Northwestern Journal of Technology and Intellectual Property

Volume 8
Issue 2 *Spring*

Article 4

Spring 2010

Machines and Transformations: The Past, Present, and Future Patentability of Software

Andrei Iancu

Peter Gratzinger

N O R T H W E S T E R N
JOURNAL OF TECHNOLOGY
AND
INTELLECTUAL PROPERTY

Machines and Transformations: The Past, Present, and Future Patentability of Software

Andrei Iancu & Peter Gratzinger

Spring 2010 VOL. 8, NO. 2

Northwestern Journal of Technology and Intellectual Property
Volume 8, Number 2 (Spring 2010)

Machines and Transformations: The Past, Present, and Future Patentability of Software

By Andrei Iancu & Peter Gratzinger*

I. INTRODUCTION

¶1 The Constitution grants Congress the power to "promote the Progress of Science and useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their respective . . . Discoveries."[1] Those words were written on the cusp of the Industrial Revolution, when "Science and the useful Arts" probably brought to mind steam engines and cotton mills. Today, the emblematic technology of our "Information Age" is the computer and associated software, which appears in almost every aspect of our lives. While some question the policy wisdom of granting "software patents,"[2] few question that computer science falls comfortably within "science and the useful arts." More controversial is whether so-called "business method patents" are the type of innovation contemplated by the Constitution or the Patent Act.[3]

¶2 On November 9, 2009, the Supreme Court heard oral argument in *Bilski v. Kappos*, No. 08-964, a case that has "transfixed the business community" and that commentators have noted has "the makings of a landmark decision in patent law."[4] At issue is the scope of the word "process" in § 101 of the Patent Act, which limits the scope of patentable subject matter.[5] A restrictive reading of "process" could greatly limit the availability of "business method patents," as well as curtailing the scope of patent protection for information-intensive processes such as software and diagnostic methods. Yet, software patents present an altogether different set of issues than business methods, and the two need not be addressed in the same way. Lumping the two together creates a risk that the patentability of software will be unnecessarily limited.

¶3 The *Bilski* case presents a claim on a process of hedging commodities risks, and does not, on its face, involve the patentability of software. Petitioner Bilski argues that any "process" is within the statute so long as it has a "practical application."[6] This

---

* Andrei Iancu is a partner and Peter Gratzinger is an associate at Irell & Manella LLP in Los Angeles, California. The views expressed in this article are those of the authors only, and do not reflect the views of Irell & Manella LLP or any of its clients.

[1] U.S. CONST. art. I, § 8, cl. 8.

[2] *See* James Besson & Robert M. Hunt, An Empirical Look at Software Patents (Mar. 2004), *available at* http://www.researchoninnovation.org/swpat.pdf.

[3] *See, e.g.*, *In re* Bilski, 545 F.3d 943, 1001 (Fed. Cir. 2008) (Mayer, J., dissenting) (arguing that "patents were designed to protect technological innovations, not ideas about the best way to run a business").

[4] Adam Liptak, New Court Term May Give Hints to Views on Regulating Business, N.Y. TIMES, Oct. 5, 2009, at A1.

[5] *See* 35 U.S.C. § 101 (2006).

[6] Brief for the Petitioner at 14-15, Bilski v. Doll, No. 08-964 (U.S. July 30, 2009).

requirement, he argues, is sufficient to comply with the long-standing doctrine that excludes natural laws, mathematical principles, or abstract ideas from the scope of patentable subject matter.[7] Bilski contends that beyond those forbidden areas Congress intended patentable subject matter to "include anything under the sun that is made by man."[8]

¶4 Bilski seeks to overturn the decision of the Federal Circuit, which held that his process for hedging commodity risks was non-statutory.[9] According to the Federal Circuit, the question before the Court was "whether Applicants' claim recites a fundamental principle and, if so, whether it would pre-empt substantially all uses of that fundamental principle if allowed."[10] However, the Federal Circuit held that more than a "practical application" is required to avoid pre-emption of fundamental principles. A statutory "process," according to the Federal Circuit, must be "tied to a particular machine or apparatus" or "transform[] a particular article into a different state or thing."[11] Bilski's process for hedging risk, according to the Federal Circuit, fails this "machine-or-transformation" test.[12] While Bilski's process was not written as a software claim, the "machine or transformation" test on its face could also impact the patentability of software that, on its own, is not tied to a particular machine nor transform any particular article.

¶5 Respondent, the Patent and Trademark Office ("PTO"),[13] agrees that "laws of thermodynamics, mathematical formulas, abstract ideas, and other phenomena of nature" should not be patented.[14] But unlike the Federal Circuit, the PTO sees this as a separate and distinct inquiry from the "machine-or-transformation" test.[15] The principle justification for the "machine-or-transformation" test, according to the PTO, is that the "historical meaning" of "process" demonstrates that "only technological and industrial processes are patent-eligible."[16]

¶6 Both Bilski and the PTO therefore agree that, contrary to the Federal Circuit's holding, the "machine-or-transformation" test is not a particularly good way to avoid preemption of "fundamental principles." As discussed below, the "machine-or-transformation" test may also not be particularly well suited to achieve the PTO's goal of excluding processes outside of the traditional notions of "technological" and "industrial" innovation. If it performs poorly at both of its stated goals, there is a strong argument that the "machine-or-transformation" test should be abandoned.

---

[7] *See id.* at 17.

[8] *See id.* at 19 (quoting S. REP. NO. 82-1979, at 5 (1952), *as reprinted in* 1952 U.S.C.C.A.N. 2394, 2399; H.R. REP. NO. 82-1923, at 6 (1952)).

[9] *In re* Bilski, 545 F.3d 943, 959-60 (Fed. Cir. 2008).

[10] *Id.* at 954.

[11] *Id.*

[12] *Id.* at 964.

[13] In the Petitioner's brief, by convention, the named Respondent is John J. Doll, Acting Under Secretary of Commerce for Intellectual Property and Acting Director of the United States Patent and Trademark Office. *See* Brief for Petitioners, Bilski v. Doll, No. 08-964 (U.S. July 30, 2009). In the PTO's brief, Acting Director Doll is replaced with Director David J. Kappos. *See* Brief for the Respondent, Bilski v. Kappos, No. 08-964 (U.S. Sept. 25, 2009).

[14] Brief for the Respondent at 34, Bilski v. Kappos, No. 08-964 (U.S. Sept. 25, 2009).

[15] *Id.*

[16] *Id.* at 16.

¶7 Instead of trying to protect "fundamental principles" and curtail "business methods" with a single test, an alternate approach could be to treat these issues separately. For example, the Court could adopt Bilski's view that a "practical application" is sufficient to protect "fundamental principles." And to the extent it agrees with the PTO that it was Congress' intent to protect only "technological and industrial processes," the Court could, for example, limit process patents to those whose "practical application" is technological or industrial, rather than those directed to the rearrangement of human, legal, or financial relationships. By treating these issues separately, the Court may be able to better tailor the test for patentable subject matter and overcome some of the criticisms of the "machine-or-transformation" test.

¶8 The "machine-or-transformation" test appears to be rooted in the view that computational processes are inherently more "abstract" than other types of processes. We present an alternative view, that computational steps, in and of themselves, are no more likely to result in the unwarranted preclusion of "fundamental principles" than any other type of process steps. Under this alternative view, the machine-or-transformation test may sweep too broadly in excluding computational processes. This seemingly philosophical issue—whether computations are inherently "abstract"—could have significant practical implications for the patent system's openness to software patents and other "Information Age" innovations. Importantly, patents that involve computational steps, such as software, should not generally be lumped in with business methods.

A. Does the "Machine-or-Transformation Test" Identify Industrial and Technological Applications?

¶9 It has been argued that the "machine-or-transformation" test is a clumsy vehicle for achieving the PTO's goal of limiting the patent system to industrial and technological applications. Take, for instance, the infamous patent "Method of Exercising a Cat," which teaches a method of shining a laser pointer at a wall and "selectively redirecting said beam out of the cat's immediate reach."[17]

[17] Method of Exercising a Cat, U.S. Patent No. 5,422,036 col. 3 ll. 66-68 (filed Nov. 2, 1993) (issued Aug. 22, 1995).

U.S. Pat. No. 5,433,036 Fig. 1

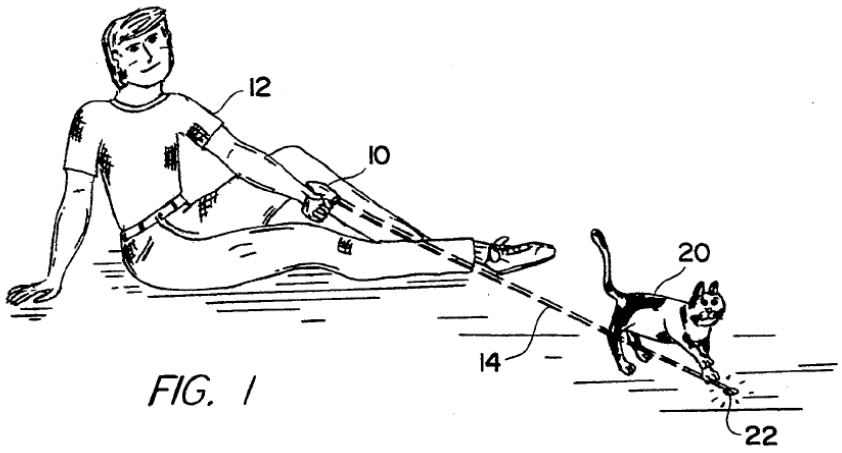


FIG. 1

¶10 Compare this process to, for example, an improved process for crawling the web.[18] As pointed out in Judge Mayer's dissent in the Federal Circuit's decision in *Bilski*, the first patent involves a transformation: "the sedentary cat becomes a fit feline."[19] Though it is not pointed out in Judge Mayer's dissent, it also involves a "particular machine"—the laser pointer. On the other hand, an improved process for crawling the web may involve no particular machine-or-transformation of an article, or at least none that count, as discussed below. The cat exercise method would seem to pass muster under the "machine-or-transformation" test, while the web crawling method might fail. From the perspective of industrial and technological innovation, the "machine-or-transformation" test appears to achieve a backwards result.

¶11 An improved process for crawling the web might have difficulty under the "machine-or-transformation" test. At best, it could satisfy the test if a general-purpose computer were considered a "particular machine," or if the manipulation of information in generic processors and memory elements were considered a "transformation." The Federal Circuit explicitly declined to take a position on this issue, because the claim in *Bilski* did not recite a computer.[20]

¶12 The problem with lowering the bar of the "machine-or-transformation" test in this way is that it becomes trivial in many contexts. If the involvement of a general-purpose computer were sufficient to make a process statutory, almost any informational process could be statutory with careful drafting, including Bilski's process for hedging commodities risk. Such a trivial version of the machine-or-transformation test is also not

[18] A web crawler is a program that automatically finds and downloads documents on the world wide web, thus making it possible to index and, ultimately, search the web. *See e.g.*, Web crawler system using parallel queues for queuing data sets having common address and concurrently downloading data associated with data set in each queue, U.S. Patent No. 6,377,984, col. 1 ll. 34-51 (filed Nov. 2, 1999) (issued Apr. 23, 2002).

[19] *In re* Bilski, 545 F.3d 943, 1009 (Fed. Cir. 2008) (Mayer, J., dissenting).

[20] *Id.* at 962 (declining to state "whether or when recitation of a computer suffices to tie a process claim to a particular machine").

a very good way to restrict patent protection to "technological or industrial processes," should the Supreme Court choose to do so.

¶13 The PTO's brief argues that Section 101 "should be read to incorporate the established understanding, reflected in historical practices and in this Court's decisions, that processes lacking any industrial or technological application are ineligible for patent protection."[21] Thus, if the Supreme Court determines that Congress did not intend to allow certain types of process patents, whether related to innovations in finance or feline fitness, one approach would be to simply define the scope of "industrial or technological applications" that Congress intended the Patent Act to protect. Focusing on such "applications" may be a more direct way of implementing any Congressional policy objective than a litmus test for machines or transformations. Certainly there would be difficult cases, but getting the arguably easy cases correct, such as the cat exercise and the web crawling processes, would be a promising start. In any event, it may be that a test specifically directed to limiting statutory subject matter to "industrial and technological" applications (or any other field of innovation) would ultimately be more successful than a dual-purpose test that must also do the work of protecting "fundamental principles" from unwarranted preclusion.

B. Does the "Machine-or-Transformation Test" Avoid Preemption of Fundamental Principles?

¶14 The machine-or-transformation test has also been argued to be an overly-restrictive means of avoiding the "preemption" of "fundamental principles." The test appears to exclude, among other things, processes directed to the manipulation of information. But information-based processes, including computations described using equations and mathematical terms, may be no more likely to unduly preempt "fundamental principles" than any other type of process. In this alternate view, information-based processes, like any other processes, should simply be required to describe a useful, practical *application* of a principle.

¶15 The first line of defense against the patenting of "principles" such as laws of nature and mathematical equations is that a "process" must describe a series of steps, or acts. After all, neither gravity nor the Pythagorean Theorem are, in and of themselves, a series of acts.

¶16 In the 1853 case *O'Reilly v. Morse*, for example, the Supreme Court disallowed a claim by Samuel Morse for the "the use of the motive power of . . . electro-magnetism, however developed, for marking or printing intelligible characters, signs or letters at any distances."[22] The Court explained that "[i]f this claim can be maintained, *it matters not by what process* or machinery the result is accomplished."[23] The Court worried about the unwarranted preemption of future inventions if such a claim were allowed: "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

[21] *See* Brief for the Respondent at 25, Bilski v. Doll, No. 08-964 (U.S. Sept. 25, 2009).
[22] O'Reilly v. Morse, 56 U.S. (15 How.) 62, 112 (1853).
[23] *Id.* at 113 (emphasis added).

specification."[24] The later invention might be superior, the Court continued, but "the inventor could not use it, nor the public have the benefit of it, without the permission of this patentee."[25]

¶17 *Morse* expressed the concern that the machine-or-transformation test is supposed to address, namely, that an overly broad claim might "preempt" all uses of a principle, known or unknown. The problem with Morse's claim, however, could have been fixed by a description of concrete acts, rather than merely "the use" of electro-magnetism. If Morse had reduced his claim to a process, the danger of preemption would have been avoided, and the "future inventor" would have been free to use a new and better process for harnessing "the motive power of electro-magnetism."

¶18 This was confirmed by the Supreme Court in *The Telephone Cases*, which upheld the patentability of Alexander Graham Bell's process for converting electricity to audible speech.[26] Bell claimed a "method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."[27]

¶19 The Court distinguished Bell's specific process from Morse's overly-broad claim to "the use" of electro-magnetism.[28] The Court first conceded that it "may be that electricity cannot be used at all for the transmission of speech except in the way Bell has discovered, and that therefore, practically, his patent gives him its exclusive use for that purpose."[29] But the Court held that "that does not make his claim one for the use of electricity distinct from *the particular process with which it is connected in his patent*. It will, if true, show more clearly the great importance of his discovery, but it will not invalidate his patent."[30] Critically, the Court recognized that there is nothing inherently wrong with "preempting" all of the uses of a principle (here, the properties of electricity that allow it to transmit information), so long as the principle is tied to a "particular process" that just happens to be the only practical way to harness the principle.

¶20 A second line of defense against unwarranted preemption of fundamental principles is that the practical application of the principle, as embodied in a "particular process," must be useful. Unlike the "machine-or-transformation" test, this requirement flows naturally from the language of Section 101 of the Patent Act, which only allows patents on processes that are "new and *useful*."[31] *Brenner v. Mansen*, a landmark Supreme Court case regarding the utility requirement, held unpatentable a process of synthesizing a particular steroid, because there was no definite use for the compound.[32] The Supreme Court acknowledged that there may be plenty of "contributions to the fund of scientific information" that do not rise to the level of patentability, and that such basic research may one day "command the grateful attention of the public."[33] But, according to the

[24] *Id.*
[25] *Id.*
[26] The Telephone Cases, 126 U.S. 1 (1888).
[27] *Id.* at 531.
[28] *Id.* at 535.
[29] *Id.*
[30] *Id.* (emphasis added).
[31] 35 U.S.C. § 101 (2006) (emphasis added).
[32] Brenner v. Manson, 383 U.S. 519 (1966).
[33] *Id.* at 535-36.

Court, "a patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion."[34] More recently, the Federal Circuit has confirmed that this doctrine "applies with equal force in the fields of chemistry and biology as well as in any scientific discipline."[35] The utility requirement ensures that a purely abstract or academic exercise does not qualify for patent protection.

¶21 Courts have apparently concluded that the requirement that a process's particular steps describe a useful, practical application of a principle is sufficient to protect the principles of physics and chemistry from unwarranted preclusion. It could be argued that the same is true when the principle is a mathematical one. For example, one application of the Pythagorean theorem, when implemented as a "process," might look like this:

> A method of computing the hypotenuse of a right triangle, comprising:
>
> (a) storing the lengths of the sides of a right triangle in a memory;
>
> (b) computing the square of each side;
>
> (c) summing the squares; and
>
> (d) computing the square root of the sum.

When used in a particular process, the algorithm is already much narrower than a claim to "the use of the Pythagorean Theorem" generally, which would have innumerable uses beyond this series of computations. The claim would likely have to be narrower still; however, to be considered a "useful" application of the theorem, as it stands, it is nothing more than a mathematical exercise.

¶22 If these computations were part of a larger process with a useful, practical application, the process could well be one that does not threaten to unduly preempt a fundamental principle. Furthermore, it is not apparent why the result should be different if the practical application involved additional steps on a computer (say, a process for image processing) or steps outside of a computer (say, a process for surveying). Neither process would appear to violate the preemption principle set forth in *Morse* and in *The Telephone Cases*. That is, future inventors would be free to come up with other uses for the Pythagorean Theorem, and free to come up with other ways of surveying or image processing.

¶23 Moreover, if it turned out that the only way to take advantage of the usefulness of the Pythagorean Theorem to surveying or image processing was through the specific claimed method, that would "show more clearly the great importance" of the invention, but would arguably not make it fall outside the bounds of patent protection.[36] The claim would not appear to be any more unduly preemptive than Alexander Graham Bell's patent, which the Court admitted may well be the only way to harness the motive power of electro-magnetism for the transmission of speech.

---

[34] *Id.* at 536.
[35] *In re* Fischer, 421 F.3d 1365, 1375 (Fed. Cir. 2005).
[36] *See* The Telephone Cases, 126 U.S. 1, 535 (1888).

¶24 If computational steps are no different from other types of process steps, a rule requiring a useful, practical application may be a superior way to avoid the undue preclusion of mathematical equations, abstract ideas, and other "fundamental principles" than the machine-or-transformation test. Specifically, rather than excluding all information-based processes, the test may be better suited to discriminating between statutory and non-statutory informational processes. For example, an improved method for crawling the web might be statutory, even though all of the steps relate to the manipulation of information. On the other hand, the process for computing a hypotenuse described above might fail because it is a purely theoretical mathematical exercise and insufficiently directed to a "practical" application. In either case, a "principle" of mathematics, like the fact that two sides of a right triangle determine the third, is put on equal footing with a "principle" of physics, like the ability of electricity to transmit information, and afforded no greater or lesser protection.

II. THE CONCEPTUAL ROOTS OF THE MACHINE OR TRANSFORMATION TEST

¶25 The remainder of this Article is concerned with tracing the "machine-or-transformation" test to its conceptual roots. One element that appears to underlie the machine or transformation test is a suspicion that computational processes are more likely to preempt fundamental principles than other types of processes. If this suspicion is unfounded, then the usefulness of the test itself is called into doubt.

A. Before Benson: The Practical Application Framework

¶26 For many years, the "practical application" framework was successfully applied to distinguish natural phenomena and other "principles" from statutory patent claims. For example, *Morse*, in its discussion of prior cases, distinguished the unpatentable principle that hot air promotes combustion, from the patentable machinery for harnessing that principle.[37] As discussed above, *Morse* and *The Telephone Cases* established that the ability of electricity to transmit information cannot be patented, but a particular method for harnessing that property can be. In *Le Roy v. Tatham*, the "principle" at issue was that lead in a semi-solid state can be welded under extreme heat and pressure.[38] The Court in *Le Roy* held that this principle was not patentable but that specific machinery for welding lead according to this principle might be.[39] In *Mackay Radio & Telegraph Co. v. Radio Corp*., the Court held that a mathematical formula for calculating the optimal angle between antenna wires for directional propagation of radio waves is not patentable, but an antenna configured according to the formula might be.[40] *Funk Brothers Seed Co. v. Kalo Inoculant Co*. held that a mixture of selected strains of bacteria for promoting nitrogen fixation was ineligible because the bacteria were naturally occurring, noting that the

[37] O'Reilly v. Morse, 56 U.S. (15 How.) 62, 114-15 (1854) (discussing Neilson v. Harford, 151 ER 1266 (1841)).
[38] *See* Le Roy v. Tatham, 55 U.S. 156, 174-75 (1853).
[39] *Id.* at 175.
[40] Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 94 (1939).

question was the patentability of the bacteria themselves, not the "methods of selecting and testing the [desired] strains."[41]

B. Benson: A Landmark Software Patent Case

¶27 In 1972, the Supreme Court decided a landmark software patent case, *Gottschalk v. Benson*.[42] In *Benson*, the applicant claimed a method for converting binary-coded decimal (BCD) numerals into pure binary numerals.[43] Apparently uncomfortable with a process consisting largely of computations, the Court lumped in such processes with naturally-occurring phenomena as being outside the scope of patent laws.[44]

¶28 First, the Court declared Benson's process to be a procedure for solving a "mathematical problem."[45] *Benson* then discussed some of the cases noted above: *Le Roy*, *Mackay*, and *Funk Brothers*.[46] While it never said so explicitly, the discussion of these cases by the *Benson* Court implied that the claimed "mathematical" process represented a "principle" somehow comparable to the chemical properties of lead, the physics of radio waves, or naturally-occurring bacteria.

¶29 Next, the *Benson* Court turned to the nature of process patents. The Court noted that the process at issue was so "abstract and sweeping" that the "end use" could "vary from the operation of a train to verification of drivers' licenses to researching the law books for precedents" and "be performed through any existing machinery or future-devised machinery or without any apparatus."[47] *Benson* stated that a process step need *not* always be tied to a particular machine: in a process step for reducing flour to a powder, it may be immaterial whether a hammer, a pestle, or a mill is used.[48] But when a process claim "does not include particular machines," *Benson* held, "[t]ransformation and reduction of an article to a different state or thing" is the "clue to the patentability."[49] The Court gave several examples where such process claims were sustained, including a process for manufacturing glycerine[50] and a process for expanding metal.[51] The Court, however, explicitly declined to turn this "clue" into a rule: "We do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents."[52] In particular, the Court said, it is not precluding all patents for "any program servicing a computer."[53] The Court then held that the claimed algorithm came too close to patenting "an idea":

> What we come down to in a nutshell is the following. It is conceded that one may not patent an idea. But in practical effect that would be the result if the

[41] Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948).
[42] Gottschalk v. Benson, 409 U.S. 63 (1972).
[43] *Id.* at 64.
[44] *Id.* at 71-72.
[45] *Id.* at 65.
[46] *Id.* at 67-68.
[47] *Gottschalk*, 409 U.S. at 68.
[48] *Id.* at 70 (citing Cochrane v. Deener, 94 U.S. 780, 788 (1876)).
[49] *Id.*
[50] *Id.* (citing Tilghman v. Proctor, 102 U.S. 707, 721 (1881)).
[51] *See id.* (citing Expanded Metal Co. v. Bradford, 214 U.S. 366 (1909)).
[52] *See id.* at 71.
[53] *Id.*

> formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.[54]

C. The Input-Output Model

¶30 *Benson* planted the seeds of a conceptual framework that we call in this Article the "Input-Output" model. As the book "PCs for Dummies" explains, "[w]hen you peel back all the mumbo jumbo, the computer is nothing more than a gadget that takes input and then modifies that input to create some form of output."[55]

PCs for Dummies Fig. 1-1

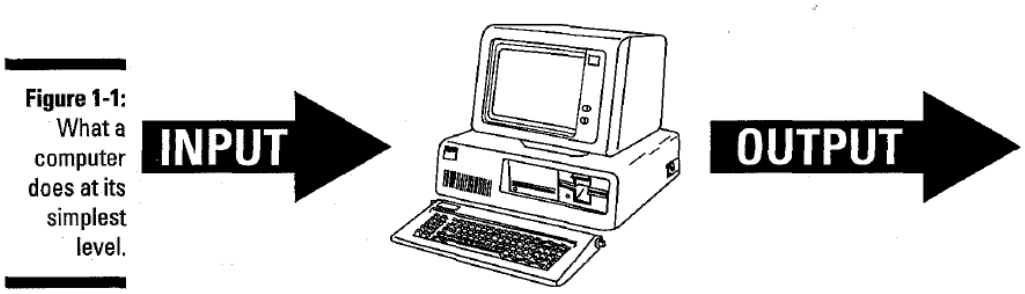


Figure 1-1: What a computer does at its simplest level.

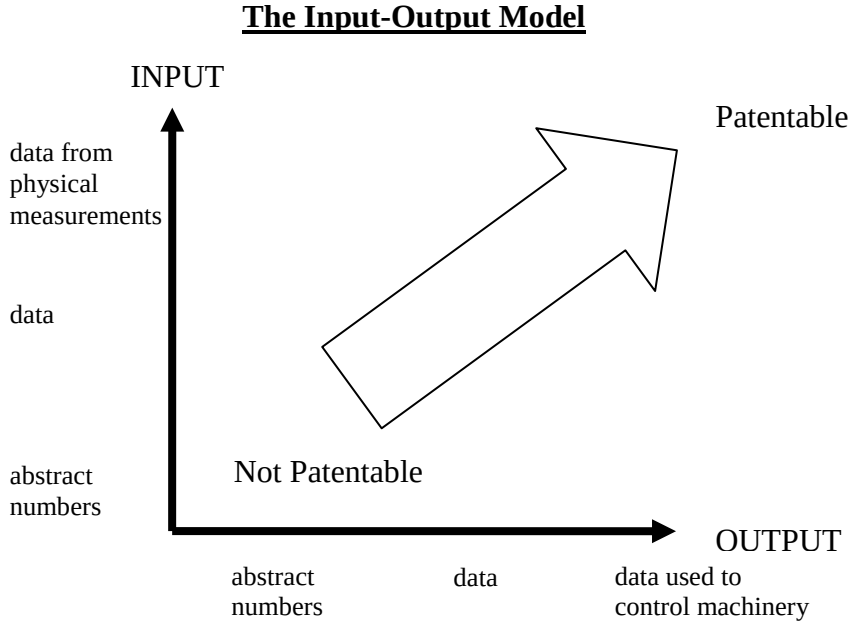
¶31 In *Benson*, however, the steps that modify the data (as well as the "digital computer" itself) do not count, or at least count less, in converting an idea to an application. The way to give the computational process a "practical application," therefore, is through the inputs and outputs.

¶32 If the input and output are abstract numbers (for example, binary-coded numerals and pure binary numerals), the process is not patentable.[56] On the other hand, *Benson* hints that if the end use or output is limited to a specific physical process, such as the operation of a train, the process is less abstract and therefore more likely to be patentable.[57] *Benson* also lists "verification of drivers' licenses" as a potential end use that might make a computational process less abstract.[58] In the Input-Output model, data such as a driver's license number is a more concrete input or output than an undefined number. To complete the picture, later cases would find that inputs tied to specific physical measurements make a computational process more "concrete" than processes where the input can be any type of data. For example, *In re Abele*, discussed in greater detail below, found an image processing claim to be statutory when the input was defined as c-ray data, but not when the input was defined merely as "data."[59]

---

[54] *Id.* at 71-72.
[55] DAN GOOKIN, PCS FOR DUMMIES 10 (11th ed. 2007).
[56] *See Gottschalk*, 409 U.S. at 73.
[57] *See id.* at 68.
[58] *Id.*
[59] *In re* Abele, 684 F.2d 902, 908 (C.C.P.A. 1982).

¶33 This sliding scale is illustrated in the figure below, where a computational process



that converts numbers into numbers is deemed an "abstract idea," but a computational process that takes data representing a physical measurement and provides an output that is used to control machinery is most likely a statutory application of a principle.

¶34 However, this conceptual framework is flawed because its premise is flawed. The premise is that computational steps are "principles" that are inherently different from input or output steps. Like bacteria or laws of physics, they are the "basic tools of scientific and technological work,"[60] "manifestations of the laws of nature, free to all men and reserved exclusively to none."[61] Yet the assumptions make little sense. First, any information that can be used in a calculation is physical. As Rolf Landauer, a prominent IBM researcher and theorist put it,

> Information is not a disembodied abstract entity; it is always tied to a physical representation. It is represented by engraving on a stone tablet, a spin, a charge, a hole in a punched card, a mark on paper, or some other equivalent. This ties the handling of information to all of the possibilities and restriction of our real physical world, its laws of physics and its storehouse of available parts.[62]

Performing a calculation, whether with an abacus or with a computer, is necessarily just as "physical" a process as grinding flour.[63] Second, there is no inherent reason to believe that a non-statutory algorithm for translating BCD numerals into pure binary numbers is

[60] *See Gottschalk*, 409 U.S. at 67.

[61] *See* Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948).

[62] Rolf Landauer, *The Physical Nature of Information*, *in* MAXWELL'S DEMON 2: ENTROPY, CLASSICAL AND QUANTUM INFORMATION, COMPUTING 335, 335 (Harvey S. Leff and & Andrew F. Rex, eds., 2003).

[63] *See, e.g.*, *In re* Comiskey, 499 F.3d 1365, 1377-79 (Fed. Cir. 2007) ("mental processes," "processes of human thinking," and "systems that depend for their operation on human intelligence alone" are not patent-eligible subject matter).

more important to "scientific and technological work" or to society in general than, for example, a statutory antiretroviral drug. To the contrary, many if not most algorithms will be trivial in comparison. To be sure, the principles behind certain steps in the process, such as addition and subtraction, are basic to scientific and technological work, but so are the principles of biochemistry that make a particular drug molecule effective against a particular target. The principles behind a computational process, and their importance, should not be conflated with the process itself.

¶35 As a policy matter, too, there are likely better ways to ensure that innovations which are "too important" are not unreasonably monopolized through the patent system. For example, Article 31 of the Agreement on Trade Related Aspects of Intellectual Property Rights ("TRIPS") provides for compulsory licensing under national patent laws, provided that there is first an effort to reach agreement on reasonable commercial terms, and that the patent holder is compensated.[64] In the case of emergency, such as a public health crisis involving HIV/AIDS, for example, there is no requirement to first attempt to obtain a commercial license.[65] Such mechanisms are arguably a more sensible and narrow way of regulating unwanted "preemption" than the Input-Output model.

D. The Platonic View of Computational Steps

¶36 With respect to concepts that should be "free to all men," the Input-Output model wrongly assumes that computational steps, more so than other types of processes, are "discovered" rather than "invented" and are, therefore, the moral birthright of mankind. This assumption was made explicit in the Supreme Court's next software patent case, *Parker v. Flook*, which involved a patent covering a series of computations useful for controlling a catalytic conversion process.[66] The Supreme Court declared that "a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has *always existed*."[67]

¶37 The Supreme Court appears to take the view of Edward Everett, a former President of Harvard University, who wrote that "[i]n the pure mathematics we contemplate absolute truths which existed in the divine mind before the morning stars sang together, and which will continue to exist there, when the last of their radiant host shall have fallen from heaven."[68] Though *Flook*'s holding that the algorithm had "always existed"[69] was a bit more terse, the sentiment appeared to be the same.

¶38 The view that mathematical concepts have *always existed* is commonly attributed to Plato, and we refer to it in this article as the Platonic view of mathematics.[70] It may well be that mathematical equations such as the Pythagorean theorem have in some sense

---

[64] Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299; 33 I.L.M. 1197 (1994), *available at* http://www.wto.org/english/docs_e/legal_ e/27-trips.pdf.

[65] *See* World Trade Organization, Declaration on the TRIPS Agreement and Public Health, Adopted on 14 November 2001, WT/MIN(01)/DEC/2, *available at* http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.pdf.

[66] Parker v. Flook, 437 U.S. 584 (1978).

[67] *Id.* at 593 n.15 (emphasis added).

[68] EDWARD EVERETT, ORATIONS AND SPEECHES ON VARIOUS OCCASIONS 514 (1870).

[69] *Flook*, 437 U.S. at 593 n.15.

[70] *See* REUBEN HERSH, WHAT IS MATHEMATICS, REALLY? 9 (1999).

"always existed." More troubling, however, is extending the Platonic view of mathematics to any series of computational steps. It is not at all clear, for example, that the series of computational steps required to calculate the Alternative Minimum Tax or to crawl the web has "always existed."

¶39 All patents, computational or not, must satisfy the "utility" requirement—that is, they must work—and therefore, some "principle" is likely involved. The biochemical mechanisms that make a particular compound effective against HIV are as much of a "truth" as a mathematical equation that may underlie some set of computations. Informational processes, therefore, do not seem to be inherently more "principles-based" than any other processes.

¶40 While the Supreme Court compared the computational process in *Benson* to a "scientific truth,"[71] an alternative view is that it *applied* certain mathematical principles (for example, comparison operations), but that the particular series of steps to convert BCD number representations to binary representations had not, in fact, "always existed." Moreover, in this alternative view, the binary translation algorithm was not a pure mathematical exercise, but rather had a useful, practical application in the operation of a computer. If this were the case, there would have been no unwarranted preemption of fundamental principles if the process had been held statutory.

¶41 In some computational processes, such as the hypothetical process for calculating the Alternative Minimum Tax or for an improved web crawler, it may be readily apparent that no fundamental principles are in danger of being preempted. In other computational processes, perhaps including that in *Benson*, it may require more analysis or even expert input to determine whether the claimed series of computational steps is a practical application of mathematical concepts, or whether it comes uncomfortably close to expressing a Platonic truth. In either case, rather than automatically discarding computational algorithms, a more discerning approach may be possible, where mathematical truths are treated with no more and no less deference than laws of physics and other principles.

III. FROM *BENSON* TO *BILSKI*: THE INPUT-OUTPUT MODEL COMES FULL CIRCLE

¶42 After *Benson*, the Courts became increasingly open to information-intensive processes, including software patents, and the Input-Output conceptual model faded. As concerns grew over the excessive scope of process patents, however, the model came back in full strength in the Federal Circuit's *Bilski* decision. The following section traces the decline and rebirth of the Input-Output conceptual model after *Benson* up to the Federal Circuit's decision in *Bilski*.

A. In re Freeman (1978)

¶43 The next landmark software process case after *Benson* was *In re Freeman* from the Court of Customs and Patent Appeals.[72] *Freeman* concerned a claim covering a method of printing or displaying characters whose meaning is partly dependent on their relative positions—for example, in a fraction, the numerator conventionally needs to be above the

[71] Gottschalk v. Benson, 409 U.S. 63, 67 (1972).
[72] *In re* Freeman 573 F.2d 1237 (C.C.P.A. 1978).

denominator. The claimed steps consisted of reading input codes and building a "tree structure of symbols," using a positioning algorithm to compose the symbols in their proper positions, and displaying the symbols.[73] The claim, in effect, covered a particular way to perform typesetting using software.

¶44 In *Freeman*, the PTO argued that the claim was nothing more than an algorithm followed by insufficient "post-solution activity," namely, "a fleeting display on a cathode ray tube."[74] In other words, the PTO's view was that displaying abstract results on a monitor was not sufficient "application" in the Input-Output framework. The *Freeman* court refused to accept this as the sole criterion. Rather, the court reasoned that if no mathematical relationship is involved, there is no reason to be concerned with inputs and outputs.[75] The court in *Freeman* postulated that *Benson* must necessarily have only been referring to *mathematical* algorithms when placing certain algorithms off limits. The *Freeman* court reasoned that "[b]ecause every process may be characterized as a 'step by step procedure for accomplishing some end, a refusal to recognize that *Benson* was concerned only with mathematical algorithms leads to the absurd view that the Court was reading the word 'process' out of the statute."[76]

¶45 The test articulated in *Freeman* has two steps. First, determine whether the claim directly or indirectly recites a "mathematical" algorithm.[77] If it does not, the claim is statutory.[78] Even if it does contain a mathematical algorithm, however, it might still be statutory if it does not "wholly preempt" the algorithm.[79] The second step is not well-developed in *Freeman*, but is based on the Input-Output model of looking "outside" the computational steps in order to avoid preemption. The *Freeman* court did not reach the second part of the test; it held that the positioning algorithm at issue did not "recite process steps which are themselves mathematical calculations, formulae, or equations."[80] The claims were therefore held to be statutory subject matter.[81]

¶46 By narrowing the forbidden computational algorithms to "mathematical" algorithms, *Freeman* appeared to narrow dramatically the type of information-intensive processes, such as software patents, that would be excluded under the Supreme Court's holding in *Benson*. "Mathematical calculations," "formulae," and "equations" implemented in software would be off-limits to avoid unfair preemption of truths born before the morning the stars sang together. Mere software algorithms, on the other hand, could be freely patented, regardless of "post-solution activity" or other considerations.

¶47 This was perhaps a step in the right direction, but as later cases demonstrated, the test was unworkable and ultimately abandoned. Distinguishing "mathematical" algorithms from mere information manipulation, in particular, would turn out to be a quixotic pursuit.

---

[73] *Id.* at 1240.
[74] *Id.* at 1246.
[75] *Id.* at 1245.
[76] *Id.* at 1246.
[77] *Id.* at 1245.
[78] *Id.*
[79] *Id.*
[80] *Id.* at 1246.
[81] *Id.*

B. Parker v. Flook (1978)

¶48 Just after *Freeman*, the Supreme Court decided *Parker v. Flook*.[82] The patent in *Flook* described a method of updating a number called an "alarm limit." This computational method was intended to be used to control the catalytic conversion of hydrocarbons, where a variable such as temperature exceeding an "alarm limit" signifies an abnormal condition.[83] The claimed steps of the process were (1) measuring an unspecified process variable, (2) using a particular algorithm to calculate an updated alarm limit value, and (3) updating the alarm limit.[84] The principal difference from the "abstract" computational algorithm in the Supreme Court's earlier software patent case, *Benson*, was that the process in *Flook* was limited to a particular type of data, namely "any process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons."[85]

¶49 *Flook* made explicit the apparent assumption in *Benson* that computational processes are like laws of physics (i.e., "a relationship that has always existed").[86] In a possible nod to *Freeman*, *Flook* stated that it is using the word "algorithm" to specifically mean "a procedure for solving a given type of *mathematical* problem."[87] However, *Flook* did not provide any analysis of what separates a "mathematical" algorithm from a merely computational one. Instead, *Flook* simply held that "[t]he only novel feature of the method is a mathematical formula."[88] Because such relationships have "always existed," they cannot be patented.

¶50 Next, *Flook* held that "post-solution activity" cannot transform "an unpatentable principle into a patentable process."[89] The Supreme Court explained that "the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques."[90] Because the limitation to catalytic conversion processes could not bring the *Flook* process within the Patent Act, the claim was held non-statutory.[91]

¶51 *Flook* embraced the holding of *Benson* that computational steps may represent an "unpatentable principle," and added the requirement that to avoid preemption of that principle, there must be more than mere "post-solution activity." Simply narrowing the use of the Pythagorean Theorem to surveying techniques is not enough, or in the words of later courts, "merely reciting the field of use" is insufficient.[92] Thus, *Flook* reinforced the Input-Output conceptual model that looks for steps outside of the computational steps to gauge whether the process is statutory.

---

[82] 437 U.S. 584 (1978).
[83] *Id.* at 585.
[84] *Id.*
[85] *Id.*
[86] *See id.* at 593 n.15.
[87] *Id.* at 585 n.1 (emphasis added).
[88] *Id.* at 585.
[89] *Id.* at 590.
[90] *Id.*
[91] *Id.* at 596.
[92] *In re* Walter, 618 F.2d 758, 767 (C.C.P.A. 1980).

¶52 The term "post-solution activity" in *Flook* can also be read to mean that the non-computational acts must be novel. In other words, if all of the novelty lies in the computational steps, the applicant should not be permitted to preclude their use by stating an obvious use for their output. The dissent in *Flook* attacked the majority for "importing into its inquiry under 35 U.S.C. § 101 the criteria of novelty and inventiveness."[93] In fact, as we shall see, a "point of novelty" approach never caught on.

¶53 Nonetheless, it is worth noting that this extension of the Input-Output model, which gives more weight to the inputs and outputs when they form the "point of novelty," can still have questionable policy implications. Taking the Court's Pythagorean hypothetical, the patent would be the same and have the same preclusive effect whether the point of novelty was the formula, the surveying technique, or the idea to combine the two. As for which type of innovation society should motivate, why reward mathematicians for coming up with new surveying techniques (which would result in a patentable combination of a new "application" for a known "principle"), but not reward surveyors for discovering new computational algorithms to apply to their trade (which would result in an unpatentable combination of a new "principle" and a known application)? After all, history tells us that surveyors can be pretty good at math: the survey conducted by Carl Friedrich Gauss for the government of Hanover stimulated his seminal paper in differential geometry, *Disquisitiones generales circa superficies curva* (1828).[94]

¶54 Like *Benson*, *Flook* notes that prior precedents have only recognized processes "tied to a particular apparatus or operated to change materials to a 'different state or thing.'"[95] There is no explicit determination in *Flook* that the algorithm is not "tied to a particular apparatus" or used to "change materials to a 'different state or thing.'" However, this bit of dicta later served as part of the basis for formalizing the Input-Output model as the machine-or-transformation test.[96]

C. In re Walter (1980)

¶55 The next significant software process case, In re Walter, made short work of the Solicitor General's argument that the Supreme Court in Flook had "adopted a 'point of novelty' approach."[97] "If this approach were to be adopted it would immeasurably debilitate the patent system," the CCPA pronounced.[98] "We do not believe the Supreme Court has acted in a manner so potentially destructive."[99]

¶56 Instead, the CCPA picked up where it had left off by refining the two-step process set forth in Freeman. Walter explained that the "common thread" running through prior decisions is that "a principle of nature or a scientific truth (including any mathematical algorithm which expresses such a principle or truth) is not the kind of discovery or invention which the patent laws were designed to protect."[100] The first step, as in

---

[93] *Flook*, 437 U.S. at 600 (1978) (Stewart, J., dissenting).
[94] *See* GEORGE RASSIAS, THE MATHEMATICAL HERITAGE OF C.F. GAUSS 3 (1991).
[95] *Flook*, 437 U.S. at 588 n.9 (quoting Cochrane v. Deener, 94 U.S. 780, 787-88 (1876)).
[96] *See In re* Bilski, 545 F.3d 943, 954 (Fed. Cir. 2008) (quoting *Flook*, 437 U.S. at 588 n.9).
[97] 618 F.2d 758, 766 (C.C.P.A. 1980).
[98] *Id.*
[99] *Id.*
[100] *Id.* at 765.

Freeman, is to detect the presence of a mathematical algorithm.[101] If no such algorithm is present, no "scientific truths" are at stake.

¶57 Next, Walter refines and fleshes out the second step of the Freeman test: determining whether the process "wholly preempts" the mathematical algorithm. If the algorithm is "mathematical," explains Walter, the "claim as a whole must be further analyzed." If the algorithm "is implemented in a specific manner to define structural relationships between the physical elements of the claim (in apparatus claims) or to refine or limit claim steps (in process claims)," it passes muster under § 101.[102] For example, if the end product is a "pure number," the claim likely fails the second step of the test, but if the invention "produces a physical thing," the claim is probably statutory.[103] Under Walter, the test for preemption is based explicitly on the Input-Output framework.

¶58 Walter highlights the difficulty of distinguishing "mathematical" algorithms from mere information manipulations.[104] The claim at issue is a method of seismic surveying in which a signal is transmitted into the earth, received at geophone stations, converted to digital format, and then certain mathematical operations are performed on the data to make it useful for understanding features of the subsurface structure of the earth.[105] The claimed computations include "computing Fourier transforms and cross-correlation utilizing the Cooley-Tukey algorithm as modified by Bergland."[106]

¶59 Walter spends no time attempting to decipher whether the series of operations is a "procedure for solving a given type of mathematical problem," as opposed to a set of data manipulations that just happen to involve lots of math. Instead, a footnote explains, "[i]t is sufficient to note that both the computation of Fourier transforms and the operation of the Cooley-Tukey algorithm are mathematical exercises or algorithms as defined by the Supreme Court in [Flook] and [Benson]."[107]

¶60 Walter holds "the claims themselves are not drawn to methods of or apparatus for seismic prospecting; they are drawn to improved mathematical methods for interpreting the results of seismic prospecting."[108] While the claims recite "signals" as their input, the court found that the signals "may represent either physical quantities or abstract quantities; the claims do not require one or the other."[109] The claim steps do not produce a physical thing; they merely manipulate this abstract data. As a result, the claims are "classic examples of an attempt to embrace the algorithm or scientific truth itself rather than a particular application," and are therefore non-statutory.[110]

---

[101] *Id.* at 766.
[102] *Id.* at 767.
[103] *Id.*
[104] *See id.* at 758.
[105] *See id.* at 761 n.1.
[106] *Id.* at 761.
[107] *Id.* at 761 n.1.
[108] *Id.* at 769.
[109] *Id.* at 770.
[110] *Id.*

D. Diamond v. Diehr (1981)

¶61 In 1981, the Supreme Court finally found a software patent it could live with.[111] In *Diamond v. Diehr*, the claimed invention was a process for molding raw, uncured synthetic rubber.[112] It was known in the prior art to calculate the optimal curing time based on temperature and other variables by means of the Arrhenius equation.[113] The patentees characterized their contribution to the art as a process for constantly measuring the temperature inside the mold and feeding the temperature measurements into a computer that repeatedly calculates the cure time based on the Arrhenius equation and signals when to open the press.[114]

¶62 The Supreme Court held that this process was statutory subject matter.[115] The Court stated that the claim involves the transformation of an article into a different state or thing, and that "[i]ndustrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws."[116] The Court further held that its conclusion "is not altered by the fact that, in several steps of the process, a mathematical equation and a programmed digital computer are used."[117] According to the Court, the patentee did not seek to preempt the use of the Arrhenius equation, but rather "to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process."[118]

¶63 The *Diehr* Court reiterated its holding in *Flook* that a "particular technological environment" or "insignificant post-solution activity" will not "transform an unpatentable principle into a patentable process."[119] But, by "transforming or reducing an article to a different state or thing," the Supreme Court held that the claims in *Diehr* had crossed the threshold into the types of process that "patent laws were designed to protect."[120] The *Diehr* Court also put to rest any possible "point of novelty" approach to § 101 analysis, holding that it is "inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis."[121]

¶64 Different results notwithstanding, the claims at issue in *Diehr* and *Flook* were similar: both concerned a computerized algorithm to monitor and control an industrial chemical process. Arguably, the process in *Diehr* was patent-eligible and the process in *Flook* was not because *Diehr* named a specific physical parameter as an input (temperature) and a specific physical act as an output (open the press), whereas *Flook* had only named the *type* of data to be used as an input (a process variable used in catalytic conversion) and had not described what to do with the output (the updated alarm limit).

¶65 *Diehr* is a milestone for attempting to define the threshold at which a computation-intensive process survives the Input-Output test. But the Input-Output conceptual model

---

[111] *See* Diamond v. Diehr, 450 U.S. 175 (1981).
[112] *Id.* at 178.
[113] *See id.*
[114] *See id.*
[115] *Id.* at 184.
[116] *Id.*
[117] *Id.* at 185.
[118] *Id.* at 187.
[119] *Id.* at 191-92.
[120] *Id.* at 192.
[121] *Id.*

was leading to results that seemed to elevate form over substance. If Flook had simply named the process variables involved in catalytic conversion, or mentioned a switch that was tripped at the alarm limit, his process may have been patentable.

¶66 More importantly, *Flook* and *Diehr* may have been overly concerned that computational processes were more likely than other types of processes to lead to the preemption of fundamental truths. An alternative approach would have been to scrutinize whether the information manipulation steps were mathematical exercises with no stated purpose, or whether they were useful, practical applications—that is, steps applied to solving a problem. If the latter, as both seemed to be, perhaps they would both have been found statutory.

E. In re Abele (1982)

¶67 *Diehr* is the Supreme Court's last word to date on the scope of "process" claims under Section 101. The nearly three decades of subsequent silence is perhaps one reason behind the eager anticipation of the Court's decision in *Bilski*.

¶68 The next significant case, *In re Abele*, came from the U.S. Court of Customs and Patent Appeals.[122] The patent in *Abele* was directed to an improvement in a CAT scan imaging technique where artifacts on the image are eliminated through the use of a computerized algorithm.[123] The *Abele* court focused on the broad process claim 5 which it found to fall outside of the statutory subject matter of § 101, and a narrower dependent claim 6 which was held patent-eligible:

> 5. A method of displaying data in a field comprising the steps of
>
> calculating the difference between the local value of the data at a data point in the field and the average value of the data in a region of the field which surrounds said point for each point in said field, and
>
> displaying the value of said difference as a signed gray scale at a point in a picture which corresponds to said data point.
>
> 6. The method of claim 5 wherein said data is X-ray attenuation data produced in a two dimensional field by a computed tomography scanner.[124]

The court applied the two-step test developed in *Freeman* and *Walter*. As in *Walter*, it did not dwell long on step one, namely, whether the claim recites a "mathematical" algorithm.[125] *Abele* noted that each of the claims requires "calculating" a "difference" and therefore "presents a mathematical formula or sequence of mathematical operations."[126]

---

[122] *In re* Abele, 684 F.2d 902 (C.C.P.A. 1982).
[123] *See id.* at 904.
[124] *Id.* at 908.
[125] *Id.* at 907.
[126] *Id.* It is worth emphasizing, once again, that a "mathematical formula" and a "sequence of mathematical operations" are not the same thing. The Pythagorean theorem is a mathematical formula. Counting the Alternative Minimum Tax a sequence of mathematical operations (which, incidentally,

¶69 *Abele* then added a further gloss to the second step of the analysis in light of *Diehr*. According to *Abele*, a mathematical algorithm can be statutory if it is "applied in any manner to physical elements or process steps," provided that "its application is circumscribed by more than a field of use limitation or non-essential post-solution activity."[127] Thus, explains *Abele*, if the subject matter is otherwise statutory without the algorithm, then it is statutory *with* the algorithm.[128]

¶70 *Abele* applied this new gloss to Claim 5, an algorithm for processing and displaying undefined "data," and Claim 6, where the "data" is limited to X-ray data. The *Abele* court held that in Claim 5, the algorithm is "neither explicitly nor implicitly applied to any certain process," but rather is "directed merely to a mathematical formula."[129] By contrast, Claim 6 requires the performance of a CAT-scan, even absent the algorithm. Therefore, according to *Abele*, "production and detection cannot be considered mere antecedent steps to obtain values for solving the algorithm."[130] The algorithm is "part of an overall process which is statutory," and hence, the narrower claim is allowable.[131]

¶71 Despite the admonition to consider the "overall process," the Input-Output conceptual model appears to drive the outcome in *Abele*, as it did in *Benson*, *Flook* and *Diehr*. The following table summarizes the "overall process" as well as the inputs and outputs in each case:

Case	"Overall Process"	Input	Output	Statutory?
Benson	data translation	BCD numeral	Binary numeral	NO
Flook	catalytic conversion	"process variable"	updated alarm limit	NO
Abele (claim 5)	displaying data	data	display	NO
Abele (claim 6)	CAT scan	X-ray data	display for CAT scanner	YES
Diehr	curing rubber	temperature	signal to open press	YES

¶72 The "overall process" inquiry does not appear to produce consistent results. In particular, the "overall process" of catalytic conversion recited in the *Flook* patent is surely just as "statutory" as a CAT-scan. Nonetheless, the claim in *Flook* was held non-statutory, while *Abele* claim 6 was held statutory. The simplest way to understand the results is to focus on inputs and outputs. When the inputs and outputs are abstract (a "process variable" input and an "alarm limit" output, or generic data input and generic display output), the claims have generally been held non-statutory. In contrast, when the inputs are concrete and tied to physical processes (a temperature input for controlling an industrial process, or x-ray data to be displayed in conjunction with a CAT scan), the claims have been held statutory.

involves "calculating" a "difference.") The former may be a "fundamental truth," but the latter is not.

[127] *Id.*

[128] *Id.*

[129] *Id.* at 909.

[130] *Id.* at 908.

[131] *Id.* at 909.

¶73 *Abele* says that a software process for removing artifacts from an image is patentable, but the patentee has to describe the source of the image. Presumably, the patentee would be allowed to claim as many data sources as he could think up—CAT scans, MRI images, images from the Hubble space telescope—and all of those claims would be allowable. But claiming the process as to *any* image source is too broad, because then some fundamental truth may be preempted. This outcome is based, once again, on the premise that patents on image processing are more likely to unfairly preclude fundamental principles than, say, patents on flour processing. There is some question whether this is the correct premise for determining patentability, especially in the information age.

F. The Freeman-Walter-Abele Test (1982-1994)

¶74 The two-step analysis of (1) determining whether a claim includes a mathematical algorithm, and (2) if so, whether the "overall process" is statutory, came to be known as the *Freeman-Walter-Abele* test.[132] The *Freeman-Walter-Abele* test was applied to five more process claims by the CCPA and its successor, the Federal Circuit, before it was effectively abandoned. The five cases are summarized below in table form in terms of the overall process, inputs, outputs, and holding:

Case	"Overall Process"	Input	Output	Statutory?
Meyer[133]	analysis of complex system	test results	probability of function or malfunction	NO
Grams[134]	diagnosing abnormal condition	laboratory test results	identification of abnormal parameters	NO
Arrhythmia[135]	analyzing electro-cardiograph signals	signal related to heart function	comparison indicating risk of ventricular tachycardia	YES
Schrader[136]	auction	bids	bids corresponding to a prevailing total price	NO
Warmerdam[137]	generating a data structure	location of medial axis of physical object	data structure representing shape of physical object	NO

¶75 Arrhythmia Research Technology, Inc. v. Corazonix Corp., the only one of these cases in which a claim was found statutory, held that the input signals and output signals in the claimed process were related to patient's heart function and therefore not "abstractions."[138] The remaining cases presented inputs and outputs that were apparently insufficiently tied to concrete physical processes. For example, in Grams, which also

[132] *See, e.g.*, *In re* Bilski, 545 F.3d 949, 958-59 (Fed. Cir. 2008) (discussing the "*Freeman-Walter-Abele* test").
[133] *In re* Meyer, 688 F.2d 789, 796 (C.C.P.A. 1982).
[134] *In re* Grams, 888 F.2d 835, 836 (Fed. Cir. 1989).
[135] Arrhythmia Research Tech., Inc. v. Carazonix Corp., 958 F.2d 1053, 1059 (Fed. Cir. 1992).
[136] *In re* Schrader, 22 F.3d 290, 294 (Fed. Cir. 1994).
[137] *In re* Warmerdam, 33 F.3d 1354, 1360 (Fed. Cir. 1994).
[138] *Arrhythmia Research*, 958 F.2d at 1059.

concerned a diagnostic process, the court noted that the "sole physical process step" is the performance of clinical tests to obtain data, and "[t]he specification does not bulge with disclosure on those tests."[139] The implication appears to be that a more concretely-defined input may have made the computational steps statutory.[140]

¶76 The last two cases in this series are of particular interest because they lead to the ultimate demise of the Freeman-Walter-Abele test, based at least in part on the recognition that "mathematical" algorithms are very difficult to distinguish from mere computations. In Schrader, the majority held that the algorithm is "similar to a class of well-known mathematical optimization procedures commonly applied to business problems called linear programming," and that a "mathematical algorithm" is therefore implicit in the claim.[141] The claim was therefore held non-statutory.[142] In a footnote, however, the court in Schrader admitted that the definition of algorithm is "not universally agreed," and discusses the problems with identifying "mathematical algorithms."[143] The dissent in Schrader argues that, in fact, no mathematical algorithm is claimed: "The only mathematical problem in Schrader's invention is identifying that combination of bids which yields the highest return, and he does not claim any particular procedure or formula for solving that problem . . . . One must distinguish the answer to be found from the method of finding that answer. The latter might be a mathematical algorithm; the former is not."[144]

¶77 In Warmerdam, the Federal Circuit recited the two-part Freeman-Walter-Abele test.[145] Then, citing to Schrader, the court stated, "the difficulty is that there is no clear agreement as to what is a 'mathematical algorithm', which makes rather dicey the determination of whether the claim as a whole is no more than that."[146] The court suggested abandoning these "arbitrary definitional terms" which "deviate from those used in the statute," and recommended "returning to the language of the statute and the Supreme Court's basic principles as enunciated in Diehr."[147] In its analysis of the claim, the Federal Circuit expressly declined to decide whether the process was a "mathematical algorithm."[148] Instead, finding that the steps involved "nothing more than the manipulation of basic mathematical constructs," the Federal Circuit held that the claim was a non-statutory "abstract idea."[149] Warmerdam did not overrule the doctrine that a "mathematical algorithm" indicates a non-statutory process. But, by calling the rule "dicey" in its application and declining to utilize it, Warmerdam all but spelled the demise of the two-step Freeman-Walter-Abele test.

¶78 Warmerdam and Schrader recognized the difficulties with defining "mathematical algorithm." Warmerdam did not specify what could make a process involving computations "concrete" as opposed to "abstract," but one interpretation is that the

---

[139] *Grams*, 888 F.2d at 840.
[140] *See id.*
[141] *Schrader*, 22 F.3d at 293.
[142] *Id.*
[143] *Id.* at 293 n.5.
[144] *Id.* at 296 n.1 (Newman, J., dissenting).
[145] *In re* Warmerdam, 33 F.3d 1354, 1359 (Fed. Cir. 1994).
[146] *Id.* at 1360.
[147] *Id.*
[148] *Id.*
[149] *Id.*

method in Warmerdam of "generating a data structure which represents the shape of a physical object" was too theoretical and did not sufficiently state a "practical" application. Indeed, this is the direction that the Federal Circuit went in its subsequent landmark cases on patent eligibility.

G. Useful, Concrete, and Tangible Result (1994-2007)

¶79 The same year that *Warmerdam*, by all appearances, discarded the *Freeman-Walter-Abele* test, the Federal Circuit's decision in *In re Alappat* introduced a new formulation: a statutory process must produce "a useful, concrete, and tangible result."[150] The claim at issue in *Alappat* related to a means for creating a smooth waveform display in a digital oscilloscope. The claim named a "rasterizer for converting vector list data … to be displayed on a display" and "means" for several manipulations of that data.[151] The Federal Circuit gave a nod to *Freeman-Walter-Abele* in a footnote, but did not apply it.[152] Instead, the Federal Circuit noted that many or all of the means elements in the disputed claim "represent circuitry elements that perform mathematical calculations," and that the claimed invention as a whole is "directed to a combination of interrelated elements which combine to form a machine for converting discrete waveform data samples into . . . data to be displayed on a display means."[153] The Federal Circuit held that this was not "a disembodied mathematical concept" but rather "a specific machine to produce a useful, concrete, and tangible result."[154]

¶80 After the Federal Circuit's decision in *State Street*,[155] the presence of a "useful, concrete, and tangible result" effectively replaced the *Freeman-Walter-Abele* test. The claim at issue in *State Street* covered "a data processing system for managing a financial services configuration of a portfolio."[156] Written in means-plus-function terms to cover a computer system, the claim effectively covered a computer and software used for maintaining the accounts of a particular type of pooled mutual fund arrangement.[157] The Court held that the *Freeman-Walter-Abele* test has "little, if any, applicability" in light of subsequent cases.[158] Under *Benson*, the Federal Circuit explained, the presence of an algorithm "may have been a sufficient indicium of nonstatutory subject matter."[159] After *Diehr* and *Alappat*, however, the Federal Circuit reasoned that "the mere fact that a claimed invention involves inputting numbers, calculating numbers, outputting numbers, and storing numbers, in and of itself, would not render it nonstatutory subject matter, unless, of course, its operation does not produce a 'useful, concrete and tangible result.'"[160]

---

[150] *In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994).
[151] *Id.* at 1537.
[152] *See id.* at 1543 n.21.
[153] *Id.* at 1544.
[154] *Id.*
[155] State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368 (Fed. Cir. 1998).
[156] *Id. at* 1371.
[157] *See id.* at 1371-72.
[158] *Id.* at 1374.
[159] *Id.*
[160] *Id.*

¶81 Because the claim in *State Street* was "directed to a machine programmed with the [accounting] software," and produced a "useful, concrete, and tangible result," the Federal Circuit found that it claimed statutory subject matter. The Federal Circuit stated that this was sufficient to bring the process within § 101 "even if the useful result is expressed in numbers, such as price, profit, percentage, cost, or loss."[161]

¶82 Notably, the Federal Circuit rejected the trial court's holding that the claim was an unpatentable "business method." *State Street* held that the trial court erred when it construed the claims to be directed to a process, with each "means" clause representing a step in that process, because in the Federal Circuit's view, there was sufficient supporting structure disclosed to qualify the claim as a "machine."[162] Moreover, the Federal Circuit rejected the idea that business methods are non-statutory, holding that "§101 should not turn on whether the claimed subject matter does 'business' as opposed to something else."[163]

¶83 The "useful, concrete, and tangible result" leaves behind the vexing problems of the Input-Output conceptual model, including the difficult task of identifying "mathematical" algorithms. However, it allows for the patentability of *any* information manipulation process, with perhaps a trivial additional limitation that the manipulation is done on a computer. It does not appear to matter whether the application of the process is scientific measurement (as in *Alappat*) or mutual fund management (as in *State Street*), so long as there is *some* useful application.

¶84 The result was a boom in patent applications covering areas such as financial software and Internet-based business models, but also criticism from numerous commentators questioning whether business method patents are a good idea.[164] For example, commentators questioned whether the traditional rationales for rewarding innovation through the patent system apply with respect to business methods, or whether the patent system should stray beyond inventions susceptible to industrial application.[165]

¶85 The logical consequence of this new scope for process claims played out in *In re Comiskey*.[166] In that case, certain claims relating to an arbitration process were held patent-ineligible because, even if they had a "practical application," they depended entirely on the use of "mental processes."[167] By contrast, other claims that recited additional limitations such as "a registration module for enrolling" a person, "an arbitration module for incorporating arbitration language," and a "means for selecting an arbitrator from an arbitrator database," were found to claim patentable subject matter.[168] According to the Federal Circuit, these claims, "under the broadest reasonable interpretation, could require the use of a computer as part of Comiskey's arbitration system."[169]

---

[161] *Id.* at 1375.
[162] *See id.* at 1371.
[163] *Id.* at 1377.
[164] *See, e.g.*, David H. Hollander, *The First Inventor Defense: A Limited Prior User Right Finds Its Way Into U.S. Patent Law*, 30 AIPLA Q.J. 37, 73 n.122 (collecting criticism of business method patents).
[165] *See id.* at 78.
[166] *In re* Comiskey, 499 F.3d 1365 (Fed. Cir. 2007), *vacated*, 89 U.S.P.Q.2d 1641 (Fed. Cir. 2009).
[167] *Id.* at 1379.
[168] *Id.*
[169] *Id.*

¶86 *In re Comiskey* appears to have presented the lowest bar yet to statutory subject matter for processes involving the manipulation of information—so long as the steps had a practical application and "could" be performed in a computer, they were statutory. The Federal Circuit seemed to believe that any problems caused by its expansive approach in *Comiskey* could be solved through traditional patentability requirements such as obviousness.[170] The court noted that "[t]he routine addition of modern electronics to an otherwise unpatentable invention typically creates a prima facie case of obviousness."[171]

¶87 Perhaps obviousness will present an alternative path to address the patentability of claims involving algorithms and the like.[172] Yet this effectively bypasses most "subject matter" analysis under 35 U.S.C. § 101.

H. In re Bilski (2008)

¶88 The Federal Circuit's *Bilski* decision was apparently intended to rein in some of the broad scope of *State Street* and *Comiskey*. Bilski's claims cover a method for managing risk of commodity costs. Claim 1 of Bilski's patent includes steps of "identifying market participants" and "initiating a series of transactions" among "commodity providers," "consumers of said commodity," and "market participants for said commodity."[173] Claim 1 does not include any explicit calculation steps, but implicitly requires a calculation of price terms: a first rate "based on historical averages," and a second rate which must "balance[] the risk position" of the transactions.[174] Claim 4, not explicitly discussed in the Federal Circuit's decision, includes a specific formula for calculating price.[175]

¶89 As noted above, *Bilski* was not a software process claim: the claimed transactions were not limited to operation on a computer.[176] Of course, modern commodities traders rely heavily on computers, and it is likely that the process could have been written to include software and/or hardware, similar to the claim in *State Street.* However, because no "machine" was recited in Bilski's claim, the Federal Circuit decided to "leave to future cases the elaboration of the precise contours of machine implementation, as well as the answers to particular questions, such as whether or when recitation of a computer suffices to tie a process claim to a particular machine."[177]

¶90 The way that the Federal Circuit decided in *Bilski* to curtail the broadening scope of process patents was by returning to a preemption analysis based on an Input-Output model. After a discussion of *Diehr* and its precursors, the Federal Court stated that "[t]he question before us … is whether Applicants' claim recites a fundamental principle and, if so, whether it would pre-empt substantially all uses of that fundamental principle if allowed."[178] The answer to this question, according to *Bilski*, is to be found in the

---

[170] *See id.* at 1380.
[171] *Id.*
[172] *See* Andrei Iancu & Jeremiah Helm, *Code on Disks and Hat Tricks – Is Computer Software on a Medium Really Patentable?*, 90 J. PAT. & TRADEMARK OFF. SOC'Y 97 (2008).
[173] *In re* Bilski, 545 F.3d 943, 949 (Fed. Cir. 2008).
[174] *See id.*
[175] *See* Brief for the Petitioner at 8, Bilski v. Doll, No. 08-964 (U.S. July 8, 2009).
[176] *See Bilski*, 545 F.3d at 950.
[177] *Id.* at 962.
[178] *Id.* at 954.

"machine-or-transformation" test. The Federal Circuit, as a result, held that a claim is statutory if "(1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing."[179] *Bilski* specifically repudiates the *Freeman-Walter-Abele* test because the first step, checking for the presence of the potentially offending "fundamental principle," looks to "individual limitations" rather than the claim as a whole.[180] In *Bilski*, the Federal Circuit proposes *both* to detect the presence of a "fundamental principle" *and* to test for preemption of that principle at the same time through the "machine-or-transformation" test.

¶91 The machine-or-transformation test of *In re Bilski* appears to state the general test for *any* process under 35 U.S.C. § 101. It does not explicitly eliminate any particular category of process, be it a business method or a software patent. The Federal Circuit explicitly rejected "calls for categorical exclusions beyond those for fundamental principles already identified by the Supreme Court."[181] Instead, it reaffirmed its conclusion in *State Street* that the "so-called 'business method exception' is unlawful," and held that "all process claims" are "subject to the same legal requirements for patentability."[182]

¶92 Applying the machine-or-transformation test to Bilski's claim, the court held that it fails the transformation prong: "Purported transformations or manipulations simply of public or private legal obligations or relationships, business risks, or other such abstractions cannot meet the test because they are not physical objects or substances, and they are not representative of physical objects or substances."[183] As noted above, the claims failed the machine portion of the test because a computer was not recited.[184] The claim was therefore found to be ineligible for patenting under § 101.[185]

¶93 *Bilski* can be seen as both a reinstatement and a refinement of the Input-Output model. The refinement offered by the Federal Circuit in *Bilski* is that certain uses of inputs and outputs, even if they take place outside of the computation steps in the "real world," do not count to make the process more concrete. According to the Federal Circuit, "while the claimed process contains physical steps (initiating, identifying), it does not involve transforming an article into a different state or thing."[186] The dissent argued that the "transformative" physical steps were ill-defined: "Entering into a transaction is a physical process: telephone calls are made, meetings are held, and market participants must physically execute contracts. Market participants go from a state of not being in a commodity transaction to a state of being in such a transaction. The majority, however, fails to explain how this sort of physical transformation is insufficient to satisfy its proposed patent eligibility standard."[187]

¶94 Perhaps a way to reconcile these views is that contract formation can be a physical "output" of a set of informational steps (identifying participants, calculating price terms), but that output is less "concrete" in the sliding scale of the Input-Output test than if an

[179] *Id.*
[180] *See id.* at 959.
[181] *Id.* at 960.
[182] *Id.*
[183] *Id.* at 963.
[184] *See id.* at 965.
[185] *Id.* at 966.
[186] *Id.*
[187] *See id.* at 1009 (Mayer, J., dissenting).

output is used, for example, to control machinery. Treating a contract as less "real" than a rubber press may be something of a fiction, but it allows the court to curtail the scope of business method patents while staying within the Input-Output framework.

¶95 The principal problem, however, is that the Federal Circuit lumped all processes under the same machine-or-transformation test. As discussed in this article, computational processes may not fare well under this test, because computational steps are regarded as "abstract" and only inputs and outputs tied to the physical world may be counted toward making a process "concrete." In addition, *Bilski* holds that certain acts involving economic activity by humans (such as "initiating a transaction") are also to be regarded as more abstract and less transformational than, say, opening a rubber press.[188] By employing what some might argue is a fiction that deems certain physical acts to be more "abstract" than others, the machine-or-transformation test appears to curtail computational (software) processes and "business methods" all in the name of protecting "fundamental principles."

¶96 Unfortunately, the test may well be throwing out the baby with the bathwater. Whatever the merits of various arguments regarding the patentability of business methods, the patentability of software processes, which are at the heart of innovation in our Information Age, at least deserves separate consideration.

IV. LOOKING AHEAD

¶97 The danger of any dual-purpose device is that, like the spork, it may not be ideally suited to either task.[189] There may be a similar danger in attempting to achieve too much with the machine-or-transformation test. A single test based on the Input-Output conceptual framework may not be the best way both to protect fundamental principles and to potentially curtail the scope of business method patents.

¶98 It is not at all clear that the goal of avoiding preemption of fundamental principles is well-served by the machine-or-transformation test, at least in the context of computational processes. For example, the typesetting algorithm in *Freeman* might be held non-statutory under the "machine-or-transformation" test, despite the *Freeman* court's recognition that it did not implicate any fundamental principles such as "mathematical calculations, formulae, or equations."[190] The claims did not recite any special hardware and could evidently be implemented on any general purpose computer, which may not pass muster under the "machine" prong (though, again, the Federal Circuit did not decide the question).[191] And the output, "a fleeting display on a cathode ray tube," may not be deemed sufficiently transformative.[192] Yet typesetting software, as the *Freeman* court recognized, is far removed from the Pythagorean theorem.[193]

¶99 Precedent suggests that a narrower test is possible. In *Freeman*, for example, the claim was found statutory because the algorithm was deemed non-mathematical.[194] As a

---

[188] *Id.* at 966.
[189] For an illustration of a spork, see U.S. Patent No. Des. 388,664 fig.1 (filed Dec. 9, 1996).
[190] *In re* Freeman, 573 F.2d 1237, 1246 (C.C.P.A. 1978)
[191] *See id.* at 1241-42.
[192] *Id.* at 1246.
[193] *See id.* (noting that the claim does not "recite process steps which are themselves mathematical calculations, formulae, or equations").
[194] *See id.*

result, the "fleeting" nature of the output did not matter.[195] Subsequent courts, however, appeared to give up on the project of distinguishing mathematical and non-mathematical algorithms.[196] Yet a pure Input-Output test, with no attention to the specifics of the computational steps themselves, may not be ideally suited to the information age where a great deal of innovation involves computational processes.

¶100 So if not all computational algorithms threaten to preempt fundamental principles, but the "mathematical" litmus test is unworkable, what test can take its place? One way forward may be to recognize that information processes pose no greater danger of preempting "fundamental principles" than any other processes. There is arguably nothing more "abstract" about calculating the time required to cure rubber than about opening a rubber press. To jump over this conceptual threshold, it may help to visualize the calculation being performed with an abacus rather than a computer. Under this view that puts computations on par with any other series of physical acts, so long as the computational process has a practical application, the fundamental principles may largely take care of themselves.

¶101 In other words, rather than focusing on whether algorithms are "mathematical" or not, it may be more feasible to focus on separating computational processes that are mere statements of mathematical truths, from computational processes (whether or not they include math) that have a "practical application." Critically, the "practical application" would not necessarily require a transformation of matter, operation of a machine, or any other physical output. It could include information, such as an index of web pages resulting from a web crawling method. So long as a principle of nature or a scientific truth is not preempted, why should these processes be treated differently than any other process, whether or not they are a machine or they create some physical transformation? A renewed focus on the nature of the computational steps themselves, rather than the Inputs and Outputs, may better serve the purpose of protecting fundamental principles while allowing patent protection to keep up in the information age.

¶102 As to the second goal—reining in business method patents—the PTO argues that the machine-or-transformation test is needed to implement Congress's intent that "only technological and industrial processes are patent-eligible."[197] Yet a method of exercising a cat with a laser pointer, which might pass the machine-or-transformation test, would be regarded by many people as outside of the "technological and industrial" sphere.

¶103 The question of whether and how to ban certain subject matter such as "business methods" is the subject of a vigorous and healthy debate. The key point for the purposes of this article is that it may be better to treat this as a separate question. If, for example, the Supreme Court determines that processes centering on contract formation were not intended to be protected by the Patent Act, such Congressional intent may be better served if it is implemented separately from a doctrine intended to exclude truths that existed "before the morning stars sang together." As to the protection of fundamental principles, as argued above, a narrow test for weeding out mathematical truths, rather than a broad exclusion based on Inputs and Outputs, may well be sufficient to the task. The software baby, in other words, should not be thrown out with the business method bathwater.

---

[195] *See id.*
[196] *See, e.g.*, *In re* Warmerdam, 33 F.3d 1354, 1359 (Fed. Cir. 1994).
[197] Brief for the Respondent at 16, Bilski v. Doll, No. 08-964 (U.S. Sept. 25, 2009).