right balance. A patent that omits too much detail embraces a principle in the abstract; yet the details specified in some patents must be ignored in favor of the "principle" at stake. The invention that can be the subject of a patent, and the invention that must be avoided by a potential infringer, lies in some middle ground of generality, with certain limits observed and others ignored. The claims are not a reliable guide to identifying that invention. Morse's invention was narrower than his Claim 8, which omitted all details except the use of electromagnetism to transmit messages. Winans' invention was broader than his claims, which specified the frustum of a cone. As the Court wrote in *Tilghman*, "[w]hoever discovers that a certain useful result will be produced in any art by the use of certain means is entitled to a patent for it, provided he specifies the 'means.' But everything turns on the force and meaning of the word 'means.'"[110] Morse characterized his "means" too ambitiously—Winans too modestly.

Westinghouse v. Boyden Power Brake Co,[111] concerning an improved automatic air brake for trains, illustrates the tension. To facilitate rapid braking in an emergency, the improved design allowed compressed air to flow directly from the main reservoir to the brake cylinder without passing through an auxiliary reservoir.[112] The defendants accomplished the same thing through a mechanically different arrangement. The patent claimed the invention in general terms, including references to what the components of the apparatus would *do*.[113] This the Court viewed as "a claim . . . to a certain extent, for a function,"[114] leading the Court to review the cases distinguishing between unpatentable principles and patentable "means." Ultimately, the Court found that Westinghouse must be limited to its

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[108] 55 U.S. at 174.
[109] *Id.* at 175.
[110] Tilghman v. Proctor, 102 U.S. 707, 728 (1881).
[111] 170 U.S. 537 (1898).
[112] *Id.* at 538.
[113] The second claim of the patent read:

> [I]n a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder and a triple-valve having a piston, whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder, substantially as set forth.

Id. at 553.
[114] *Id.* at 554.

own mechanism.[115] Justice Shiras, writing in dissent, relied on *Winans* for the proposition that a patent should extend to other mechanisms that operate by the same principle.[116] His summary of *Tilghman*, which Shiras thought "[v]ery applicable to the present case," is that "a patent may be validly granted for carrying a principle into effect,"[117]and the patentee may claim a "mode" of operation, if no particular apparatus is necessary to "obtain benefit from the principle."[118] Shiras, in short, took a more general view of Westinghouse's invention than did the majority, regarding as "means" what the majority held to be "principle."[119]

D. Rubber-Tip Pencil

Before we leave the nineteenth century, one more case is worth considering: *Rubber-Tip Pencil Co. v. Howard*.[120] The patentee claimed a simple invention—a rubber eraser with a hole in it so that the eraser could be affixed to the end of a pencil. The eraser could be of almost any shape, as could the hole, so long as it was slightly smaller in width than the diameter of the pencil.[121] Rubber erasers were already known, as was the natural elasticity of rubber and its ability to grip objects in the manner described. "What," asked the Court, "is left for this patentee but the idea that if a pencil is inserted into a cavity in a piece of rubber smaller than itself the rubber will attach itself to the pencil, and when so attached become convenient for use as an eraser?"[122] The Court concluded, "[a]n idea of itself is not patentable, but a new device by which it may be made practically useful is. The idea of this patentee was a good one, but his device to give it effect, though useful, was not new. Consequently he took nothing by his patent."[123]

Rubber-Tip Pencil is difficult to categorize. It resembles *Le Roy* in two respects: its reference to the natural elastic properties of rubber, and its concession that one may patent the means by which "ideas" are "made practically useful." But the "idea" in this case is not some principle of nature in the abstract; it is a plan for an eraser conveniently attached to the end of a pencil. The inventor had not only this "idea," but a "device" for making it useful.

The case raises many questions. Why is affixing a rubber eraser to the end of a pencil an unpatentable "idea," compared to any other "idea" for an invention? What did the Court mean by the "device to give it effect?" How does this "device,"

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[115] *Id.* at 572–73.
[116] *Id.* at 575–76 (Shiras, J., dissenting).
[117] *Id.* at 578–79.
[118] *Id.*
[119] Westinghouse, Justice Shiras concluded, was a "pioneer inventor . . . entitled to protection against those who, availing themselves of [his] discovery, seek to justify themselves by pointing to mere differences in form . . . ." *Id.* at 581.
[120] 87 U.S. 498 (1874).
[121] *Id.* at 506–07.
[122] *Id.* at 507.
[123] *Id.*

as a concept, differ from the "idea" that could not be patented? Does any of this matter if the case is really about novelty? The legacy of *Rubber-Tip Pencil* is primarily this: it includes the convenient phrase "[a]n idea of itself is not patentable," a phrase that enjoyed a rich after-life, as we will see, in the twentieth century. Although the subsequent cases bore little factual resemblance to the original, and the ambiguities of the reasoning were never resolved, the phrase has been quoted, repeatedly, as authority to disallow patents to "abstract ideas" in many guises.[124]

To summarize, the benchmark cases of the nineteenth century hold that one cannot patent principles of nature or natural phenomena in the abstract. A patent of such breadth would only hinder technological progress. One can, however, patent the means discovered for putting nature to work. The usual point of contention is the generality with which one can claim the means, and the extent to which one can describe the means in terms of underlying principles.

IV. "ABSTRACT IDEAS" IN THE TWENTIETH CENTURY: ADAPTING TO THE INFORMATION AGE

The Supreme Court would revisit these themes in the twentieth century, when the inventions debated often involved, in place of natural phenomena like electromagnetism or the properties of lead, the less tangible components of information age technology. Now the principle at work might be a principle of mathematics rather than chemistry or physics.[125] Yet the Supreme Court would continue to cite cases like *Morse* and *Le Roy* for the ground rules of patentable subject matter, reinforcing the fundamental divide between unpatentable principles and patentable means. By the end of the century, enthusiastic application of the principle/means approach would push the lower courts to endorse the patentability of any invention capable of producing a "useful, concrete and tangible result"[126]—even inventions that manipulate data, account balances, symbols, or other intangibles. The courts still maintained that abstract ideas are not patentable, but it would become increasingly uncertain what that meant.

The following sections explore several analytical frameworks the Court has employed in confronting inventions that are, in some respects, inherently abstract. Section A discusses the Supreme Court's response to patents on computer software and mathematical algorithms. Section B examines the confusing history of the mental steps doctrine. Section C looks patents claiming methods of analysis. Finally, Section D reviews the expansion of patentable subject matter to embrace methods of doing business and other intangible pursuits of the information age.

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[124] *See infra* notes 134, 156, 205 and accompanying text.

[125] *See, e.g.*, Parker v. Flook, 437 U.S. 584 (1978) (analyzing patentability of mathematical algorithm); Gottschalk v. Benson, 409 U.S. 63 (1972) (addressing invention of method for converting binary-coded-decimal numerals into pure binary numbers).

[126] *See infra* note 238 and accompanying text.

A. Mathematical Algorithms

In *Gottschalk v. Benson*,[127] the applicant claimed a mathematical procedure, or "algorithm," for converting numbers represented in binary-coded decimal (BCD) form into pure binary form. The claims were not confined "to any particular art or technology, to any particular apparatus or machinery, or to any particular end use," although the method was intended for use in a computer.[128] Addressing whether the algorithm qualified as a patentable process, the Court cited *Morse* for its warning that a claim without limits would impede the "onward march of science."[129] The Court found Benson's claim unacceptably broad:

> Here the "process" claim is so abstract and sweeping as to cover both known and unknown uses of the BCD to pure binary conversion. The end use may (1) vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents and (2) be performed through any existing machinery or future-devised machinery or without any apparatus.[130]

The Court found that Benson's patent would preempt any practical use of his algorithm, so that "in practical effect," Benson's patent would be one for an "idea."[131] "It is conceded," the Court remarked, "that one may not patent an idea."[132]

The Court's discussion of the law begins with an uncontroversial proposition, stated in *Mackay Radio & Tel. Co. v. Radio Corp. of America*,[133] a case concerning an antenna optimized by the use of scientific principles: "While a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be."[134] This statement, the Court writes, "followed" the venerable rule of *Rubber-Tip Pencil* that "an idea of itself is not patentable."[135] Next the Court quotes from *Le Roy* the passage holding that "[a] principle, in the abstract, is a fundamental truth;

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[127] 409 U.S. 63 (1972).

[128] *Id.* at 64.

[129] *Id.* at 68 (quoting O'Reilly v. Morse, 56 U.S. (15 How.) 62, 113 (1854)) (internal quotation marks omitted).

[130] *Id.*

[131] *Id.* at 71–72.

[132] *Id.* at 71.

[133] 306 U.S. 86 (1939).

[134] *Benson*, 409 U.S. at 67 (quoting *Mackay*, 306 U.S. at 94) (internal quotation marks omitted).

[135] *Id.* (quoting Rubber-Tip Pencil Co. v. Howard, 87 U.S. 498, 507 (1874)) (internal quotation marks omitted).

an original cause; a motive" and cannot, therefore, be patented.[136] So far, one could conclude, in spite of the general reference to "ideas," that the Court is merely rehearsing the distinction between principles of nature and practical applications. Then the Court writes without quotation: "Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work."[137] The paragraph concludes with another reference to the distinction between natural phenomena and their practical application.[138]

With the possible exception of the cryptic phrase from *Rubber-Tip Pencil*, the authorities cited here, and throughout the *Benson* opinion, deal with principles or phenomena of nature. They do not refer, at least in the same terminology, to "abstract intellectual concepts." It is important to ask, therefore, whether *Benson* adds something new to the domain of unpatentable subject matter, or whether "abstract intellectual concepts" simply refers to principles of nature—a category that might be stretched to include mathematical relationships of the kind exploited by the algorithm in question. Unfortunately, it is not clear what the Court means. Later the Court attacks Benson's claim as "abstract and sweeping," referring to the breadth of the claim and its potential to preempt the work of other researchers.[139] The scope of the claim, and its impact on the progress of the technological arts, is what ultimately condemns it. Although Benson might have regarded the wide-ranging utility of his invention as a point in his favor,[140] this very quality seems to be the measure of an "abstract intellectual concept."

The Court did not conclude that all innovations in computer software must be dismissed as unpatentable ideas. *Benson* calls the "[t]ransformation and reduction of an article to a different state or thing" the "clue to the patentability" of any process not limited to particular machines.[141] Software only manipulates symbols and data; it does not produce any physical transformation. But the Court did not say, explicitly, that only processes limited to particular machines, or that transform articles into a different thing, qualify as patentable subject matter.[142] Perhaps limits

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[136] *Id.* (quoting Le Roy v. Tatham, 55 U.S. (14 How.) 156, 175 (1853)) (internal quotation marks omitted).

[137] *Id.*

[138] *Id.*

[139] *Id.* at 68.

[140] A sign of "the beauty and simplicity, and comprehensiveness of the invention," to borrow a phrase from the *Le Roy* dissent. 55 U.S. at 186 (Nelson, J., dissenting).

[141] 409 U.S. 63, 70 (1972) (quoting Cochrane v. Deener, 94 U.S. 780, 788 (1877)) (internal quotation marks omitted).

[142] The Court cautioned:

> It is argued that a process patent must either be tied to a particular machine or apparatus or must operate to change articles or materials to a "different state or thing." We do not hold that no process patent could ever qualify if it did not

could be imposed in other ways that would prevent an algorithm claim from being "abstract and sweeping" in the manner of Benson's claim.

In the subsequent case of *Parker v. Flook*,[143] the invention concerned the catalytic conversion of hydrocarbons.[144] During the conversion process, measured temperatures, pressures, and other factors were not to exceed predetermined "alarm limits." Flook's "invention" was the use of a mathematical algorithm to continuously update the alarm limits.[145] Flook's claim was not as "abstract and sweeping" as Benson's because it did not extend to any field in which the algorithm might be applied.[146] Nevertheless, the Court held that Flook did not claim a patentable "process." When the Court discounted the mathematical algorithm, treating it as though it were part of the prior art, the remainder of Flook's application contained no patentable invention.[147]

Flook rejected the algorithm because laws of nature cannot be patented, and *Benson* had reasoned that "an algorithm, or mathematical formula, is like a law of nature."[148] That is one interpretation of *Benson*, though it misses the element of breadth and preclusion that *Benson* stressed, and that is far less evident in *Flook*. To justify the unpatentability of natural laws, *Flook* invokes "[t]he underlying notion . . . that a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed."[149] Patentable subject matter must be new, "not merely heretofore unknown."[150] The reason for the exclusion is that "the public must not be deprived of any rights that it theretofore freely enjoyed."[151]

Flook repeats the list of unpatentable subject matter offered in *Benson*—"[p]henomena of nature . . . mental processes, and abstract intellectual concepts," again referring to these as "the basic tools of scientific and technological work."[152] *Flook* does not clearly state whether a mathematical algorithm is a phenomenon of nature, an abstract intellectual concept, or something else entirely. It does not define "abstract intellectual concepts," nor does it explain whether such concepts are necessarily ones that, like natural relationships, "already existed." Although *Flook* cites the historic cases that distinguished between natural principles and practical applications, it criticizes the applicant for "assum[ing] that if a process

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> meet the requirements of our prior precedents. It is said that the decision precludes a patent for any program servicing a computer. We do not so hold.

Id. at 71.

[143] 437 U.S. 584 (1978).

[144] *Id.* at 586.

[145] *Id.* at 585.

[146] *Id.* at 586.

[147] *Id.* at 594.

[148] *Id.* at 589.

[149] *Id.*at 593 n.15.

[150] *Id.* (quoting PETER D. ROSENBERG, PATENT LAW FUNDAMENTALS 13 (1975)).

[151] *Id.* (internal quotation marks omitted).

[152] *Id.* at 589 (internal quotation marks omitted).

application implements a principle in some specific fashion, it automatically falls within the patentable subject matter of §101."[153] This approach, the Court explained, "would make the determination of patentable subject matter depend simply on the draftsman's art[154] and would ill serve the principles underlying the prohibition against patents for 'ideas' or phenomena of nature."[155]

The final chapter in the Court's mathematical algorithm trilogy is *Diamond v. Diehr*.[156] Here the invention was a process of molding synthetic rubber. Instruments continuously monitored the temperature inside the press, and when a computer, employing the well-known Arrhenius equation, calculated that the time had arrived, it signaled a device to open the mold.[157] The facts resemble those in *Flook*; both involve instruments monitoring an industrial process and a computer constantly recalculating a useful figure. In *Flook* the figure is the updated alarm limit, in *Diehr* the right time to open the press. But in *Diehr* the Court held the claims patentable subject matter because, *as a whole*, they described an industrial process that transformed liquid rubber into manufactured articles. That one part of the process involved a mathematical algorithm did not disqualify it.[158] The Court distinguished *Flook* by observing that an alarm limit is "simply a number," and that Flook's application had not discussed any of the physical process steps involved in the catalytic conversion of hydrocarbons; "[a]ll that [Flook] provides is a formula for computing an updated alarm limit."[159]

Diehr identifies as unpatentable discoveries "laws of nature, natural phenomena, and abstract ideas."[160] The list has evolved somewhat since *Flook*, adding "laws of nature" to "natural phenomena," omitting "mental processes," and substituting "abstract ideas" for "abstract intellectual concepts." *Diehr* adds little to our understanding of abstract ideas, though it is clear that an industrial process taking advantage of a mathematical formula is not abstract. The authorities *Diehr* cites are the familiar ones, including the remark from *Le Roy* that "[a] principle in the abstract, is a fundamental truth . . . [in which] no one can claim . . . an exclusive right,"[161] as well as the phrase from *Rubber-Tip Pencil* warning that "[a]n idea of itself is not patentable."[162] As in *Flook*, the Court treats a

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[153] *Id.* at 593.

[154] Meaning, apparently, that one could artificially constrict the reach of one's claims without adding anything genuinely inventive—without, in other words, really going beyond the natural principle itself. An example might be claiming all uses of the laws of gravity in the field of hydroelectric power.

[155] *Flook*, 437 U.S. at 593.

[156] 450 U.S. 175 (1981).

[157] *Id.* at 177–79.

[158] *Id.* at 184–85.

[159] *Id.* at 186–87.

[160] *Id.* at 185.

[161] *Id.* at 185 (quoting Le Roy v. Tatham, 55 U.S. (14 How.) 156, 175 (1853)).

[162] *Id.* (quoting Rubber-Tip Pencil Co. v. Howard, 87 U.S. 489, 507 (1874)).

mathematical algorithm, separated from a practical application "like a law of nature, which cannot be the subject of a patent."[163]

Benson, *Flook*, and *Diehr* firmly established that "abstract ideas" are not patentable subject matter, but they did little to clarify the prohibition. Are abstract ideas limited to principles of nature or mathematics? Are they limited to truths or relationships that "already existed"? Or do they include any broadly-conceived idea that, claimed as such, would preempt a vast area of technological inquiry, or deny researchers their "basic tools"?

B. Mental Processes

Another category of unpatentable subject matter is what *Benson* calls "mental processes"—the type of invention once subject to the "mental steps doctrine." Justice Stevens, dissenting in *Diehr*, calls the mental steps doctrine a product of the "familiar principle that a scientific concept or mere idea cannot be the subject of a valid patent."[164] Mental processes, then, might be a species of abstract idea, or they might have something in common with abstract ideas that disqualifies them both as patentable subject matter.

The history of the mental steps doctrine is a confusing one, described shortly before *Benson* as "something of a morass."[165] In the 1940s, inventions depending on new ways to exercise human judgment had been held to lie beyond the limits of patentable subject matter. An example is *In re Heritage*,[166] where the applicant claimed a method of selecting the optimal amount of coating for sound-absorbing boards by subjecting samples, with differing thicknesses applied, to acoustic tests.[167] The feature said to be novel was the selection itself, based on criteria set out in the applicant's system. "Such purely mental acts," held the Court, "are not proper subject matter for protection under the patent statutes."[168] Similarly, methods of observing and calculating had been held unpatentable. In *Halliburton Oil Well Cementing Co. v. Walker*,[169] the Ninth Circuit addressed a method of using echoes to locate an obstruction in a well.[170] The "mental steps" detailed—including steps of "observing," "measuring," "counting," and "computing"—were not patentable subject matter, even if novel.[171] The Court referred to the *Cochrane* definition of "process" as "an act, or a series of acts, performed upon the subject

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[163] *Id.* at 186.
[164] *Id.* at 195 (Stevens, J., dissenting).
[165] *In re* Musgrave, 431 F.2d 882, 890 (C.C.P.A. 1970).
[166] 150 F.2d 554 (C.C.P.A. 1945).
[167] *Id.* at 556.
[168] *Id.*
[169] 146 F.2d 817 (9th Cir. 1944).
[170] *Id.* at 818.
[171] *Id.* at 821 (internal quotation marks omitted).

matter to be transformed and reduced to a different state or thing."[172] That transformation is absent in a thought process. If such methods were patentable, the Court observed, "the patentee would have a monopoly much broader than would the patentee of a particular apparatus."[173]

The story becomes more complicated when the claimed method is an otherwise patentable process that *includes* one or more mental steps. In *In re Abrams*,[174] the applicant claimed a method of prospecting for petroleum deposits by measuring the outflow of gasses from exploratory drill sites.[175] The method included some physical steps (e.g., sealing boreholes and reducing their pressure) and some mental steps (e.g., comparing the outflow of different boreholes to detect anomalies).[176] The applicant suggested certain "rules of law" for dealing with hybrid claims. If the method was "purely mental in character," it would be unpatentable. If the method combined mental steps with physical steps, then patentability would depend on the source of the novelty. Where the physical steps were novel, and the mental steps "incidental parts of the process," the method could be patented. Where the innovation lay entirely in the mental steps, the method would be disqualified.[177] Although these suggestions "appear[ed] to accord" with precedent,[178] the court found that Abrams' invention actually fell in the latter category, disqualifying his invention as patentable subject matter.[179]

In 1951, the Court of Customs and Patent Appeals (CCPA) held it "thoroughly established" that mental processes do not constitute patentable subject matter.[180] The *Abrams* court hardly bothered to justify that conclusion: "It is self-evident," the court proclaimed, "that thought is not patentable."[181] But things began to unravel in the late 1960s.

In the first *Prater* opinion,[182] Judge Smith of the CCPA questioned the origins of the mental steps doctrine. *Cochrane*, he found, should not be read to limit process claims to those that physically transform matter. The often-quoted passage[183] had been "misconstrued as a 'rule' or 'definition'" excluding processes without a physical dimension; in fact, the intention had been merely "to point out

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[172] *Id.* (quoting Cochrane v. Deener, 94 U.S. 780, 788 (1877)) (internal quotation marks omitted).

[173] *Id.*

[174] 188 F.2d 165 (C.C.P.A. 1951).

[175] *Id.* at 165.

[176] *Id.*

[177] *Id.* at 166.

[178] *Id.* at 167.

[179] *Id.* at 170.

[180] *In re* Yuan, 188 F.2d 377, 380 (C.C.P.A. 1951).

[181] 188 F.2d at 168.

[182] *In re* Prater, 415 F.2d 1378 (C.C.P.A. 1968).

[183] Corning, 56 U.S. at 254 ("A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing.").

that a process is not limited to the means used in performing it."[184] In the *Telephone Cases*, the Supreme Court had approved method claims "involving processes acting on energy rather than physical matter,"[185] and in *Tilghman* the court had "focuse[d] attention on the mental aspect of process inventions."[186] Cases rejecting thought processes had really turned on an absence of novelty.[187] Finally, the rules discussed in *Abrams*, according to Judge Smith, had been adopted by that court merely for purposes of argument—to demonstrate that the applicant could not win, even on his own terms.[188]

Having cast doubt on the mental steps doctrine in its entirety, Judge Smith concluded that any process that could be performed by a machine *or* in the human mind should qualify as patentable subject matter, so long as it was "directed to an industrial technology—a 'useful art' within the intendment of the Constitution."[189] Here the patent claimed a method of spectrographic analysis that could be performed by an analog or digital computer, making it a patentable process.[190]

The following year, the second *Prater* opinion[191] superseded the first. On this occasion, the court held the claims indefinite for failing to limit the invention to machine implementation, as the applicant had intended.[192] The court's discussion of mental processes, much of it reproduced from the first *Prater* opinion, could be dismissed *as dicta*. However, the court once again distinguished cases in which a claimed method consisted of "purely mental steps" that could only be performed in the human mind.[193] Whether such methods qualify as a process under the 1952 Patent Act was, the court concluded, "an issue which has never been squarely decided."[194] Nevertheless, because the applicant had invented a process that could be performed by machines, the court found it unnecessary to address the issue.[195]

The next development came with *In re Musgrave*,[196] a 1970 case concerning a method of analyzing seismograms. Here the court firmly rejected the *Abrams* rules,

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[184] *Id.* at 1388.
[185] *Id.*
[186] *Id.*
[187] Judge Smith traced the mental steps doctrine to *Don Lee, Inc. v. Walker*, 61 F.2d 58 (9th Cir. 1932). *Don Lee* held that a method of computing the best distribution of counterweights in a V-8 engine was not statutory subject matter. *In re Prater*, 415 F.2d at 1387. That conclusion is expressed in a statement which, said Judge Smith, "is not only unsupported by any citation of precedent but in its inception was directed to subject matter that was not even novel." *Id.*
[188] *In re Prater*, 415 F.2d at 1386.
[189] *Id.* at 1389.
[190] *Id.*
[191] 415 F.2d 1393 (C.C.P.A. 1969).
[192] *Id.* at 1404.
[193] *Id.* at 1402.
[194] *Id.* at 1402 n.23.
[195] *Id.*
[196] 431 F.2d 882 (C.C.P.A. 1970).

finding it "logically unsound" to consider a method with both physical and mental steps a patentable process only if the physical steps are novel.[197] As to processes without *any* physical steps, the court conceded that certain "peculiarly human" activities, impossible for machines, might constitute unpatentable subject matter. These would include methods requiring "human 'value judgments'" in matters such as politics, morals, or aesthetics.[198] On the other hand, no machine-ready process should be rejected as unpatentable subject matter merely because the process *could* be could be carried out by a thoughtful human being. "All that is necessary," held the court, "to make a sequence of operational steps a statutory 'process' . . . is that it be in the technological arts so as to be in consonance with the Constitutional purpose to promote the progress of the 'useful arts.'"[199] Judge Baldwin, who dissented, characterized the latter statement as "throw[ing] out entirely the 'mental steps' doctrine and replac[ing] it with a new rule."[200]

Although *Musgrave* is the case identified by Justice Stevens as "effectively dispos[ing] of any vestiges of the mental steps doctrine,"[201] the obituary was premature. As computers displaced human operators in countless areas of technology, debates concerning machine-implemented mathematical algorithms took center stage. Yet the categories of unpatentable subject matter listed in *Benson* and *Flook* still include mental processes.[202] The Federal Circuit, successor to the CCPA, would ultimately reaffirm the unpatentability of thought processes.[203] Although the reasoning is difficult to follow, it suggests, as discussed in Part VI.A., that if mental processes and "abstract ideas" are not the same thing, at least they have elements in common.[204]

C. Methods of Analysis

Methods of analyzing data have often tested the limits of abstractness. Shortly after *Diehr*, the CCPA decided *In re Meyer*,[205] a case involving a computer-implemented method of testing a complex system and analyzing the results to

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[197] *Id.* at 889 ("[A] given process including both 'physical' and 'mental' steps could be statutory during the infancy of the field of technology to which it pertained, when the physical steps were new, and non-statutory at some later time after the physical steps became old, acquiring prior art status, which would be an absurd result.").

[198] *Id.* at 889 n.4 (quoting Robert I. Coulter, *The Field of the Statutory Useful Arts*, 34 J. PAT. & TRADEMARK OFF. SOC'Y 417, 426 (1952)).

[199] *Id.*at 893.

[200] *Id.* at 894 (Baldwin, J., dissenting).

[201] Diamond v. Diehr, 450 U.S. 175, 200 (1981) (Stevens, J., dissenting).

[202] Gottschalk v. Benson, 409 U.S. 63, 67 (1972); Parker v. Flook, 437 U.S. 584, 589 (1978).

[203] *See infra* notes 308–313 and accompanying text.

[204] *See infra* notes 306–320 and accompanying text.

[205] 688 F.2d 789 (C.C.P.A. 1982).

locate a malfunction.[206] The applicants envisioned the use of their system to aid a neurologist in rendering a diagnosis.[207] The claims, however, were not limited to any particular field; they referred generally to "factors" associated with the "elements" of a system, which were "modified" (in an unspecified fashion) according to the response of those "elements" to a sequence of tests.[208] Because of the lack of specifics, and the potential to apply the method in any number of fields, one might have expected the court to dismiss the claim as an abstract idea. Instead, the court treated the claim as one embracing a "mathematical algorithm," in spite of the absence from the claim of any specific formula or mathematical procedure.[209]

The court called the exclusion of mathematical algorithms "consistent with the [Supreme] Court's long-standing exclusion from patentable subject matter of scientific principles, laws of nature, ideas and mental processes."[210] Some mathematical algorithms represent laws of nature, which cannot be patented because those laws "have existed throughout time, define the relationship of man to his environment, and, as a consequence, ought not to be the subject of exclusive rights of any one person."[211] Other mathematical algorithms do not embody principles of nature, but rather "ideas or mental processes"; they are, in other words, "simply logical vehicles for communicating possible solutions to complex problems."[212] To explain why these are unpatentable, the court cites none of the cases involving the mental steps doctrine. The most pertinent authority the court

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[206] *Id.* at 790.

[207] *See id.* at 793. The court observed:

> The Solicitor characterized the invention, without objection, as a 'diagnostic' or 'memory' aid for a physician and emphasized that the invention does not conduct a diagnosis in and of itself, but is used by a doctor when performing a diagnosis to store and to accumulate test responses obtained by this standard process of elimination and to narrow the neurological area of possible malfunction.

Id.

[208] *See id.* at 792–93.

[209] *Id.* at 796. The examiner, who came to the same conclusion, quoted the following language from *In re Richman*: "That a claim includes a mathematical expression is not determinative. The decisive factor is whether a claimed method is essentially a mathematical calculation." *Id.* at 793 (quoting *In re* Richman, 563 F.2d 1026, 1030 (C.C.P.A. 1977)). Replacing mathematical notation with "words which mean the same thing" does not affect whether the claim describes statutory subject matter. *Id.* (citation omitted) (internal quotation marks omitted).

[210] *Id.* at 794.

[211] *Id.* at 795 (citing LeRoy v. Tatham, 55 U.S. (14 How.) 155, 175 (1853)).

[212] *Id.* at 794–95.

does provide is the familiar phrase from *Rubber-Tip Pencil*—"[a]n idea of itself is not patentable."[213]

The court identified the mathematical algorithm implicit in Meyer's claims as an algorithm representing "a mental process that a neurologist should follow,"[214] even though Meyer's intention was actually to *replace* a human thought process with a machine-implemented logic and "memory aid."[215] Nevertheless, the court did not find that the presence of the algorithm necessarily condemned the claim; the question was whether the patent claimed the algorithm itself, or a specific application of the algorithm to modify an otherwise statutory process.[216] In short, was Meyer's invention more like Benson's or more like Diehr's? The court concluded that the claims described nothing more than "a mathematical algorithm representing a mental process," and rejected the patent application on that basis.[217]

In the subsequent case *In re Grams*,[218] the Federal Circuit addressed a similar patent application. The invention was a method of testing a complex system with a number of components and identifying the components responsible for an abnormality.[219] As in *Meyer*, the claims specified very little about the nature of the system or the tests to be conducted. The method could be used to assist in patient diagnosis, or it could be applied to any other electrical, chemical, mechanical, or biological system.[220] The result was the same, but this time the court did not rely on characterizing the claimed invention as a "thought process" or an "idea." Instead, the court simply identified the invention as a mathematical algorithm, which in *Benson* had joined the list of unpatentable "processes."[221] Where physical steps are also involved, a process claim incorporating a mathematical algorithm may be patentable.[222] But the only physical step in this case involved gathering data, and so little was disclosed about that step that, "in essence," the invention was nothing more than the algorithm itself.[223]

The *Arrhythmia* case[224] of 1992 provides a useful contrast. The patentee claimed a method of analyzing cardiographic signals in order to identify patients at risk of ventricular tachycardia.[225] The Federal Circuit reversed the finding of the

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[213] *Id.* at 795 (alteration in original) (quoting Rubber-Tip Pencil Co. v. Howard, 87 U.S. (20 Wall.) 498, 507 (1874)).

[214] *Id.*

[215] *See id.* at 793 (internal quotation marks omitted).

[216] *See id.* at 795–96.

[217] *Id.* at 796.

[218] 888 F.2d 835 (Fed. Cir. 1989).

[219] *Id.* at 836.

[220] *Id.*

[221] *See id.* at 837.

[222] *Id.* at 838 (quoting *In re* Walter, 618 F.2d 758, 767 (C.C.P.A. 1980)).

[223] *Id.* at 840.

[224] Arrhythmia Research Tech., Inc. v. Carazonix Corp., 958 F.2d 1053 (Fed. Cir. 1992).

[225] *See id.* at 1054–55.

district court that the invention embraced an unpatentable mathematical algorithm. A mathematical formula, the court explained, "may describe a law of nature, a scientific truth, or an abstract idea."[226] Alternatively, "mathematics may also be used to describe steps of a statutory method or elements of a statutory apparatus."[227] As the court read *Diehr*, it is the "abstract" rather than "sweeping" nature of claim incorporating a mathematical algorithm that may cause it to be condemned as unpatentable subject matter.[228] In this case the claimed invention was neither abstract nor sweeping. The mathematical formulas were part of a procedure to transform, through filtering and otherwise, an electrical signal obtained by monitoring a patient's heart.[229] The product of that transformation was "not an abstract number, but . . . a signal related to the patient's heart activity."[230] Unlike the claims in *Morse* or *Benson*, these did not preempt the use of the formulas in other applications yet to be discovered.[231] Certainly the claims at issue in *Arrhythmia* were very different from those rejected in *Meyer* and *Grams.* Where those claims described analytical procedures in the most vague and general terms, these detailed a specific application of mathematics to obtain useful information—a distinction that recalls the principle/application dichotomy.

D. Business Methods and Other Intangibles

In the 1990s, the fault lines of patentable subject matter moved sharply in the direction of utility, a transition foreshadowed in *Arrhythmia*.[232] A principle might be unpatentable, but a practical application of a principle was another matter, even if the application did not involve physical things or fields of endeavor generally regarded as technological. An important step in this evolution was *In re Alappat*,[233] an *en banc* 1994 Federal Circuit decision.

Alappat concerned an improved digital oscilloscope display. A display composed of pixels arranged in rows and columns is prone to "aliasing"—the appearance of jagged shapes and other imperfections when depicting anything other than vertical or horizontal lines. Alappat invented a method of smoothing the appearance of lines on an oscilloscope display by illuminating certain pixels with

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[226] *Id.* at 1056.

[227] *Id.*

[228] *Id.* at 1057.

[229] *Id.* at 1059 ("These claimed steps of 'converting,' 'applying,' 'determining,' and 'comparing' are physical process steps that transform one physical, electrical signal into another.").

[230] *Id.*

[231] *Id.*

[232] *See id.* at 1061 (apparatus claims met the criteria for statutory subject matter because "[t]hey [were] directed to a specific apparatus of practical utility and specified application").

[233] 33 F.3d 1526 (Fed. Cir. 1994) (en banc).

reduced intensity.[234] A computer employing a mathematical formula determined the intensity for each pixel.[235] Alappat's claim 15 described an apparatus consisting of means for calculating and outputting the necessary data.[236] The Federal Circuit reversed the decision of the Patent Office and held that Alappat's invention was patentable subject matter.

Although the Supreme Court had held mathematical algorithms unpatentable, close examination of the decisions in *Benson*, *Flook* and *Diehr* showed that the court had not intended to create a new category of unpatentable subject matter distinct from "laws of nature, natural phenomena, and abstract ideas."[237] In each case, the Supreme Court had tried to "explain a rather straightforward concept, namely, that certain types of mathematical subject matter, standing alone, represent nothing more than *abstract ideas* until reduced to some type of practical application . . . ."[238] Abstract ideas are "disembodied concepts" that are not "useful until reduced to some practical application."[239] Alappat had claimed something useful—a better-looking oscilloscope display. His invention was not a disembodied concept; his invention was a "specific machine to produce a useful, concrete, and tangible result."[240]

A claim that fell short of specifying the useful application of a mathematical process could still be dismissed as an abstract idea. *In re Warmerdam*,[241] decided shortly after *Alappat*, concerned a mathematical construct known as a "bubble hierarchy," best visualized in connection with its most likely application—helping robots avoid collisions.[242] If the path of a robot intersects an imaginary bubble generally surrounding the location of an object, a computer evaluates the chance of a collision by looking next at a set of smaller bubbles more closely matching the actual shape of the object.[243] If the analysis still shows a possible collision, the process continues until the system discounts the occurrence of a collision or takes action to avoid it.[244] Warmerdam's invention involved positioning the bubbles

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[234] *Id.* at 1537.
[235] *Id.* at 1538.
[236] *Id.* at 1538–39.
[237] *Id.* at 1542–43.
[238] *Id.* at 1543.
[239] *Id.* at 1542 n.18 (internal quotation marks omitted).
[240] *Id.* at 1544; *see also* Richard S. Gruner, *In Search of the Undiscovered Country: The Challenge of Describing Patentable Subject Matter*, 23 SANTA CLARA COMPUTER & HIGH TECH. L.J. 395, 412 (2007) (describing the *Alappat* standard as a "negative test" to identify advancements that are not "abstract ideas" under *Benson*).
[241] 33 F.3d 1354 (Fed. Cir. 1994).
[242] *Id.* at 1355.
[243] *Id.*
[244] *See id.* at 1355–56.

along the medial axis of the object in question.[245] The court rejected his method claims as unpatentable subject matter.[246]

Warmerdam's claims, which included steps of "locating" the medial axis of an object and "creating" a bubble hierarchy, "describe[d] nothing more than the manipulation of basic mathematical constructs, the paradigmatic 'abstract idea.'"[247] Citing *Rubber-Tip Pencil*, and its admonition that "[a]n idea of itself is not patentable," the court concluded that "taking several abstract ideas and manipulating them together adds nothing to the basic equation."[248] The court found Warmerdam's argument that the manipulation of data provided enough "physical" activity to make the claims patentable unconvincing.[249]

> It is true, particularly with ideas expressed in mathematical form, that if a claim requires more than the manipulation of ideas so that the process described in the claim produces something quite different, then the process might indeed describe statutory subject matter. The problem with Warmerdam's argument is that the claims here do not have that effect. It is the claims which define the metes and bounds of the invention entitled to the protection of the patent system.[250]

If the claims had specified that the bubble data represented the possible location of an object with which a robot could collide, and that the output information was to be used by a robot in avoiding a collision, then consistency with *Arrhythmia* suggests that the claim would have been patentable subject matter.[251] Warmerdam's invention had a practical application in the world of solid, tangible things, where one robot scrapes by another as they traverse a crowded factory floor.[252] Perhaps Warmerdam's error was in failing to claim his invention in those concrete terms and limit his claims to that real-world application.

Other kinds of inventions are inherently more abstract, regardless of the how they are claimed. *In re Schrader*[253] concerned a method of conducting an auction

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[245] *Id.* at 1356.
[246] *Id.* at 1362.
[247] *Id.* at 1360.
[248] *Id.*
[249] *Id.*
[250] *Id.*
[251] Indeed, the court did find Warmerdam's "machine" claim, which described nothing other than a computer executing the claimed method, to be patentable subject matter. Claim 5, in the words of the court, "covers any machine (presumably including a known computer) having a memory which contains any data representing a bubble hierarchy determined by any of the methods of claims 1–4." *Id.* at 1361. Although it appears in substance to be the same invention, the court simply says "[c]laim 5 is for a machine, and is clearly patentable subject matter." *Id.* at 1360.
[252] *Id.* at 1355.
[253] 22 F.3d 290 (Fed. Cir. 1994).

designed to extract the best price for the seller where a number of related items, like contiguous tracts of land, are offered for sale.[254] The auctioned items might have been tangible, but the method involved only intangibles—offering items for sale, receiving bids, recording bids, identifying the optimum combination of bids, and so forth.[255] In *Arrhythmia*, the claimed method had manipulated information related to the activity of a patient's heart; it had a connection, in other words, to the world of physical things. Here the information related to non-physical things, like the willingness of buyer and seller to exchange symbols in a bank account for documents representing ownership of land.[256] The manipulation of intangibles, the court held, does not constitute a patentable process unless those intangibles represent "physical activity or objects."[257] Judge Newman dissented, arguing that Schrader's method "involve[d] more than mental steps or theories or plans," and that it did not constitute "a scientific principle, law of nature, natural phenomenon, or abstract idea."[258] Even if the mathematics involved was an abstract idea, Schrader had applied it in "a technological process to produce a useful result."[259] Judge Newman wrote that "the patent system is directed to tangible things and procedures, not mere ideas,"[260] yet her use of the word "tangible" seems to refer not to things that are physical, but to things that are useful in a specific application.

Judge Newman's view prevailed in the controversial *State Street Bank and Trust v. Signature Financial Group* decision.[261] The patent in *State Street* claimed a system for managing a family of mutual funds. The funds shared certain resources through a commonly owned investment portfolio organized as a partnership. This "Hub and Spoke Financial Services Configuration" combined economies of scale with tax advantages.[262] The patent claimed the "data processing system" for carrying out the necessary calculations—a machine.[263] Yet the claims defined the machine solely in terms of the functions it would perform, and the court observed that the exceptions to patentable subject matter, including the exception for abstract ideas, could be applied to machine claims as well as process claims.[264] Combining the authority of *Diehr* with its own language from *Alappat*, the court held that "certain types of mathematical subject matter . . . represent

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[254] *See id.* at 291.

[255] *See id.* at 291–92. Because "there is nothing physical about bids *per se*," even acts like "the grouping or regrouping of bids" does not produce "a physical change, effect, or result." *Id.* at 293–94.

[256] *See id.* at 293–94.

[257] *Id.* at 294. Bell's method of transmitting speech by electrical signal was patentable because the signal represented the physical activity of speaking. *See id.* at 295 n.12.

[258] *Id.* at 296 (Newman, J., dissenting).

[259] *Id.* at 297.

[260] *Id.* at 298.

[261] 149 F.3d 1368 (Fed. Cir. 1998).

[262] *See id.* at 1370.

[263] *Id.*

[264] *Id.* at 1372 n.1.

nothing more than abstract ideas until reduced to some type of practical application, i.e., 'a useful, concrete and tangible result.'"[265] Although "concrete" and "tangible" suggest something physical, the court adopted Judge Newman's view that utility is the key: "[u]npatentable mathematical algorithms are identifiable by showing they are merely abstract ideas constituting disembodied concepts or truths that are not 'useful.' From a practical standpoint, this means that to be patentable an algorithm must be applied in a 'useful' way."[266] The invention here was not an abstract idea because managing a family of mutual funds is a practical application of mathematics—a "useful, concrete and tangible result."[267] Underscoring the irrelevance of physicality in defining what is abstract, the court also took the "opportunity to lay . . . to rest" the traditional view that methods of doing business are not patentable.[268] In the end, whether a claim describes patentable subject matter does not depend on whether the invention "does 'business' instead of something else."[269]

The *AT&T v. Excel Communications*[270] case in 1999 further emphasized that utility is the opposite pole of abstractness. The invention in this case was a message record for long-distance telephone calls that includes a flag to indicate which long-distance service had been used by the local carrier.[271] The record keeping involved basic aspects of Boolean algebra.[272] Although mathematics in the

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[265] *Id.* at 1373 (quoting *In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994)).

[266] *Id.*

[267] *Id.*

[268] *Id.* at 1375. Judge Newman called for the abolition of the business methods exception in her *Schrader* dissent. *In re* Schrader, 22 F.3d 290, at 298 (Fed. Cir. 1994) (Newman, J., dissenting) (calling the business methods exception a "fuzzy" concept and "unwarranted encumbrance," best dismissed as "error-prone, redundant, and obsolete"). Judge Newman concluded that the traditional cases recognizing the exception "simply reaffirm that the patent system is directed to tangible things and procedures, not mere ideas." *Id.* As in the *State Street* opinion, her use of "tangible" is striking, clearly not referring to physical things that one could touch, but something (like a method of maximizing the prices realized in an auction) that is useful in a *specific way*.

[269] *State Street*, 149 F.3d at 1377. Interestingly, in light of *Morse*, *Benson*, and other cases that treat the preemptive effect of the claim as the mark of an abstract idea, the court in *State Street* held that the breadth of the claim had no bearing on whether it was directed to patentable subject matter. *Id.* The lower court had observed that the challenged claims were broad enough to "*foreclose virtually any computer-implemented accounting method necessary to manage this type of financial structure*." *Id.* The foreclosure would not have been as dramatic as that described in *Benson* or *Morse*, yet, surprisingly, the *State Street* court dismissed the foreclosure as having "nothing to do with whether what is claimed is statutory subject matter." *Id.*

[270] 172 F.3d 1352 (Fed. Cir. 1999).

[271] *Id.* at 1353.

[272] *See id.* at 1353–55, 1358.

abstract could be unpatentable subject matter,[273] here the invention was not "a disembodied mathematical concept."[274] AT&T claimed Boolean processes only to obtain the "useful, non-abstract result" of recording carrier information relevant to certain billing practices.[275] When "reduced to some practical application rendering it 'useful,'" mathematical subject matter no longer constitutes an abstract idea.[276] Whether the patented method produced any physical transformation, or whether it was bound by physical limitations, was not the issue.[277] Although physical limitations *could* distinguish a practical invention from an abstract idea, even an invention that merely involved inputting, calculating, storing, and outputting numbers could qualify as patentable subject matter, so long as it applied mathematics "in a practical manner to produce a useful result."[278]

V. "ABSTRACT IDEAS" IN THE TWENTY-FIRST CENTURY: READJUSTING THE BALANCE

AT&T and *State Street* marked the high point of the idea that no invention is an abstract idea, no matter how non-physical its subject matter, so long as it produces a practical result. These cases were instrumental in opening the door to patenting diverse business methods that, in their capacity to generate profits, are undeniably practical. When the tide began to turn, the first hint of change came from the Supreme Court.

Laboratory Corp. v. Metabolite Labs[279] concerned a patented method of detecting a vitamin deficiency by observing an elevated level of the amino acid homocysteine in a patient's blood.[280] The Supreme Court granted certiorari to assess whether the patent claimed a principle of nature. Before the case could be decided, the court dismissed the writ as improvidently granted.[281] Justice Breyer, joined by Justices Stevens and Souter, dissented from the dismissal. Justice Breyer noted that too much patent protection might impede, rather than foster, the progress of technology.[282] One way in which patent law "sail[s] between [the] opposing and risky shoals"[283] of too much or too little protection is by denying exclusive rights to "fundamental scientific (including mathematical) and

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[273] *Id.* at 1356 ("[T]he judicially-defined proscription against patenting of a 'mathematical algorithm,' to the extent such a proscription still exists, is narrowly limited to mathematical algorithms in the abstract.").

[274] *Id.* at 1357.

[275] *Id.* at 1358.

[276] *Id.* at 1357.

[277] *See id.* at 1358–60.

[278] *Id.* at 1359–60.

[279] 548 U.S. 124 (2006).

[280] *Id.* at 125.

[281] *See id.* at 125–26.

[282] *Id.* at 127.

[283] *Id.*

technological principles."[284] The opinion focuses on natural phenomena, like the natural relationship between a vitamin deficiency and an elevated level of homocysteine, but it offers a few insights into abstract ideas as well.

Justice Breyer admitted that categories like "abstract intellectual concepts" are "not easy to define."[285] "After all," he wrote, "many a patentable invention rests upon its inventor's knowledge of natural phenomena; many 'process' patents seek to make abstract intellectual concepts workably concrete; and all conscious human action involves a mental process."[286] Moreover, such categories as the court had enumerated are of little value in identifying the patents that would harm or help technological advancement.[287] This patent, however, failed the narrowest interpretation of the doctrine that denies patents to phenomena of nature.[288] Justice Breyer's conclusion depends on his repudiation of the *Alappat* notion that an invention is patentable so long as it produces "a useful, concrete and tangible result."[289] The Supreme Court, he wrote, had "never made such a statement" and the language, "if taken literally," would contradict a number of the Court's decisions.[290] One of these is the *Morse* decision. Sending messages over long distances is "a result that seems 'useful, concrete and tangible,'" yet Morse's claim had been denied.[291] Similarly, in *Benson*, the court had invalidated a computer-programming method that was "useful, concrete and at least arguably (within the computer's wiring system) tangible."[292] Usefulness, in Justice Breyer's view, is not the fixed star by which to navigate the "risky shoals" of patentable subject matter.[293]

Section A, which follows, discusses the subsequent Federal Circuit cases that restricted the patentability of intangible subject matter, no matter how useful it may be. Section B examines the landmark *Bilski* case, in which those restrictions were endorsed by the Federal Circuit *en banc*, only to be struck down by the Supreme Court in favor of the traditional exclusion of patents to "abstract ideas."

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[284] *Id.* (quoting W. LANDES & R. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 305 (2003)) (internal quotation marks omitted).

[285] *Id.* at 134.

[286] *Id.*

[287] *Id.*

[288] *Id.* at 135.

[289] *In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994).

[290] *Lab. Corp.*, 548 U.S. at 136.

[291] *Id.* at 136–37.

[292] *Id.* at 137.

[293] *Id.* at 127.

A. Intangibles Revisited

Justice Breyer, in his *Lab. Corp.* opinion, did not speak for the majority of the Supreme Court, but his message was heard. Soon the Federal Circuit began to pull back from its more liberal, utility-oriented views on patentable subject matter. The applicant in *In re Nuijten*[294] invented a technique for encoding a signal with a minimally intrusive "watermark" that one could use to identify the origins of a copyrighted sound or video recording.[295] The PTO allowed claims to the method of encoding the watermark, but rejected claims to "a signal" that had been subjected to the technique.[296] The PTO Board[297] held that a "signal" did not fall within any of the statutory classes of patentable subject matter, and having no physical attributes, it constituted an abstract idea.[298] A divided Federal Circuit panel affirmed.[299] Although a signal must take some physical form in order to be transmitted or received, the claims did not specify the medium of transmission or any other physical constraints.[300] The majority held that the four statutory categories of patentable subject matter—process, machine, manufacture, and composition of matter—define "the exclusive reach of patentable subject matter"; no invention outside of those categories can be patented, no matter how useful it may be.[301]

The majority did not address whether the encoded signal was an abstract idea. However, Judge Linn, who advocated a more expansive definition of "manufacture,"[302] concluded that it was not abstract. For Judge Linn, the issue of

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[294] 500 F.3d 1346 (Fed. Cir. 2007).

[295] *See id.* at 1348–49.

[296] *See id.* at 1351.

[297] The PTO Board of Patent Appeals and Interferences (PTO Board) reviews decisions rendered by patent examiners. The Board's decisions may be appealed directly to the Federal Circuit.

[298] *Id.* at 1351–52.

[299] *Id.* at 1357.

[300] *Id.* at 1353.

[301] *Id.* at 1354. A signal is not a "process," but a "thing." *Id.* at 1355. It is not a "machine," a term that applies to concrete devices consisting of mechanical components, and it is not a "composition of matter." *Id.* at 1355–57. Whether a signal qualifies as a "manufacture" is a more difficult question, because signals are "man-made." *Id.* at 1356. However, not everything that is artificial is a "manufacture." *Id.* A "manufacture" is an "article" created by giving new form to raw materials; it refers to "tangible articles or commodities." *Id.* Manufactures do not include transient phenomena like signals, even if they are "man-made and physical," and even if they "exist[] in the real world and [have] tangible causes and effects." *Id.* Whether the signal could be called "useful, concrete and tangible" was beside the point. That language had been used, in *Alappat* and in *State Street*, in connection with patentable machines, and in *AT&T* in connection with a patentable process, but here the claimed invention was neither. *See id.* at 1356 n.7.

[302] Judge Linn did not agree that manufactures are limited to "non-transitory, tangible things." *Id.* at 1358 (Lynn, J., dissenting in part). The signal described in the claim required

abstractness arises from the requirement that a patented invention be "new and useful."[303] "[A]bstract truths" are not patentable because they are not "made by man."[304] They are not "new" but "timeless"—an observation that Judge Linn extends not only to natural phenomena but also to abstract relationships, like the "timeless mathematical relationship among integers" at the heart of Benson's unpatentable algorithm.[305] At the same time, an abstract idea is too far removed from practical application to be "useful."[306] Nuijten's "signal," wrote Judge Linn, was not abstract because it was man-made, because it was not a timeless truth, and because it had a specific utility.[307]

On the same day that it decided *Nuijten*, the Federal Circuit released its first *Comiskey* opinion.[308] The invention in *Comiskey* was a method of providing binding arbitration in connection with legal documents like contracts or wills.[309] The court held the method unpatentable based, in part, on the re-discovered doctrine that "mental processes—or processes of human thinking" are not patentable subject matter.[310] *Comiskey* is a confusing opinion that makes little attempt to distinguish between mental processes, algorithms, and abstract ideas—as though they were necessarily interchangeable.[311] Much of the court's reasoning

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some physical dimension, and whether it took the form of "a pulse of energy or a stone tablet," it must be given "new form" when encoded. *Id.* "The resulting signal is thus a 'manufacture' in the 'expansive' sense of § 101." *Id.* In Judge Linn's view, "Congress has consistently intended statutory subject matter to cover the full scope of technological ingenuity, however it might best be claimed." *Id.* at 1362.

[303] *See id.* at 1363.

[304] *Id.* at 1364. Judge Linn wrote:

> Certain innovations, no matter how new to human thought, are not the type of technological invention to which Congress has extended patent protection, but instead are considered to be abstract truths that were not 'made by man.' . . . This insight, I believe, is at the core of the judicial doctrine by which laws of nature, natural phenomena, and abstract ideas are excluded from patentable subject matter.

Id.

[305] *Id.*

[306] *Id.* at 1365 ("[A]lthough mathematical algorithms and similarly abstract principles may be useful (in the casual sense of the term) in a wide variety of contexts, their utility is too far removed from what is claimed for them to be 'useful' under § 101.").

[307] *See id.* at 1368–69.

[308] 499 F.3d 1365 (Fed. Cir. 2007). The Federal Circuit *en banc* later vacated the first *Comiskey* opinion. *See In re* Comiskey, 554 F.3d 967, 969 (Fed. Cir. 2009) (en banc). The passages discussed here are unchanged in the substituted opinion.

[309] *Cominsky*, 499 F.3d at 970–71.

[310] 554 F.3d at 979. If *Musgrave* had suggested otherwise, it had later been "significantly cabined by *Benson*." *Id.* at 980 n.15.

[311] The court first discusses abstract ideas, then shifts, with little transition, to mental processes. *See id.* at 977–79 (moving from a generalized discussion of abstract ideas to claims involving both "a mental process" and something more concrete, such as a machine,

relies on the premise that only inventions in the "useful arts" can be patented.[312] Purely mental processes—a species of, or synonymous with, abstract ideas—exceed those limits, even when they have practical applications. In other words, the useful arts limitation, offered in *Musgrave* as a *substitute* for the mental steps doctrine, now justifies its resurrection:

> It is thus clear that the present statute does not allow patents to be issued on particular business systems—such as a particular type of arbitration—that depend entirely on the use of mental processes. In other words, the patent statute does not allow patents on particular systems that depend for their operation on human intelligence alone, a field of endeavor that both the framers and Congress intended to be beyond the reach of patentable subject matter. Thus, it is established that the application of human intelligence to the solution of practical problems is not in and of itself patentable.[313]

The Supreme Court had rejected a "purely literal reading" of the categories of patentable subject matter enumerated in § 101.[314] Specifically, its exclusion of abstract ideas had been "repeatedly . . . confirmed."[315] Yet the court's discussion of abstract ideas is regrettably obscure. The prohibition, writes the Court, has "two distinct (though related) aspects."[316] One bars patents to abstract concepts that have "no claimed practical application."[317] For this proposition, the Court cites *Rubber-Tip Pencil* and *Benson*. The Court cannot mean concepts having no practical application *at all* (a pencil eraser is a practical application, as are the numerous potential uses of Benson's mathematical algorithm), but rather concepts that are not limited by the claims to any *particular* application.[318] The second "aspect" concerns abstract ideas in the context of industrial processes. A process claim involving an "abstract concept" is patentable subject matter if it is "tied to a particular apparatus" or if it "operate[s] to change materials to 'a different state or thing.'"[319] What the Court means by "abstract concept" in this context is even less

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manufacture or composition of matter). In note 12, the court refers to "process claims not limited to claiming an abstract concept or algorithm (i.e., a mental process)"—the "i.e." suggesting that the categories are identical. *Id.* at 978 n.12. The court relies in part on cases like *Benson* that list mental processes as unpatentable subject matter but that tell us little about them, other than to suggest, by their separate listing, that mental processes and abstract ideas are *not* coextensive.

[312] *Id.* at 977.

[313] *Id.* at 980.

[314] *In re* Comiskey, 499 F.3d 1365, 1375 (Fed. Cir. 2007).

[315] *Id.* at 1376.

[316] *Id.*

[317] *Id.*

[318] *See id.* (referring to the preemptive effect of the claim in *Benson*, which had not been limited to "any particular end use").

[319] *Id.*

clear. Apparently it means processes, like mental processes and mathematical algorithms, that are symbolic or non-physical even when put to specific use.[320] These are not patentable subject matter in themselves. They may, however, be a part of a patentable process that also involves physical things, as the Arrhenius equation can be a part of a patentable process for curing rubber.[321] Physicality appears to be essential; usefulness alone does not make an abstract concept, like a thought process, patentable.[322]

B. Bilski *and Beyond*

Comiskey led the way to the landmark case *In re Bilski*.[323] The applicants in *Bilski* claimed a method of managing risk in commodities transactions.[324] A middleman would pair buyers and sellers with fixed-rate contracts, protecting the buyer against the risk of rising prices and the seller against the risk of falling prices.[325] Claim 1 described steps of "identifying market participants" and "initiating . . . transactions."[326] The method applied to any commodity that might be traded, or even options to purchase commodities.[327] The PTO Board, affirming the actions of the patent examiner, rejected the claim as "an abstract idea ineligible for patent protection."[328] A divided Federal Circuit, sitting *en banc*, affirmed.

As in *Comiskey*, the decision turned on the meaning of "process" in the context of § 101. If an application claimed a "fundamental principle"—a category that includes abstract ideas[329]—then it did not claim a patentable "process." The question, said the court, comes down to preemption; a process claim that preempts every use of a fundamental principle is unpatentable,[330] because it is a patent on the

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[320] This interpretation seems to explain the footnote where the court states "[o]f course, process claims not limited to claiming an abstract concept or algorithm (i.e., a mental process) may not be subject to the same requirements." *Id.* at 1377 n.12.

[321] *See id.* at 1377.

[322] *See id.* ("[M]ental processes—or processes of human thinking—standing alone are not patentable even if they have practical application."). The court explained *AT&T*, *State Street*, and *Arrhythmia* as cases in which processes involving algorithms were limited to practical applications *and* "tied to specific machines." *Id.* at 1377 & n.14.

[323] 545 F.3d 943 (Fed. Cir. 2008) (en banc).

[324] *Id.* at 949.

[325] *Id.* at 949–50.

[326] *Id.* at 949.

[327] *See id.* at 950.

[328] *Id.*

[329] *Id.* at 952 & n.5.

[330] The court wrote:

> *Diehr* can be understood to suggest that whether a claim is drawn only to a fundamental principle is essentially an inquiry into the scope of that exclusion; i.e., whether the effect of allowing the claim would be to allow the patentee to

principle itself.[331] How does one identify that sweeping preemption?[332] The Supreme Court had supplied a "definitive test" to determine if a process claim involving a fundamental principle covers only a patentable application of that principle, or the principle itself.[333] This test, which the Federal Circuit called the "machine-or-transformation test,"[334] holds that a process is patentable subject matter if "(1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing."[335] While the Supreme Court might someday devise other tests to guard against granting exclusive rights to fundamental principles, for now this was the sole test to use in determining if a process claim is eligible for patenting.[336]

The "transformation" aspect of the test required some elaboration. What if the "article" transformed by the process is not a physical substance, but something more symbolic? As the court recognized, "[t]he raw materials of many information-age processes . . . are electronic signals and electronically-manipulated data."[337] Some business methods "involve the manipulation of even more abstract constructs such as legal obligations, organizational relationships, and business risks."[338] The adequacy of data transformation to delimit patentable subject matter depends on what the data represents. Methods that transform data representing

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> pre-empt substantially all uses of that fundamental principle. If so, the claim is not drawn to patent-eligible subject matter.

Id. at 953. If the "fundamental principle" has limited utility, then a more limited claim has the necessary preemptive effect. In *Benson*, for example, the algorithm had no utility except in connection with a computer. Hence, the claim limiting its use to a computer "did not reduce the preemptive footprint of the claim since all uses of the algorithm were still covered by the claim." *Id.* at 955.

[331] Preemption, the court argued, is not the ultimate problem, but a symptom of a claim that seeks to patent a fundamental principle. *Id*. at 957 ("Preemption is merely an indication that a claim seeks to cover a fundamental principle itself rather than only a specific application of that principle."). Preemption of all uses in one field suggests, as much as preemption of all uses in all fields, that the patent claims a principle in the abstract rather than an application of the principle. *Id.*

[332] The court noted that "the more challenging process claims of the twenty-first century are seldom so clearly limited in scope as the highly specific, plainly corporeal industrial manufacturing process of *Diehr*; nor are they typically as broadly claimed or purely abstract and mathematical as the algorithm of *Benson*." *Id.* at 954.

[333] *Id.*

[334] *See id.* at 955.

[335] *Id.* at 954. The association of the process with a particular machine, or its use to transform an article into a different state or thing, must impose "meaningful limits" on the scope of the claim. *Id.* at 961. "[I]nsignificant extra-solution activity" does not suffice. *Id.* at 962. "Transforming" a piece of paper by printing on it the solution to a mathematical calculation is an example of "insignificant extra-solution activity."

[336] *Id.* at 956.

[337] *Id.* at 962.

[338] *Id.*

physical and tangible objects (e.g., data representing the rhythms of a beating heart) are limited enough that they do not threaten preemption of a fundamental principle.[339] Methods that operate on other sorts of data may compel a different result.

The method at issue was not a patentable process because it was not tied to a particular machine, and it did not transform an article into a different state or thing.[340] The only transformation involved "simply . . . public or private legal obligations or relationships, business risks, or other such abstractions."[341] These are not "physical objects or substances," nor are they "representative of physical objects or substances."[342] The claimed method, on the contrary, encompassed a mental process that would "effectively pre-empt any application of the fundamental concept of hedging," at least in the field of consumable commodities.[343]

Embracing the "machine-or-transformation test" as the sole test of a patentable process, the court rejected alternative tests of patentable subject matter. Following Justice Breyer's lead in *Lab. Corp.*, the court declared that a "useful, concrete and tangible result" was, at best, a "useful indication[] of whether a claim is drawn to a fundamental principle or a practical application of such a principle."[344] As a substitute for the machine-or-transformation test, it was "inadequate."[345] Nor did the court endorse the "technological arts" test suggested in *Comiskey* and *Musgrave*. Because the term "technological arts" is "both ambiguous and ever-changing," the "contours of such a test . . . would be unclear."[346] The court also declined to adopt categorical exclusions for business methods or any other kind of invention not already identified by the Supreme Court as unpatentable subject matter.[347] Finally, the court disavowed a "possible misunderstanding" of *Comiskey* that would bar patents to mental processes without "significant physical steps."[348] In short, as far as processes are concerned, the majority placed all of its eggs in the "machine-or-transformation" basket.

The decision prompted two concurring opinions and two dissents. Notably, Judge Rader argued that a single sentence could have been substituted for the majority's elaborate disquisition: "Because Bilski claims merely an abstract idea, this court affirms the Board's rejection."[349] The only limits on patentable subject matter, he wrote, are those identified by the Supreme Court—natural laws, natural

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[339] *Id.* at 962–63.
[340] *Id.* at 963.
[341] *Id.*
[342] *Id.*
[343] *Id.* at 965–66.
[344] *Id.* at 959.
[345] *Id.* at 960.
[346] *Id.*
[347] *Id.*
[348] *Id.* (internal quotation marks omitted).
[349] *Id.* at 1011 (Rader, J., dissenting).

phenomena, and abstract ideas.[350] Natural laws and phenomena are not patentable subject matter because "they cannot be invented at all";[351] abstract ideas are not patentable subject matter because they are not useful as such.[352] Bilski's method of hedging risk in commodities transactions presented "a classic example of abstractness," either "a vague economic concept or obvious on its face."[353] Judge Newman, who agreed that abstract ideas are "fundamental truths" that cannot be patented,[354] concluded that Bilski's method of hedging risk was *not* an abstract idea, apparently because it included enough "details and limitations" to distinguish it from a "fundamental truth."[355]

As the *Bilski* decision awaited review by the Supreme Court, the Federal Circuit decided *In re Ferguson*.[356] *Ferguson* concerned a "paradigm" for marketing software from a number of independent companies through a single marketing entity.[357] Ferguson's method claims failed the machine-or-transformation test,[358]

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[350] *Id.* at 1012 (Rader, J., dissenting).

[351] *Id.* at 1013 (Rader, J., dissenting). "After all, God or Allah or Jahveh or Vishnu or the Great Spirit provided these laws and phenomena as humanity's common heritage." *Id.*

[352] *Id.*

[353] *Id.* Obviousness plays an uncertain role in Judge Rader's conclusion that hedging is an abstract idea. "Hedging," he observes, "is a fundamental economic practice long prevalent in our system of commerce and taught in any introductory finance class." *Id.* Perhaps the familiar place of hedging in school curricula simply demonstrates that it is a "fundamental" concept.

[354] *Id.* at 977 (Newman, J., dissenting).

[355] *Id.* at 997 (Newman, J., dissenting). Judge Newman wrote:

> Bilski's process for determining risk in commodity transactions does not become an abstraction because it is broadly claimed in his first claim. It may be claimed so broadly that it reads on the prior art, but it is neither a fundamental truth nor an abstraction. Bilski's ten other claims contain further details and limitations, removing them farther from abstraction.

Id.

[356] 558 F.3d 1359 (Fed. Cir. 2009). The court also decided *Prometheus Labs., Inc. v. Mayo Collaborative Servs.*, 581 F.3d 1336 (Fed. Cir. 2009), a case reminiscent of *Lab. Corp.* Here the patented method was a process for optimizing the administration of a drug by monitoring metabolites in the patient's blood. *Id.* at 1339. The measured levels "indicate[d] a need to increase or decrease the level of drug to be administered so as to minimize toxicity and maximize efficacy." *Id.* (internal quotation marks omitted). The defendant argued that the patents claimed a natural phenomenon, constituting the natural correlation between the metabolite levels and the efficacy (and toxicity) of the drug that had been administered. *Id.* at 1340–41. The Federal Circuit disagreed. The court found that the claims were not drawn to a natural principle or an abstract idea; the patented method passed the "machine-or-transformation test" because administering the drug "transformed" the patient's body physically and chemically. *See id.* at 1345–46.

[357] *See In re Ferguson*, 558 F.3d at 1361.

[358] *Id.* at 1363–65.

and claims to the "paradigm" fell within none of the statutory categories of § 101.[359] In fact, the "paradigm" claims describing "a business model for an intangible marketing company" constituted "quite literally . . . the paradigmatic abstract idea."[360] Disagreeing with Judge Newman, who found the claims "not at all abstract" because they were "definite and concrete and limited,"[361] the majority explained that "there is nothing definite or concrete about Ferguson's marketing paradigm."[362] It involved only "legal obligations, organizational relationships, and business risks," the kind of non-physical entities identified in *Bilski* as "abstract constructs."[363]

The Supreme Court issued its own *Bilski* decision in 2010,[364] affirming the decision of the Federal Circuit on different grounds.[365] The Court repeated the well-known exceptions to patentable subject matter—"laws of nature, physical phenomena, and abstract ideas."[366] Conceding that these exceptions are not found in the statute, the Court held the exceptions "consistent with the notion that a patentable process must be new and useful."[367] They each represent "part of the storehouse of knowledge of all men . . . free to all men and reserved exclusively to none."[368] Bilski's method of hedging risk could not be patented because it was an abstract idea, much like the mathematical algorithms discussed in *Benson* and *Flook*.[369] Hedging was a "fundamental economic practice," and Bilski's claims would preempt its use.[370]

The Court did not endorse the "machine-or-transformation test" as the *sole* measure of a patentable process; it was "not intended to be an exhaustive or exclusive test," but merely "a useful and important clue."[371] It was a test adapted to

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[359] *Id.* at 1365–66.

[360] *Id.* at 1366 (citations omitted) (internal quotation marks omitted). The applicants "conceded during oral argument, 'you cannot touch the company.'" *Id.* "Tangible" now refers to physical things that can be touched, whereas in *State Street*, in the context of a "useful, concrete and tangible result" involving mutual fund management, "tangible" meant something quite different.

[361] *Id.* at 1367 (Newman, J., concurring). Judge Newman found the marketing method "not an abstraction, even in *Bilski* terms" because it did not "pre-empt all uses of a fundamental principle." *Id.* (internal quotation marks omitted).

[362] *Id.* at 1366 n.6.

[363] *Id.* (internal quotation marks omitted).

[364] 130 S. Ct. 3218 (2010).

[365] *Id.* at 3230.

[366] *Id.* at 3225 (internal quotation marks omitted).

[367] *Id.* (internal quotation marks omitted).

[368] *Id.* (quoting Funk Bros. Seed Co. v. Kalo, 333 U.S. 127, 130 (1948)) (internal quotation marks omitted).

[369] *Id.* at 3231.

[370] *Id.* Bilski's broadest claim would preempt the use of his hedging technique in any field. Those that limited its use to the commodities or energy markets were also unpatentable under *Flook*. *Id.*

[371] *Id.* at 3226–27.

industrial age inventions "grounded in a physical or other tangible form," but less suited to the information age, an age of "new technologies . . . call[ing] for new inquiries."[372] The Court was also unwilling to exclude, categorically, methods of doing business,[373] though it invited the Federal Circuit to define a subset of business methods that represent only abstract ideas.[374] In the end, the *Bilski* opinion is one of calculated circumspection. It endorses no tests, strikes no balances, and leaves us with little more than the age-old proscription against patenting abstract ideas.

Justice Stevens, who with three other Justices would have ruled unpatentable all business methods, agreed that Bilski sought to patent an abstract idea,[375] but he found the majority's explanation inadequate. According to Justice Stevens, Bilski's patent application did not claim "the sort of phenomenon of nature or abstract idea that was embodied by the mathematical formula at issue in [*Benson*] and in *Flook*."[376] It did not claim "a principle, in the abstract, or a fundamental truth."[377] Bilski's process was not an abstract idea merely because it was generally described,[378] and whether hedging was a well-known practice was irrelevant.[379] As Justice Stevens sums up the majority opinion:

> The Court . . . never provides a satisfying account of what constitutes an unpatentable abstract idea. Indeed, the court does not even explain if it is using the machine-or-transformation criteria. The Court essentially asserts its conclusion that petitioner's application claims an abstract idea. This mode of analysis (or lack thereof) may have led to the correct outcome in this case, but it also means that the Court's musings on this issue stand for very little.[380]

Subsequently, the Federal Circuit took up abstractness again in *Research Corp. Technologies, Inc. v. Microsoft Corp.*,[381] a case involving methods of improving the quality of halftone images.[382] Citing Justice Steven's lament that *Bilski* provided no "satisfying account" of an abstract idea, Judge Rader, more

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[372] *Id.* at 3227. The Court did not, however, decide whether the technologies of the information age should, in the end, be patentable. *Id.*

[373] *Id.* at 3228–29.

[374] *Id.* at 3229.

[375] *Id.* at 3235 (Stevens, J., concurring).

[376] *Id.*

[377] *Id.* (quoting Parker v. Flook, 437 U.S. 584, 589 (1978)) (internal quotation marks omitted). Because of these statements, it is difficult to understand why Justice Stevens agreed that Bilski claimed an "abstract idea."

[378] *Id.*

[379] *Id.* at 3236.

[380] *Id.*

[381] 627 F.3d 859 (Fed. Cir. 2010).

[382] *Id.* at 862.

diplomatically, writes that "[t]he Supreme Court did not presume to provide a rigid formula or definition of abstractness."[383] Following suit, the Federal Circuit panel also declined to define abstractness "beyond the recognition that this disqualifying characteristic should exhibit itself so manifestly as to override the broad statutory categories of eligible subject matter and the statutory context that directs primary attention on the patentability criteria of the rest of the Patent Act."[384] Although the patented method employed mathematical equations, the court did not find the invention abstract. On the contrary, it offered "functional and palpable applications in the field of computer technology."[385] Some claims required tangible elements—like printers and memory—and the invention as a whole represented an improvement of technologies already available.[386] The court described the abstract ideas exception as a "coarse . . . filter," to be applied only in cases where the invention is "manifestly abstract,"[387] leaving problems of indefiniteness or inadequate disclosure to other tools provided in the patent statute.

VI. THE CONCRETE DILEMMA OF "ABSTRACT IDEAS"

In 1874, the Supreme Court wrote in *Rubber-Tip Pencil* that "[a]n idea of itself is not patentable"—planting a seed in *dicta* that flourished in subsequent opinions, growing at last into a thicket of obscurity.[388] Almost a century later, the *Benson* Court restated the concept with the same disarming simplicity: "It is conceded that one may not patent an idea."[389] Yet the subject matter of a patent is an invention, and an invention *is* an "idea"—a point brought home in recent Supreme Court decisions.

An invention begins with a "conception." Conception means the "formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention."[390] The invention is "reduced to practice" when reduced to a tangible embodiment.[391] If it is a machine, it is reduced to practice when a prototype is built; if a process, it is reduced to a practice when the steps of the method are performed.[392] But, as the Supreme Court stated in *Pfaff v. Wells Electronics, Inc.*, "[t]he primary meaning of the word 'invention' in the Patent Act

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[383] *Id.* at 868.
[384] *Id.*
[385] *Id.*
[386] *Id.* at 869.
[387] *Id.*
[388] 87 U.S. (20 Wall.) 498, 507 (1874).
[389] Gottschalk v. Benson, 409 U.S. 63, 71 (1972).
[390] Univ. of Pittsburgh v. Hedrick, 537 F.3d 1290, 1297–98 (Fed. Cir. 2009) (citation omitted) (internal quotation marks omitted).
[391] ALAN L. DURHAM, PATENT LAW ESSENTIALS: A CONCISE GUIDE 101 (3d ed. 2009).
[392] *See id.*

unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."[393]

The invention is an "idea," and the patent claims that reduce it to words cannot reproduce the idea perfectly: "Unfortunately, the nature of language makes it impossible to capture the essence of a thing in a patent application."[394] Describing an invention with a limited vocabulary produces "unintended idea gaps."[395] For that reason, the doctrine of equivalents discussed in *Winans*[396] lives on, and "[t]he scope of a patent is not limited to its literal terms but instead embraces all equivalents to the claims described."[397] In other words, even the claims, generally said to define the "metes and bounds" of the invention, are secondary to the idea they represent.[398]

So when the Court said in *Benson* that "one may not patent an idea," it did not mean *any* idea. It must have meant an abstract idea, or what *Rubber-Tip Pencil* called "[a]n idea of itself."[399] How, then, are abstract ideas distinguished from patentable ideas? In *Bilski*, the Court's interpretation of the Patent Act emphasized the importance of giving terms their "ordinary, contemporary, common meaning."[400] Although the term "abstract" appears only in judicial opinions, it is worth considering the ordinary meaning of the word.

The Second Edition of Webster's New International Dictionary, used in the *Bilski* decision for its definition of "method,"[401] includes several definitions of "abstract."[402] "Abstract" comes from the Latin *abstrahere*, meaning to draw from, or separate.[403] Relevant definitions include: "considered apart from any application to a particular object"; and "expressing a property, quality or attribute apart from any object or thing; as, 'honesty,' 'whiteness,' 'triangularity' are *abstract*

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[393] 525 U.S. 55, 60 (1998); *see also* Stern v. Trustees of Columbia Univ., 434 F.3d 1375, 1378 (Fed. Cir. 2006) ("[C]onception is the touchstone of inventorship." (internal quotation marks omitted)).

[394] Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 731 (2002).

[395] *Id.* (quoting Autogiro Co. v. United States, 384 F.2d 391, 397 (Ct. Cl. 1967)) (internal quotation marks omitted); *see also* Dan L. Burk & Mark A. Lemley, *Quantum Patent Mechanics*, 9 LEWIS & CLARK L. REV. 29, 31–32 (2005) (referring to the difficulty of "mapping words to things").

[396] *See supra* notes 101–105 and accompanying text for discussion of doctrine of equivalents addressed in *Winans*.

[397] *Festo*, 535 U.S. at 732.

[398] Burk & Lemley distinguish between the claims of a patent and the "actual invention," suggesting the latter as a guide for interpreting ambiguous claims. *See* Burk & Lemley, *supra* note 395, at 32.

[399] 87 U.S. 498, 507 (1874).

[400] Bilski v. Kappos, 130 S. Ct. 3218, 3221 (2010) (citations omitted) (internal quotation marks omitted).

[401] *Id.* at 3228.

[402] WEBSTER'S NEW INTERNATIONAL DICTIONARY 10 (2d ed. 1954).

[403] *Id.*

words."[404] The same dictionary defines "abstraction" as an "[a]ct or process of leaving out of consideration one or more qualities of a complex object so as to attend to others. Thus, when the mind considers the form of a tree by itself, or the color of the leaves as separate from their size or figure, the act is called *abstraction*."[405]

Unfortunately, the abstractness described in the dictionary sounds very much like the abstractness that is a part of any invention. In fact, the process of abstraction—the mental separation of qualities from their manifestation in concrete things—is a critical part of the act of conception. Let us consider a hypothetical, to see how abstraction and invention go hand-in-hand.

A. An Abstraction Hypothetical

Smith and Jones operate a commercial bakery that supplies grocers with sliced bread. To date, the machinery that slices fresh loaves has employed straight-edged blades; no slicing implement other than the straight blade is known to commercial bakers, home chefs, or anyone else. Because of the inefficient sawing action of the straight edge, the slicing process slightly crushes the bread, resulting in many misshapen and unsalable loaves. Profits would rise if the loaves held their shape, but neither Smith, nor anyone else, knows how to accomplish this. One day, as he is speaking to a customer on the telephone, Smith holds a tool used to apply decorative grooves to cake icing. It has a serrated edge. Smith absent-mindedly brushes the tool against the top of a bread loaf still warm from the oven. The conversation concluded, Smith notices that even with minimal downward pressure he has managed to open a neat incision in the bread. Smith imagines the solution to his problem—commercial bread-slicing machines employing serrated blades.

There are still questions to be answered. How should the slicing machines be adapted to use serrated blades? How quickly should the blades move, and with what downward pressure? At what temperature should the loaves be sliced? Some of these questions Smith answers by contemplating the problem and applying his expertise, others by experimenting until he sees success. Finally, Smith designs a practical bread-slicing machine. He builds the machine, tests it, and finds that it works. Conception and reduction to practice are complete.

Smith now prepares a patent application. For the first time, Smith searches for language to describe his invention. As he designed his prototype, Smith's thoughts often ran from the general to the specific; he had goals to achieve and devised

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[404] *Id.* Of potential interest in the patent law context is the definition of "abstract" as "[d]ealing with a subject in the abstract or dealing with an abstract subject;—applied to sciences, esp. to the *pure* as distinguished from the *applied* sciences." *Id.* In the same spirit, the dictionary defines "abstract noun" as, in grammar, "a noun denoting an attribute, as a quality, activity, or state, considered apart from its substance or that which manifests the activity, state, or condition (*sweetness*, *wisdom*, *motion*)." *Id.*

[405] *Id.*

specific means to achieve them. As he drafts his patent claims, his thoughts sometimes run in the other direction. In his first attempts at claim language, he describes a serrated edge with just the spacing and geometry of his prototype blade. But Smith does not want claims easily evaded by minor changes, nor does he want to rely on the doctrine of equivalents if he can avoid it. Smith considers which aspects of the blade geometry are essential and which are not, and his application evolves as he pares away, from his broadest claims, the unnecessary limitations. This process is more than simply translating a completed idea into claim language; perhaps Smith does not truly understand his invention until he has contemplated it in terms of its essential elements.

Smith considers various approaches to claiming his invention. One is to claim the product of his ingenuity—sliced bread. This would be a valuable claim because of its breadth, but it is too broad to avoid the prior art. Sliced bread had been available before Smith came along. Instead, Smith claims *perfectly* sliced bread, defined as bread cut consistently and on an industrial scale with minimal deformation of the loaves. Until Smith's invention, perfectly sliced bread was unknown. With this claim, Smith can avoid, during the term of his patent, competition from means later developed for achieving the same desirable results—perhaps bread-slicing machines that employ lasers instead of serrated blades.

Smith also drafts apparatus claims. He uses terms as general as possible in some claims, and, as protection against unknown prior art, Smith drafts narrower claims too. He cannot claim the serrated edge in isolation, because we know from his own story that serrated tools already existed. Section 112, ¶ 6 of the Patent Act allows claim elements to be expressed as "means" for performing a function, without specifying a specific structure to accomplish that function.[406] Some of Smith's apparatus claims include "means to hold the loaf in place during slicing." "Means-plus-function" elements cover structures that perform the designated function, and that are identical or equivalent to the corresponding structure disclosed in the patent specification.[407] Smith's specification shows a metal bracket holding the loaf in place during slicing, so his means-plus-function claims cover bread-slicing machines with equivalent structures. This helps Smith in his search for language adequate to capture the essence of his invention, but it leaves him vulnerable to a decision by a court that a structure performing the same function is not equivalent.

Process claims are best suited to capture what Smith considers important—not the particular machinery he has built, but the perfectly sliced loaves that he can sell. Smith describes his process as a series of steps, including the back-and-forth motion of the blades, their downward movement, their withdrawal from the sliced loaves, and so forth. As Smith searches for language to describe his process, he again considers which details are unnecessarily limiting and best omitted. Yet he

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[406] *See* 35 U.S.C. §112 (2006).

[407] *See* Nomos Corp. v. Brainlab USA, Inc., 357 F.3d 1364, 1369 (Fed. Cir. 2004).

must not describe his process so generally that it includes the use of the straight-edged machinery already known.

Meanwhile, Jones, co-owner of the Smith & Jones Bakery, produces an insight of her own. She has observed that unsold bread sometimes accumulates in the warehouse, while at other times the factory cannot fill all of its last-minute orders. She believes that variations in demand are largely seasonal and repeat themselves every year. Jones pores over sales records from previous years and produces a curve illustrating the historical demand for each variety of bread during each week of the year. In order to project future demand for bread, Jones multiplies the historic demand by a factor based on the growing population of the area served by the bakery and a figure related to economic conditions generally. Jones uses this prediction to increase the efficiency of the bakery by having extra supplies and workers on hand when demand for particular varieties of bread requires it.

Jones decides to patent her own invention. Like Smith, she searches for language to capture her insights, and she contemplates which limitations are essential and which are not. Could some other multiplier be used to factor in economic circumstances? Could her general technique apply to commodities other than bread? Jones prepares process claims describing a series of steps to adjust production according to predicted seasonal demands. Because a computer is the means by which she implements her method, Jones also drafts apparatus claims describing a hardware "system" programmed to perform the required calculations. Some claims end with the calculation, others with action taken to modify orders for raw materials.

B. The Varieties of Abstraction

All of Smith's and Jones' patent claims are abstract in the dictionary sense. They separate the essential qualities of the inventive idea from their concrete realizations—the prototype bread slicer in Smith's case, the implemented inventory control plan in Jones' case. The blade in Smith's prototype may be six feet long and forged of stainless steel, but if those qualities are unnecessary to define the invention or avoid the prior art, Smith will separate them from the attributes that do matter.

Abstractness is an inherent quality of patent claims because claims describe *classes* of things. Smith's claimed invention is not a particular bread slicer, but the class of all bread slicers sharing the specified attributes. Although the blade of a particular slicer could be made of brass, ceramic, plastic, or materials later invented, the device will still infringe Smith's claim if it has the properties set forth as defining the class of infringing machines. Abstractness is not only a quality of patent claims, it is a characteristic of the invention the claims represent. Smith's insight is not fully embodied in the prototype he built. The machine represents choices—like the choice of a steel blade rather than a ceramic blade—that Smith knows could have been different without materially changing the principle at work. Even if Smith were not forced to reduce his insights into language or precisely delimit a class of infringing bread-slicers, his invention would still have an abstract

quality. It would still be something he could contemplate without regard to the concrete attributes of any particular machine. Similarly, Jones' invention is one that could be applied to production of sour dough bread, pumpernickel or, for that matter, any product with seasonally varying demand. Abstractness is a quality of any patented invention.

Some claims are abstract in ways that others are not. They describe timeless principles that have always existed, or generalized concepts with no practical utility. They define the rights of the patentee too broadly, or they deny researchers their "basic tools." They describe thought processes, or other matters without physical qualities. But claims may be abstract in some of these respects without being abstract *in all*. In spite of so many court decisions confirming the unpatentability of abstract ideas, it is still not clear which of these attributes we are looking for, or whether patentable subject matter is the right way to deal with these concerns. In Justice Stevens' words, we still have no "satisfying account" of abstract ideas.

1. Principles That Were Not Invented

Suppose Smith's claims discussed the molecular bonds characteristic of a bread loaf rather than the machine he had invented for slicing it. Even if Smith's insights into bread chemistry were unknown, valuable, and critical to the success of his machine, he must claim the machine rather than the chemistry itself. This is nothing more than the principle/application distinction discussed as far back as *Le Roy*. The clearest reason to deny patents to natural principles is not because these principles are abstract, but because they are not invented. Although § 102 of the Patent Act contemplates novelty in terms of prior human activity, § 101 also requires that a patented invention be "new."[408]

To deny Smith a claim to principles of chemistry, we do not need to rely on abstractness. A natural principle described in the most limited and concrete terms would still be unpatentable because it is not an invention, a point reflected in the separate listing of natural principles and abstract ideas in the usual litany of unpatentable subject matter.[409] There are many intriguing questions surrounding natural principles and phenomena. For example, is the physics of a loaf undergoing slicing by a serrated edge a natural phenomenon if it did not occur in nature until Smith supplied the blade? But these issues are not clarified by confusing them with abstractness, and the host of other issues that abstractness suggests.

Most ideas labeled by the courts as "abstract" are human inventions. Hedging financial risk is not a timeless process found in nature, nor is calculating the best

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[408] 35 U.S.C. §§ 101–102.

[409] Diamond v. Diehr, 450 U.S. 175, 185 (1981). If Jones claimed the seasonally varying demand for bread, her claim might be harder to dismiss as a natural principle. The demand for bread is a human-created phenomenon. But the principle is the same: Jones did not create the demand for bread, she merely observed it.

price to be obtained at an auction, or selling software through a common marketing entity. Some abstract ideas correspond to natural phenomena, but the absence of human agency is not the means to identify which ideas are abstract and which are not, nor is abstractness the soundest principle for denying patents to manifestations of nature.

2. Ideas That Are Not Useful

Another concern associated with abstract claims is lack of utility.[410] Here we should distinguish between claims describing subject matter having *no* known utility, and claims, like Benson's, that do not specify any *particular* utility. Claims in the former category fail the utility requirement, based on § 101's demand that inventions be "useful."[411] Some abstract ideas are not useful, just as some concrete ideas are not useful. Both can be denied patents based on the utility requirement, without having to categorize the invention as abstract or non-abstract. In *Brenner v. Manson*,[412] the Supreme Court held unpatentable a process of making steroids.[413] Because the steroids had no known uses, the applicant did not offer the quid pro quo expected in exchange for exclusive rights.[414] If Smith sought to patent a functionless blade, or Jones a worthless observation about the bread market, each could be denied a patent on the same basis.[415]

3. Claims That Are Too Broad

More relevant to the question of abstractness is a claim that encompasses *too many* useful applications, including some that may be long delayed if the patent hinders further research.[416] The more abstract or generalized claims become, the

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[410] *See In re* Bilski, 545 F.3d 943, 1013 (Fed. Cir. 2008) (Rader, J., concurring) ("[A]bstract ideas can never qualify for patent protection because the Act intends, as Section 101 explains, to provide 'useful' technology. An abstract idea must be applied to (transformed into) a practical use before it qualifies for protection.").

[411] 35 U.S.C. § 101.

[412] 383 U.S. 519 (1966).

[413] *Id.* at 532, 535–36.

[414] *Id.* at 534.

[415] Professor Karjala has discussed making the utility requirement a part of the abstract ideas inquiry. *See* Dennis S. Karjala, *Distinguishing Patent and Copyright Subject Matter*, 35 CONN. L. REV. 439, 467–68 (2003) ("It seems reasonable . . . to fold the practical utility requirement into the subject matter exclusion for abstract ideas, in the sense that if the specified utility cannot be objectively demonstrated to result from the claimed invention, the invention should be treated as an unpatentable abstract idea."). "Folding in" suggests that the absence of practical utility would not be the *only* measure of an abstract idea, so this incorporation might only add to the ambiguity.

[416] Steering close to contradiction, the Court in *Brenner* raised the same concern, noting not only that the applicant's invention had no present value to provide a quid pro

more difficult it is to justify the breadth of the monopoly. If Smith claimed all methods of producing a perfectly sliced bread loaf, or Jones claimed all means of adjusting factory output to meet varying demand, these concerns would be genuine. Over-breadth was critical in *Benson*. The mathematical algorithm Benson invented could be applied in numerous applications, from managing transportation systems to researching legal precedent.[417] It was critical also in *Morse*, where the broadest claim would have covered any means of transmitting messages using electromagnetism, including means not invented by the patentee.[418]

There are, however, other tools than the exclusion of abstract ideas to deal with over-breadth. One of these is the enablement requirement of § 112, increasingly used by the Federal Circuit to reject claims that are broader in scope than the enabling disclosure of the patent specification.[419] In *Sitrick v. Dreamworks, LLC*,[420] for example, the Federal Circuit rejected claims covering a system for integrating user-created images into movies and video games.[421] Because the patent specification only enabled application of the technology to movies, not video games, the claim was invalid. Broad claim language, warned the court, must be accompanied by an equally broad disclosure.[422] The written description requirement, also found in § 112 of the Patent Act, demands a correspondence between the claimed invention and the invention described in the specification.[423] A claim is invalid if it is broader than the invention shown by that description to be in the "possession" of the applicant.[424] If Smith claimed all means

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quo, but that the claims he sought might "block off whole areas of scientific development." *Brenner*, 383 U.S. at 534.

[417] *See* Gottschalk v. Benson, 409 U.S. 63, 68 (1972).

[418] *See* O'Reilly v. Morse, 56 U.S. (15 How.) 62, 112–13 (1854). Burk & Lemley write that "[t]he rule against patenting abstract ideas, while couched in terms of patentable subject matter, is really a judicial effort to restrict the permissible scope of patents and to channel patent protection towards finished products." Burk & Lemley, *supra* note 4, at 1642.

[419] *See, e.g.*, ALZA Corp. v. Andrx Pharm., LLC, 603 F.3d 935, 942–43 (Fed. Cir. 2010); Automotive Techs. Int'l, Inc. v. BMW of N. Am., Inc., 501 F.3d 1274, 1282 (Fed. Cir. 2007); Liebel-Flarsheim Co. v. Medrad, Inc., 481 F.3d 1371, 1378–80 (Fed. Cir. 2007).

[420] Sitrick v. Dreamworks, LLC, 516 F.3d 993 (Fed. Cir. 2008).

[421] *Id.* at 1002.

[422] *Id.* at 999; *see also Automotive Techs. Int'l*, 501 F.3d at 1285 (rejecting claims covering a side-impact airbag activated by mechanical or electronic sensors, where the disclosure enabled only the former implementation); *Liebel-Flarsheim Co.*, 481 F.3d at 1380 (holding claims encompassing injectors with and without pressure jackets invalid where the specification enabled only the former); *AK Steel Corp.* v. Sollac, 344 F.3d 1234, 1244 (Fed. Cir. 2003) ("[W]hen a range is claimed, there must be reasonable enablement of the scope of the range.").

[423] 35 U.S.C. § 112 (2006).

[424] *See In re* Curtiss, 354 F.3d 1347, 1353 (Fed. Cir. 2004). Like the utility requirement, the written description requirement denies patents to "academic theories, no matter how groundbreaking." Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d. 1336, 1353

of obtaining a perfectly sliced loaf, but disclosed and enabled only the serrated edge, his claim could be rejected under the enablement and written description requirements, without having to characterize Smith's invention as an abstract idea.

There are distinct advantages to using § 112 as the gatekeeper against overly broad claims. The first is a more obvious tie to statutory language. Section 112 requires that a patent specification describe and enable the claimed invention; Section 101 says nothing about abstract ideas. More fundamentally, questions of statutory subject matter should have yes-or-no answers. An invention should be a machine or not a machine; it should not be a machine *to a certain extent*, so long as one can adequately define the term "machine." The breadth of the claim *is* a matter of degree, and one better suited to analysis under § 112.

A comparison to copyright law shows why § 112 is a particularly useful tool for addressing over-breadth. Copyright law protects an author's way of expressing an idea.[425] Expression is not limited to the precise text of the copyrighted work; if it were, infringement could be avoided by insignificant variations.[426] Expression extends to something more general than the text.[427] In a play, expression might include plot developments, settings, character traits, and other story-telling devices that could be substantially reproduced without verbatim copying.[428] On the other hand, copyright law does not allow an author to protect the *idea* underlying the work.[429] Separating idea and expression is, as Judge Learned Hand famously observed, an analysis involving "abstraction."

> [W]hen the plagiarist does not take out a block in situ, but an abstract of the whole, decision is more troublesome. Upon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at times might consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his "ideas," to which, apart from their expression, his property is never extended.[430]

(Fed. Cir. 2010). In other words, it "limits patent protection to those who actually perform the difficult work of 'invention'—that is, conceive of the complete and final invention with all of its claimed limitations—and disclose the fruits of that effort to the public." *Id.*

[425] *See* Harper & Row Publishers, Inc. v. Nation Enter., 471 U.S. 539, 547 (1985).

[426] *See* Nichols v. Universal Pictures Corp., 45 F.2d 119, 121 (2d Cir. 1930).

[427] *Id.*

[428] *See* Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49, 54–55 (2d Cir. 1936); Benay v. Warner Bros. Entm't Inc., 607 F.3d 620, 624 (9th Cir. 2010).

[429] 17 U.S.C. § 102(b) (2006) ("In no case does copyright protection for an original work of authorship extend to any idea . . . regardless of the form in which it is described, explained, illustrated, or embodied in such work."); *Harper & Row*, 471 U.S. at 547.

[430] *Nichols*, 45 F.2d at 121 (citations omitted).

Having defined the problem, Judge Hand admitted that "[n]obody has ever been able to fix that boundary, and nobody ever can."[431] There is no bright line between idea and expression, only a continuum of generality. In a particular case, a court must decide if the similarities between the copyrighted work and allegedly infringing work are so *general* in nature that copyright policy is best served by treating those similarities as unprotectable ideas.[432] The policy objectives of copyright law are much like those of patent law—to promote creativity by securing to authors the exclusive right to their works, while avoiding property rights so extensive that they stifle further creativity or deny the public the benefit of valuable materials.[433] When it comes to separating idea and expression in a close case, courts have little more than instinct to guide them.[434]

Patents and copyrights present the same risk of over-reaching through over-generalizing. If an author's "expression" extends to the most basic aspects of the work, the author's rights are too all-encompassing. Other authors are unable to explore the same concepts in their own fashion, denying the public the benefit of other viewpoints and other talents. A patent claim that omits too much detail has similar effects. As the Court pointed out in *Morse*, a claim to all methods of transmitting messages by electromagnetism would hamper exploration of other means than those already invented.[435] But patents and copyrights are different in important respects.

Copyright interests are not claim-based. The copyrighted work is a specific text—like the text of a novel. Abstraction enters the picture only *after* the copyright owner identifies another work as substantially similar. Then a court considers the level of abstraction at which any similarities appear, and whether they are too general to be treated as similarities of expression. In contrast, an inventor "abstracts" a patented invention at the outset when deciding how

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[431] *Id.*

[432] *See* Nash v. CBS, 899 F.2d 1537, 1539–41 (7th Cir. 1990). Burk & Lemley describe copyright's treatment of abstraction as an exercise in "hierarchical category sorting" to determine if the two works share a "sufficiently narrow categorical space" to justify a finding of common expression. Burk & Lemley, *supra* note 395, at 35.

[433] *See Harper & Row*, 471 U.S. at 546; *Nash*, 899 F.2d at 1540–41; Karjala, *supra* note 415, at 369 ("[T]he underlying social policy goal of traditional copyright and patent law . . . is to draw a balance between creation incentives (protection) on the one hand and freer use by both consumers and competitors (less protection) on the other.").

[434] *See Nichols*, 45 F.2d at 121 ("[A]s soon as literal appropriation ceases to be the test, the whole matter is necessarily at large, so that, as was recently well said by a distinguished judge, the decisions cannot help much in a new case.").

[435] O'Reilly v. Morse, 56 U.S. (15 How.) 62, 113 (1854); *see also* Burk & Lemley, *supra* note 4, at 1643 (describing the exclusion of abstract ideas as a "micro policy lever" that "provides room for subsequent innovators to work out new implementations of the abstract idea without fear of patent liability").

generally to draft the claims.[436] The applicant controls the claim-drafting process and determines the contents of the disclosure in the patent specification. The disclosure is the applicant's opportunity to explain the significance of the invention and its readiness to be applied in a variety of settings. This provides the court with a context—a context absent in copyright—for judging the significance of the patentee's contribution to the art, and how much work remains to be done to realize its full implications.[437] If Smith claimed any means to obtain perfectly sliced bread but disclosed only the serrated blade, the court could decide that the disclosure was too limited to support such a broad claim. Comparison of the claims to the specification is characteristic of the enablement and description requirements, but has little role in the subject matter inquiry of § 101. In short, the abstract ideas exception poses an abstract question: "Is the claim too broad?" Section 112 poses a question more concrete and more answerable: "Is the claim too broad *in comparison to the teachings of the disclosure*?"

4. Basic Tools of Research

Abstract ideas are said to be among the "basic tools" of research that belong in the "storehouse of knowledge of all men."[438] The "basic tools" criterion is too vague to identify an abstract idea. An engineer who designs equipment for use in commercial bakeries might consider Smith's serrated blade a basic tool for further development and improvement. Smith might regard the serrated blade as the conclusion of the search. It is certainly true that patents, in the end, should encourage technological advancement and not the reverse. But, together with the exclusion of natural phenomena and principles, the best means of protecting the basic tools of research from unproductive patents are the utility, enablement, and novelty requirements.[439]

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[436] Courts may also view the invention at a more or less abstract level in deciding how to interpret ambiguous claim language. *See* Burk & Lemley, *supra* note 387, at 31. This exercise in "abstraction" would, however, be subsequent to, and much subtler than, the patentee's initial decisions regarding how to characterize the invention.

[437] The same context may be useful in deciding issues of infringement. *See* Burk & Lemley, *supra* note 395, at 54 (advocating application of the doctrine of equivalents because it "would permit the courts to pay attention to the issues that really matter in deciding patent scope—the importance of the invention to the industry, the nature of the technology, how this invention relates to others in producing marketable products, and the relationship between the patentee's invention and the accused device").

[438] *See, e.g.*, Bilski v. Kappos, 130 S. Ct. 3218, 3225 (2010) (citations omitted). Peter Lee refers to abstract ideas as part of the "'raw' ingredients of creation" constituting our "intellectual infrastructure." Peter Lee, *The Evolution of Intellectual Infrastructure*, 83 WASH. L. REV. 39, 64–65 (2007). "Open access" to such infrastructure "enhances downstream productivity." *Id.* at 65.

[439] 35 U.S.C. § 101–103, 112 (2006).

If a concept is so general that no application has been discovered, the utility requirement keeps the concept in the "storehouse of knowledge" until it is more fully developed.[440] If the patentee discloses a practical use, then a court can inquire whether the disclosure fully enables the use of the concept in all of its potential applications. The more generally the applicant claims the invention, the more likely it is that a court will find the enabling disclosure lacking. If the applicant claims a "basic tool" of research, an enabling disclosure of matching scope will be hard to achieve. On the other hand, on those few occasions where the disclosure fully enables a "basic tool" of research, the applicant's fundamental contribution warrants a broad patent, and the "march of science" continues unabated.[441] It may be difficult to judge how much disclosure is necessary to warrant a broad claim, but at least a court would be asking the right questions, rather than searching in vain for the meaning of the term "abstract idea."

In short, some patents on abstract ideas might deny researchers tools that, for the sake of technological progress, should be freely available. But the "basic tools" issue does not help to identify which ideas are abstract, and the concern about continuing research can be handled without resort to patentable subject matter.

5. Innovation without a Physical Dimension

Jones' insights into the marketplace raise issues of abstractness that Smith's invention does not. Most inventions are reduced to practice in concrete, tangible things. Samuel Johnson refuted Bishop Berkeley's arguments for the non-reality of matter by applying a sharp kick to a rock.[442] With a blow to his bread-slicing machine, Smith could demonstrate that his invention, in one sense, is not abstract.

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[440] Burk & Lemley note that the abstract ideas exclusion "forces patents downstream, away from unfinished research and toward completed products or processes more suitable for the market." Burk & Lemley, *supra* note 4, at 1643. The utility requirement performs the same function in cases where the discoverer of a principle has no useful applications to offer. *See Brenner v. Manson*, 383 U.S. 519, 535–36 (1966) (employing the utility requirement to ensure that a patent is more than a "hunting license"). The utility requirement enforces the principle that a patent "is not a reward for the search, but compensation for its successful conclusion." *Id.* at 536. If the inventor *has* developed the idea to the point of offering practical contributions, then the issue is whether the claim matches the scope of those contributions.

[441] *See* Gruner, *supra* note 240, at 405 ("[B]reakthrough discoveries—that is, pioneering discoveries that become category controlling discoveries upon the issuance of patent rights—are ones that deserve the clearest and strongest patent protections to encourage inventors to pursue and investors to back these advances that make possible a group of downstream advances and associated societal benefits.").

[442] JAMES BOSWELL, LIFE OF SAMUEL JOHNSON 248 (Penguin Classics 2008) ("After we came out of the church, we stood talking for some time together of Bishop Berkeley's ingenious sophistry to prove the nonexistence of matter, and that everything in the universe is merely ideal. I observed, that though we are satisfied his doctrine is not true, it is impossible to refute it. I never shall forget the alacrity with which Johnson answered,

Inventions involving machines, manufactures, compositions of matter, or matter-altering processes are abstract *only in the imagination*. When Smith contemplates a class of bread-slicing machines that share attributes critical to the invention, but that are in other respects undefined, his thought process produces an abstraction—a concept divorced from any concrete example of the machine. Reducing his thoughts to claim language is a part of the process. Smith may describe the shape of a serrated edge without limiting himself to a blade of any particular material. Any description in language of a concrete thing omits details. It is an exercise in generalizing, and an instance of, in the dictionary sense, "abstraction." What is different about Jones' invention is that it has no physical embodiment. It is abstract not only in contemplation, but in execution.

Jones could reduce to practice her invention by projecting a reduced demand for pumpernickel in the summer months and communicating a smaller order for rye flour to her supplier. Producing no concrete thing on which a realist philosopher could stub his toe, Jones' invention resembles the marketing paradigm of *Ferguson*, the arbitration system of *Comiskey*, and the hedging procedure of *Bilski*. Inventions composed of contractual obligations, legal commitments, thought processes, and other non-physical components have been singled out as classic examples of abstract ideas. Although the Supreme Court in *Bilski* rejected the machine-or-transformation test as the sole manner of identifying an abstract idea, it still endorsed the test, and the connection to the physical world that it implies, as an important "clue" or "investigative tool."[443] So while processes that do not involve physical things are not always "abstract ideas," they are very much in danger of rejection under § 101.

Is that because non-physical processes raise the policy concerns associated with abstract ideas? Not necessarily. Hedging contracts, arbitration commitments, and market projections are human-created phenomena. They may be so basic that they are not *new*, but novelty is a question distinct from patentable subject matter. We can assume that Jones' demand calculations are so clever, or at least so idiosyncratic, that they did not exist before she invented them. Do non-physical processes have utility? In the ordinary sense, they do. They can increase efficiency, conserve resources, generate wealth, or further understanding. One could redefine "useful" to demand something more concrete, but that redefinition would require some justification. Non-physical inventions can supply the *quid pro quo* necessary to justify the patent bargain.

Are patents to non-physical processes overbroad? Not in every case. Jones could draft her claims so narrowly that they would have little preemptive effect. A claim limited to a method of ordering 99.009% of the rye flour used in the previous month of June would be useless and absurd, but it would not be overbroad. Do patents covering non-physical processes deny researchers their basic tools? Again, not if the claims are narrow. Claims to non-physical processes may *tend* to be

striking his foot with mighty force against a large stone, till he rebounded from it, 'I refute it *thus*.'").

[443] Bilski v. Kappos, 130 S. Ct. 3218, 3227 (2010).

overbroad, and share the other concerns associated with abstract ideas, but the only thing unfailingly abstract about claims that cover non-physical processes is exactly that—they cover non-physical processes.

Perhaps that is enough to hold them ineligible for patenting, either because a non-physical process is not a "process" within the meaning of § 101 (a position rejected by the Supreme Court in *Bilski*), or because non-physical processes are not among the "useful arts" envisioned in the Constitution. After endorsing a "useful arts" limitation in *Comiskey*,[444] the Federal Circuit abandoned it as too vague in *Bilski*.[445] The court may wish to reconsider that, now that the Supreme Court has rejected the more definite machine-or-transformation test in favor of the venerable, but persistently muddled, abstract ideas exception. A useful arts test might be difficult to apply. Some non-physical processes, like advances in computer programming, may have the technological pedigree to pass the test. Inventions that mix programming with business methods or other endeavors might be difficult to categorize as technological or non-technological. In any case, labeling non-physical processes as "abstract ideas" only confuses the issue.

In short, Smith or Jones might draft patent claims that should be summarily denied. They might claim too broadly in comparison to their disclosures, appropriate subject matter they did not invent, stray into fields of endeavor that are not suitable for patenting, or describe concepts too undeveloped to have any practical utility. But the "abstract ideas" label adds little to the analysis. The concept has been pulled in too many directions, its inherent contradictions too seldom recognized. Other tools are better adapted to the same goals. Perhaps the absence in the Patent Act of any reference to "abstract ideas" is a sign of wisdom, not oversight.

VII. CONCLUSION

After the Supreme Court's *Bilski* decision, the abstract ideas exception to patentable subject matter has become an even more important gatekeeper in the area of business methods and other intangible pursuits. The principle survives because it reflects important policy goals—rewarding practical advancements, tailoring the patent grant to the inventor's contribution to the art, and leaving the door open to further improvements. But identifying an unpatentable abstract idea has been problematic from the beginning; *all* patented inventions, in certain respects, are abstract ideas. Some inventions are closer to the "timeless truths" than others. Some hold more promise of further development. Some are claimed more broadly in comparison to the patent disclosure. Some are less firmly connected to the world of tangible things. But courts have too often applied the "abstract idea" label without clarifying what we are looking for, or what, precisely, we are trying to achieve.

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[444] *See In re* Comiskey, 554 F.3d 967, 969 (Fed. Cir. 2009).
[445] *See Bilski*, 130 S. Ct. at 3256–57.

In *Bilski*, the Supreme Court acknowledged the need for "new inquiries" in patent law to address the challenges of changing technology. The abstract ideas exception is an old inquiry. It is the patent law equivalent of a time-weathered stone, its inscription—hard to read when it was new—grown indecipherable under the moss of intervening years. If the label must persist, the courts should at least clarify which of the several aspects of abstractness are disqualifying, and examine whether patentable subject matter is really the right means to address their concerns. They might find that the Patent Act itself supplies the tools required, making the judicially created "abstract ideas" doctrine a counterproductive addition.