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Useful Arts in the Information Age

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The computer is a powerful symbol of technological progress. Once a prohibitively expensive and specialized piece of equipment, the computer has become a tool of nearly universal application, transforming such diverse fields as engineering, communications, entertainment, medicine, business, education, mathematics, and science.[1] The computer defines our technological era as the steam engine defined the early years of the industrial revolution;[2] indeed, the term used to characterize our modern times is no longer "the space age," but "the information age." The most direct contribution of the law to technological advancement rests in the grant of economic incentives to inventors via the patent system. Article I, Section 8 of the United States Constitution explicitly empowers Congress to grant exclusive rights to inventors in order to "promote the

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1. For a rather critical account of the computer's increasing impact on society, see BENJAMIN B. WELLS, THE COMPUTER REVOLUTION (1997).

2. *See* J. DAVID BOLTER, TURING'S MAN: WESTERN CULTURE IN THE COMPUTER AGE 40 (1984) ("The computer is succeeding the clock and the steam engine as the defining technology and the principal technological metaphor of our time, chiefly because it can reflect the versatility of the human mind as no previous mechanism could do."); Yoneji Masuda, *Computopia*, *in* THE INFORMATION TECHNOLOGY REVOLUTION 621 (Tom Forrester ed., 1985).

> The prime innovative technology at the core of development in industrial society was the steam engine, and its major function was to substitute for and amplify the physical labor of man. In the information society, 'computer technology' will be the innovational technology that will constitute the developmental core, and its fundamental function will be to *substitute for and amplify the mental labor of man.*

Id.

Progress of . . . [the] useful Arts,"[3] commonly defined as the "technological arts."[4] No one questions the importance or technological credentials of the computer revolution, yet, until recently, many advancements in computing were coldly received in the courts and administrative bodies that apply the patent laws. Such advancements, when reduced to the fundamental operations of calculating numbers and manipulating data, were often viewed as fatally close to mathematics, principles of nature, or "abstract ideas," none of which are subjects of exclusive rights under the patent laws.[5]

With the Supreme Court's decision in *Diamond v. Diehr*,[6] and even more decisively with the Federal Circuit's decision in *In re Alappat*,[7] the tide of judicial opinion has turned. Now a broad range of computer-related inventions are considered patentable, at least so long as the invention is claimed as a tangible apparatus (i.e., a programmed computer) or in connection with a specific and concrete application. The rules of the Patent Office have reflected this change.[8] Yet the new liberality brings into prominence another dilemma, whose origins rest in the very ubiquity, or universality, of computers. While the proper subject matter of patents has been loosely described as "anything under the sun that is made by man,"[9] there may be some innovations, however ingenious, that lie beyond the technological "useful arts" and, hence, outside the patent system. Advancements in business, the fine arts, and the social sciences have been so described. The dilemma is this: If an advancement in a non-technological field is claimed, not as the advancement *per se*, but in terms of the computer system by which such advancements increasingly are realized, is such advancement sufficiently brought within the "technological arts"

3. "The Congress shall have the power . . . [t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and inventors the exclusive Right to their respective Writings and Discoveries." U.S. CONST. art. 1, § 8, cl. 8. This provision is the source of both patent and copyright law in the United States. *See infra* notes 19-21.

4. *See infra* Part I.B.

5. *See infra* Part II.

6. 450 U.S. 175 (1981). *See infra* notes 293-309 and accompanying text.

7. 33 F.3d 1526 (Fed. Cir. 1994) (en banc). *See infra* notes 337-57 and accompanying text.

8. *See infra* notes 369-375 and accompanying text.

9. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952)). *See infra* note 172 and accompanying text.

to be patentable? More broadly, when is computer programming a "useful art"? And how must patent applicants characterize their programming advancements in order to gain the benefits of the patent laws? These are the issues that I address in this article.

The Federal Circuit's decision in *State Street Bank & Trust Co. v. Signature Financial Group*[10] illustrates the issues at stake. The patent litigated in *State Street* uses a "Hub and Spoke" configuration to describe a new way to administer a family of mutual funds. Each mutual fund (or "Spoke") invests in a common portfolio (or "Hub"). The latter, organized as a partnership, provides management services for the "Spoke" funds. This arrangement is said to provide both economies of scale and beneficial tax consequences.[11] While it was apparently the "Hub and Spoke" organizational scheme that was new and that was, in some sense, the applicant's invention, the patent *claims*[12] read in terms of the "data processing system" that performs the necessary calculations. There is nothing new about the computer system *per se*, and, in fact, it is described so generally that the claims could be met by virtually *any* computer system managing a "Hub and Spoke" portfolio of mutual funds.

Although one can applaud the business sense, or accounting acumen, that led to the invention of the "Hub and Spoke" arrangement, one has to ask whether such an arrangement is an advancement in the "useful" or "technological" arts. If not, does it matter that the computer system inevitably used to implement the arrangement is claimed as the patentable invention? Although the Federal Circuit upheld the validity of the *State Street* patent, it addressed neither of these issues. The court merely characterized the manipulation of data representing dollar amounts as a "practical application of . . . a mathematical algorithm, . . . because it produces 'a useful, concrete and tangible result.' "[13] Whether the Federal Circuit reached the

10. 149 F.3d 1368 (Fed. Cir. 1998), *cert. denied*, ___ U.S. ___, 119 S. Ct. 851 (1999); *see infra* Part IV.B.

11. *See State Street*, 149 F.3d at 1371.

12. Patent claims are the numbered paragraphs that formally describe the applicant's invention and define the scope of the patent. Section 112 of the Patent Act requires that a patent application "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 (1994).

13. 149 F.3d at 1373.

right result is debatable, but the *analysis* in *State Street* is seriously deficient because the court failed to address, in any explicit or coherent fashion, the central problem of defining the "technological arts."

After the *State Street* decision, we can expect to see further patents and patent applications reflecting "non-technological" innovations claimed in terms of the computers used to implement them. Indeed, a patent has already been issued for a scheme of rewarding those who view on-line advertisements.[14] Another patent claims a system for funding an education by promising "investors" shares of a student's future earnings.[15] Before we stray too far into this brave new world, we should consider how best to define the "technological" or "useful arts" in an era when so much is accomplished merely through the manipulation of data. Is an innovation realized through the use of a computer inherently "technological?" Is the programmer's art a "useful art?" Must we entirely redefine the "useful arts" to reflect the genius of our postindustrial information age? I do not suggest that there are simple answers to these questions, but they are matters of consequence, and computers have become so pervasive in so many fields of endeavor that no one is unaffected.

In Part I of this article, I consider the meaning of the term "useful arts" in light of the scant historical evidence, court decisions equating "useful arts" with "technological arts," and definitions of "technology" offered by philosophers, historians, and others. I also discuss the computer programmer's art and whether programming should be considered a "useful art." In Parts II and III, I review the two threads of patent jurisprudence that converged in the *State Street* case. The first, addressed in Part II, is the protracted struggle of the courts to decide when a software-related invention should be held unpatentable because it is nothing more than a "mathematical algorithm." The second thread, addressed in Part III, concerns the tradition long recognized in treatises but "la[id] . . . to rest" in the *State Street* opinion[16] that "methods of doing business" are not patentable subject matter. These subjects have been treated exhaustively by others;[17] I review them here with a

14. *See* U.S. Patent No. 5,794,210.

15. *See* U.S. Patent No. 5,809,484; *infra* note 442 and accompanying text.

16. 149 F.3d at 1375.

17. Useful reviews of the "mathematical algorithm" problem can be found in

particular emphasis on the problem of separating a "technological" application from a "non-technological" insight when the invention involves aspects of both.

In Part IV, I review the cases, culminating in *State Street*, where technological and non-technological ideas intersect in the realm of computer programming. I also review some alternatives for deciding whether such cross-disciplinary inventions should be awarded a patent. One alternative is to treat all computer-implemented inventions as patentable subject matter.[18] It is a simple solution, but an uncomfortable one when the invention reflects an essentially non-technological idea. Another alternative is to focus exclusively on the tangible, technological nature of the computer *hardware*, or the *physical medium* on which the program is stored, in cases where the invention is claimed in those terms. The Federal Circuit and the Patent Office are headed in that direction and perhaps have already gone that far. This is another simple solution, but it seems to place undue emphasis on form, not to mention the tricks of the claim-drafter's art. My own proposal is to recognize that the programmer's art is the art of converting an often non-technological plan (such as a particular scheme for managing a family of mutual funds) into the kind of logical structure executed by a computer. Fashioning a logical structure is, like fashioning a physical structure, a "technological" endeavor, at least when the purpose is to produce a useful computer program. As long as the claimed invention reflects specific aspects of the technological endeavor (specifics that reflect the programmer's art and not, for example, the accountant's art), then the invention should be considered within the realm of the "useful arts" and, hence, patentable subject matter. The distinction is a difficult one, but some guidance can be found in

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David S. Benyacar, *Mathematical Algorithm Patentability: Understanding the Confusion*, 19 RUTGERS COMPUTER & TECH. L.J. 129 (1993) and Alan D. Minsk, *The Patentability of Algorithms: A Review and Critical Analysis of the Current Doctrine*, 8 SANTA CLARA COMPUTER & HIGH TECH. L.J. 251 (1992). Examinations of the "methods of doing business" exception include George E. Tew, *Method of Doing Business*, 16 J. PAT. OFF. SOC'Y 607 (1934) and, more recently, Rinaldo del Gallo, *Are 'Methods of Doing Business' Finally Out of Business as a Statutory Rejection?* 38 IDEA 403 (1998).

18. 35 U.S.C. § 101 defines patentable subject matter as "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." Although § 101 is broadly worded, and deliberately so, it is subject to any limitations imposed by the constitutional reference to "the progress of . . . [the] useful Arts." *See infra* notes 29-33 and accompanying text.

the "levels of abstraction" analysis applied in the copyright context as well as in the typical process of software design. This is not a simple solution, but I believe it is the only one that properly situates the programmer's skills, which are so important in today's technological environment, within the larger context of the "useful arts."

Some of the questions I address in this article are so subtle, even metaphysical, that no answers can be expressed with complete certainty. Yet we must address these questions seriously and soon. If we are too narrow in defining what is a patentable software invention, we unwisely withhold the benefits of the patent system from a field of increasing technological and economic importance. On the other hand, if we err too far in the other direction, we will open a Pandora's Box of future patents for which even the most progressive citizens of the "information age" may be unprepared.

I. DEFINING THE "USEFUL ARTS"

Article I, Section 8 of the Constitution includes what is often called the "intellectual property clause."[19] It states that Congress shall have power "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and inventors the exclusive Right to their respective Writings and Discoveries.[20]" This clause is the source of congressional authority to establish both copyright and patent laws. The intellectual property clause is unusually specific in the direction it provides to Congress. Not only does it detail the kind of protection that Congress may legislate ("exclusive right[s]" for "limited Times"), it also spells out the goal of such protection: to "promote the Progress of Science and useful Arts."[21]

The common meanings of the terms "science" and "art" have

19. This term is something of an anachronism since the phrase "intellectual property" was unknown to the Framers. Walterscheid suggests "the Science and useful Arts clause" as a more historically correct description. EDWARD C. WALTERSCHEID, TO PROMOTE THE PROGRESS OF USEFUL ARTS: AMERICAN PATENT LAW AND ADMINISTRATION, 1798-1836, at 24 n.2 (1998). The clause might also be called the "patents and copyrights clause" since these appear to be the only forms of intellectual property the Framers had in mind. However, since "intellectual property clause" is the term most often used, it is the term I adopt throughout my article.

20. U.S. CONST. art. I, § 8.

21. *See In re* Shao Wen Yuan, 188 F.2d 377, 380 (C.C.P.A. 1951) ("It is interesting to note that this particular grant is the only one of the several powers conferred upon the Congress which is accompanied by a specific statement of the reason for it.").

changed in the intervening years. Today the term "science" refers to the investigation of the natural world through observation, experimentation, and application of the "scientific method." In the eighteenth century, what we call "science" would have been called "natural philosophy."[22] The Framers understood the term "science" as something broader, which today we might call "knowledge" or "learning."[23] The term "art," on the other hand, was less identified with the fine arts than it is today. "Art" meant something closer to the terms "technique" or "craft."[24] Many patented inventions reflect an application of scientific principles or discoveries, using "science" in the modern sense. Hence, some have explained the patent system as a vehicle for promoting "Science and useful Arts."[25] However, scholars now regard the intellectual property clause as an example of a "balanced sentence," a common stylistic device of

22. *See* Anthony William Deller, *An Inquiry Into the Uncertainties of Patentable Invention and Suggested Remedies*, 38 J. PAT. OFF. SOC'Y 152, 161-62 (1956); Giles S. Rich, *Principles of Patentability*, 28 GEO. WASH. L. REV. 393, 396-97 (1960) ("A reference to Dr. Johnson's definition of 'scientifick' will show . . . that the natural science which the present connotation of the word calls to mind was, in the days when the Constitution was written, referred to as 'natural philosophy.' ").

23. *See* Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 51 (1948) ("The word 'science,' which comes from the Latin, *scire*, 'to know,' at the writing of the Constitution meant learning in general."); Arthur H. Seidel, *The Constitution and a Standard of Patentability*, 48 J. PAT. OFF. SOC'Y 5, 11 (1966).

24. "Art" can also be synonymous with "method" or "process," particularly when applied in the context of an industry. *See* Cochrane v. Deener, 94 U.S. 780, 788 (1877). The Patent Act of 1790 included "art" with manufacture, engine, machine, and device as the classes of invention that are potentially patentable. The general recodification of the patent laws in 1952 replaced the term "art" with "process," apparently without any intention of changing the scope of patentable subject matter. *See* Diamond v. Diehr, 450 U.S. 175, 182-84 (1981). The current Patent Act still defines "process," with striking circularity, as a "process, art or method." 35 U.S.C. § 100(b) (1994). Something like the original meaning of "art" survives in usages such as "the art of baseball," yet now such "arts" are often contrasted with "science."

25. The most infamous example is found in the concurring opinion of Justice Douglas in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 154-58 (1950). Emphasizing the constitutional reference to "science," Justice Douglas argued that a patentable invention must "make a distinctive contribution to scientific knowledge" sufficient to "push back the frontiers of chemistry, physics, and the like." *Id.* at 154. He concluded that "[t]he Constitution never sanctioned the patenting of gadgets. Patents serve a higher end—the advancement of science." *Id.* at 155. Justice Douglas' fixation on "science" led him to an exaggerated view of the goals of the patent system. It is actually very common for "gadgets" to be patented—gadgets that do little if anything to advance scientific knowledge, but which are nevertheless "useful."

eighteenth-century prose.[26] In this balanced sentence, "science" is logically related to "authors" and "writings"; "useful arts" is related, in a parallel fashion, to "inventors" and "discoveries."[27] The goal of "promoting" by a grant of exclusive rights for limited times is the same in both cases, but rights are granted to authors to promote the progress of "science" and to inventors to promote the progress of the "useful arts." The former is the source of copyright law, and the latter the source of patent law.[28]

Even with the "balanced sentence" literary device sorted out, one may ask how the constitutional goal of "promot[ing] the Progress of . . . useful Arts" is of any significance in applying the patent laws. It is significant in two respects. First, it may limit the power of Congress to enact legislation such that any patent law that does not "promote the Progress of . . . [the]useful Arts" (or, at least, any patent law that hinders the progress of the useful arts) is unconstitutional. Second, even if it does not *limit* Congress's power, the "Progress of . . . useful Arts" may be viewed as the preeminent guide to the *interpretation* of the patent laws.

In *Graham v. John Deere Co.*,[29] the Supreme Court adopted the strict view that the intellectual property clause of the Constitution actually limits Congress's power, at least to the extent of denying Congress the power to grant a monopoly on matters that are not sufficiently inventive:

> At the outset it must be remembered that the federal patent power stems from a specific constitutional provision which authorizes the Congress "To promote the Progress of . . . useful Arts . . . ." The clause is both a grant of power and a limitation. This qualified authority, unlike the power often exer-

26. *See* WALTERSCHEID, *supra* note 19, at 60-61; Robert I. Coulter, *The Field of the Statutory Useful Arts* (pt. 2), 34 J. PAT. OFF. SOC'Y 487, 491 (1952) [hereinafter Coulter (pt. 2)].

27. *See* Lutz, *supra* note 23, at 51.

28. As the Court elaborated in *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470 (1974),

> The patent laws promote this progress by offering a right of exclusion for a limited period as an incentive to inventors to risk the often enormous costs in terms of time, research, and development. The productive effort thereby fostered will have 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.

Id. at 480.

29. 383 U.S. 1, 5-6 (1966).

> cised in the sixteenth and seventeenth centuries by the English Crown, is limited to the promotion of advances in the "useful arts." . . . The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose.[30]

For example, Congress could not authorize a patent that would withdraw access to information already in the public domain because the effects of such a patent would be contrary to the constitutional mandate. As the Court explained, "Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must 'promote the Progress of . . . useful Arts.' This is the *standard* expressed in the Constitution and it may not be ignored."[31]

Certainly Congress's other sources of power give it authority to impose laws that do nothing to promote the progress (and some laws that actually hinder the progress) of the useful arts. For example, Congress may pass legislation to preserve the secrecy of information on weaponry even if such secrecy hinders the progress of such useful arts as nuclear engineering and lasers. What Congress may not do, according to *John Deere*, is to establish patent laws under the authority of the intellectual property clause that are contrary to the stated purpose of that clause. The rhetoric of *John Deere* further suggests that Congress may not enact patent laws *exceeding* the constitutional objective even if they are not contrary to that objective. In other words, Congress may not "overreach the restraints imposed by the stated constitutional purpose" by awarding patents that promote only the progress of "non-useful" arts.[32] While this was not the situation presented in *John Deere*, it is

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30. *Id.* at 5 (citations omitted). Justice Douglas expressed a similar view in his dissenting opinion in *Special Equipment Co. v. Coe*, 324 U.S. 370, 380-84 (1944), in which Justices Black and Murphy joined. According to Douglas, "[t]he purpose 'to promote the progress of science and useful arts' . . . provides the standards for the exercise of the power [of Congress] and sets the limits beyond which it may not go. That purpose also provides the guide for the interpretation of patent laws enacted pursuant to that power." *Id.* at 381-82.

31. *John Deere*, 383 U.S. at 6. The Court did recognize, however, that "[w]ithin the limits of the constitutional grant, the Congress may . . . implement the stated purpose of the Framers by selecting the policy which in its judgment best effectuates the constitutional aim. This is but a corollary to the grant to Congress of any Article I power." *Id.*

32. *Id.*

an important issue that will be discussed in due course.[33]

While *John Deere* treats the promotion of the "useful arts" as a limitation on Congress's power, the constitutional provision is more often employed as a tool for interpreting the patent statutes and divining congressional intent. Indeed, the "useful arts" goal may be considered a part of the legislative history of the Patent Act of 1952.[34] House and Senate committee reports[35] that accompanied the bill referred to the constitutional language and adopted the "balanced sentence" interpretation, which, as previously discussed, singles out promotion of the "useful arts" as the objective of the patent laws. Earlier versions of the Patent Act even included the constitutional language in their titles, as in the case of the first Patent Act called "An Act to Promote the Progress of Useful Arts."[36] Hence, courts interpreting fundamental concepts of patent law have sought guidance in the ultimate purpose of the law as stated in the text of the Constitution and as reaffirmed by Congress.

Specifically, the "Progress of . . . useful Arts" has been understood as the bedrock of Section 101 of the Patent Act,[37] entitled "Inventions patentable." Section 101 states that "[w]hoever 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 therefor, subject to the conditions and requirements of this title."[38] No patent may be obtained for any discovery, "however useful, novel, and nonobvious, unless it falls within one of the enumerated categories."[39] The most difficult of these categories to define has been "process." Any activity may be considered, in a broad sense, a "process," yet some activities—the solving of a mathematical formula, the composition of a piece of music, the operation of a business—may be incompatible with the common idea of a patentable invention. When such conflicts arise, the constitutional reference to the "useful arts" provides an interpretive

33. *See infra* Parts I.D, III.

34. *See* Rich, *supra* note 22, at 397. The Patent Act of 1952 was the last general revision of the patent laws. Patent Act of 1952, ch. 950, 66 Stat. 792 (1952) (codified at 35 U.S.C. § 101 (1994)).

35. S. REP. NO. 82-1979, at 3 (1952); H.R. REP. NO. 82-1923, at 4 (1952).

36. The Act was passed on April 10, 1790. *See* Lutz, *supra* note 23, at 53.

37. 35 U.S.C. § 101 (1994).

38. *Id.*

39. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 483 (1974).

touchstone. For example, in *In re Musgrave*,[40] the court considered whether a method involving human thought would meet the definition of "process."[41] The court concluded that it would so long as the method fell within the "useful arts." "All that is necessary, in our view, to make a sequence of operational steps a statutory 'process' within 35 U.S.C. § 101 is that it be in the technological arts so as to be in consonance with the constitutional purpose to promote the progress of 'useful arts.' "[42]

Most of the debate over the patentability of computer-related inventions (particularly those inventions embodied in computer software) has focused on whether the invention falls within one of the § 101 categories. If the invention is only a "mathematical algorithm" or an "abstract idea," it fails the subject matter test, but if the invention is a "process" or "machine," it may be patented.[43] The "promot[ing] . . . [of the] useful Arts" objective has played, and continues to play, an important role in these definitional questions. Yet, in many of the cases litigated so far, the computer-related invention addressed a technological or industrial goal. In *Parker v. Flook*,[44] for example, the invention concerned an improved system for curing rubber implemented with a programmed computer. Applications such as rubber curing meet anyone's definition of a "useful art," so, in principle, patenting such inventions would seem consistent with the constitutional objective of the patent laws. As more patents of the *State Street* variety appear—i.e., patents describing computer implementations of *non-technological* ideas—we must pay even closer attention to the meaning of "useful arts," both in construing § 101 and in applying the patent laws as the Framers intended. Unfortunately, "useful arts" is not a term that is easily defined.

A. The Historical Perspective

There is little "legislative history" to assist in interpreting the intellectual property clause of the Constitution. The Ameri-

40. 431 F.2d 882, 893 (C.C.P.A. 1970).

41. *See infra* notes 113-119 and accompanying text.

42. *Musgrave*, 431 F.2d at 893. *See also In re* Foster, 438 F.2d 1011, 1014-15 (C.C.P.A. 1971). The use of "technological arts" as a synonym for "useful arts" is discussed *infra* at Part I.B.

43. This is assuming that it meets the other patentability requirements such as novelty and non-obviousness.

44. 437 U.S. 584 (1978).

can patent system was, to a large degree, a continuation of the British tradition embodied in the Statute of Monopolies of 1623.[45] Britain and other European nations awarded patents to persons who introduced new industries to the national economy, either through invention or through importing the knowledge from abroad.[46] Thomas Jefferson, who is sometimes called the first administrator of the United States patent system,[47] is well known for expressing doubts as to whether such a system should be emulated in the United States. In 1788 he wrote to James Madison expressing his general satisfaction with the newly ratified Constitution but suggesting that monopolies were so objectionable that they should not be granted even as an encouragement to inventors. He proposed an antimonopoly provision for the Bill of Rights, and although he recognized that a monopoly for a limited time might be an "incitement[] to ingenuity," he concluded that "the benefit even of limited monopolies is too doubtful to be opposed to that of their general suppression."[48] However, notwithstanding Jefferson's hesitation, the intellectual property clause did appear in the Constitution, and it was adopted, according to Madison's notes, *ne-*

45. Statute of Monopolies, 1623, 21 Jam., ch. 3 (Eng.), *reprinted in* DONALD S. CHISUM, CHISUM ON PATENTS app. 8 (1999). *See* George Ramsey, *The Historical Background of Patents*, 18 J. PAT. OFF. SOC'Y 6, 6 (1936); Edward C. Walterscheid, *To Promote the Progress of Science and Useful Arts: The Background and Origin of the Intellectual Property Clause of the United States Constitution*, 2 J. INTELL. PROP. L. 1, 12-13, 33-36 (1994).

46. *See* Frank D. Prager, *A History of Intellectual Property From 1545 to 1787*, 26 J. PAT. OFF. SOC'Y 711 (1944) (discussing the history of patents, particularly in Venice and France, prior to the adoption of the United States Constitution); Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 1)*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 697, 706 (1994).

47. *See, e.g.*, Graham v. John Deere Co., 383 U.S. 1, 7 (1966). The first Patent Act provided for examination of patent applications by a commission of three individuals: the Secretary of State, the Secretary of War, and the Attorney General. *See*, Edward C. Walterscheid, *Patents and the Jeffersonian Mythology*, 29 J. MARSHALL L. REV. 269, 279 (1995). Jefferson served as Secretary of State, and, perhaps because of his personal interest in inventions, he is thought to have taken a leading role in the interpretation and administration of the first Patent Act of 1790. *See id.* at 279-80. However, Walterscheid argues that Jefferson's reputation as the founder of the patent system has been exaggerated. *See id.* at 311-14.

48. Letter from Thomas Jefferson to James Madison (July 31, 1788), *quoted in* Walterscheid, *supra* note 47, at 274. Jefferson's views were, however, equivocal. In 1807 he wrote to Oliver Evans, saying, "Certainly an inventor ought to be allowed a right to the benefit of his invention for a certain time .... Nobody wishes more than I do that ingenuity should receive a liberal encouragement." Letter from Thomas Jefferson to Oliver Evans (May 1807), *quoted in John Deere*, 383 U.S at 8.

mine contradicente—"no one dissenting."[49]

The patent aspects of the intellectual property clause arose from a suggestion made by Charles Pinckney to the Constitutional Convention's Committee of Detail on August 18, 1787, and possibly from a similar suggestion made at the same time by Madison.[50] According to Madison's published notes, Pinckney proposed that Congress have the power "[t]o grant patents for useful inventions."[51] Madison himself proposed that Congress have the power "[t]o encourage by premiums & provisions, the advancement of useful knowledge and discoveries."[52] Each of these proposals includes the word "useful" in describing the subject matter to be encouraged although neither includes the precise phrase "useful arts." How these proposals were transformed into the ultimate language of the intellectual property clause is unknown.[53] In any event, the modified language was proposed by the Committee on September 5, 1787, and was approved unanimously by the Constitutional Convention on the same day.[54]

What did the Framers mean by the phrase "useful arts"? The first clue comes from the language of the intellectual property clause itself. The "balanced sentence" in which that clause is phrased distinguishes the "useful arts" from "science" and makes only the former the province of the patent laws. Therefore, if "science" means knowledge in general, "useful arts" must mean something different, or at least narrower. Further, the substance of the "useful arts" must be the "discoveries" of "inventors," as opposed to the "writings" of "authors." Yet none of this gets us very far if the question is as subtle as whether, for example, law or business could be considered a "useful art."

As United States patent law is to some extent a continuation of European practices, it is relevant to examine the kinds

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49. Walterscheid, *supra* note 45, at 26.

50. *See id.* at 43-47.

51. *Id.* at 45.

52. *Id.* Madison's unedited, contemporaneous notes indicate that he proposed to give Congress the power "to secure to the inventors of useful machines and implements the benefits thereof for a limited time." *Id.* at 46. The omission of this from Madison's edited notes has not been explained. *See id.* at 46-47.

53. *See id.* at 51. *The Federalist* has little to say about the intellectual property clause, other than that "[t]he utility of this power will scarcely be questioned," and "[t]he right to useful inventions seems . . . to belong to the inventors." THE FEDERALIST NO. 43 (James Madison).

54. *See* Walterscheid, *supra* note 45, at 50-51.

of "arts" those countries encouraged by issuing patents. Venice issued one of the earliest known examples of a patent in 1469 to one John of Speyer, who is said to have introduced the art of printing to that nation.[55] The patent "decreed that for five years next following there should be nobody whosoever who would, could, might or dare exercise said art of bookprinting in Venice and its territories, except master John himself."[56] Interestingly, the patent referred to the reservation of exclusive rights "[i]n the same manner as usual in other useful arts."[57] Later patents concerned specific innovations in printing and new developments in the important Venetian art of glass making.[58] In sixteenth-century France, patents served as an element of the "mercantile system" designed to encourage manufactures and export.[59] In 1536 France granted a patent-like "privilege" to Etienne Turquetti for the introduction of a silk-making industry.[60] France awarded its first genuine monopoly patent to an Italian, Theses Mutio, who in 1551 introduced the art of making glassware in the Venetian manner.[61] Examples such as these suggest a time-honored European tradition of awarding patents for industrial developments considered important to the nation.[62]

Like its continental counterparts, Britain issued patents to foster the introduction of new industries.[63] In 1561, for example, Britain issued patents for the milling of soap and the

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55. *See* Prager, *supra* note 46, at 715.

56. *Id.* at 750.

57. At least in the translation that appears in Prager's account. *See id.*

58. *See id.* at 716.

59. *Id.* at 721.

60. *Id.* at 722.

61. *See id.* at 723; *see also* Walterscheid, *supra* note 46, at 711.

62. The "mercantilist" view is reflected in a Connecticut statute of 1672, which states that "There shall be no monopolies granted or allowed amongst us but of such new inventions as shall be judged profitable for the country . . . ." Prager, *supra* note 46, at 758.

63. The defendant in the so-called "Case of Monopolies," decided in 1603, offered a classic expression of the underlying principle:

> [W]hen any man by his own charge and industry, or by his own wit and invention doth bring any new trade into the realm, or any engine tending to the furtherance of a trade that never was used before; and that for the good of the realm;—in such cases the king may grant to him a monopoly-patent for some reasonable time, until the subjects may learn the same, in consideration of the good that he doth bring by his invention to the commonwealth . . . .

Quoted in P. J. Federico, *Origin and Early History of Patents*, 11 J. PAT. OFF. SOC'Y 292, 301 (1929).

manufacture of saltpeter.[64] Other patents covered specific inventions better characterized as advancements in existing industries. These included patents issued in the 1560s and 1570s on such things as an improvement in knife handles, a grinding mill, dredging machines, ovens and furnaces, and a knapsack.[65] The Crown also granted monopolies on already existing commodities, such as salt and paper, not to encourage the development of new industries, but for other ends, such as rewarding favored subjects.[66] Popular resentment of such oppressive and "illegal" monopolies led to the Statute of Monopolies in 1623. The Statute is primarily directed to the prohibition of monopolies, but it is most significant in the study of patent law for the exception it provides for inventions. The prohibition does not extend to "grants of privilege for the term of fourteen years or under . . . of the sole working or making of any manner of new manufactures within this realm . . . to the first and true inventor . . . and inventors of such manufactures."[67]

By the late eighteenth century, patent applications for specific improvements, as opposed to general industries, had become the norm—perhaps a sign of Britain's industrial maturity.[68] At the same time, the number of patents issued increased significantly.[69] Although the American colonies were far less industrialized than England, there were instances in which individual colonies granted exclusive rights for the purpose of introducing new industries.[70] As in England, colonial monopolies included broader industries as well as specific mechanical inventions.[71] Examples include salt, pitch and turpentine production, paper and glass manufacturing, water-powered mills, a surveying instrument, and an improved scythe.[72]

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64. *See id.* at 296.

65. *See id.* at 297.

66. *See id.* at 299.

67. 21 Jam. 1, ch. 3 (Eng.), *reprinted in* CHISUM, *supra* note 45, at app. 8.

68. *See* 11 SIR WILLIAM HOLDSWORTH, A HISTORY OF ENGLISH LAW 427-29 (1938).

69. More patents were issued in Britain between 1760 and 1785 than in the preceding 140 years. *See id.* at 426 n.1. The increase may have been due to the advancing industrialization of the British economy. *See id.* at 425-26.

70. *See* P.J. Federico, *Colonial Monopolies and Patents*, 11 J. PAT. OFF. SOC'Y 358 (1929). These efforts primarily focused on the introduction of new industries by importation, as opposed to invention. *See id.*

71. *See id.* at 359-64.

72. *See id.* at 360-62.

Clearly, patents were closely associated with industry and mechanical innovation. Yet it is difficult to reduce this association to any sharply defined rule or custom regarding the subject matter of patents, or to argue that the Framers consciously intended to embody such a rule in the phrase "useful arts." Moreover, the Framers did not adopt the phrase "manufactures" to describe the subject matter of patents, as they might have done had they used the Statute of Monopolies as a more explicit model. Hence, it is conceivable (though there is no real evidence for this) that the Framers intended "useful arts" to suggest a broader subject matter for patents than had been customary in Britain.[73]

"Useful arts" is not a term unique to the Constitution, so a better understanding of the phrase can be sought in other, roughly contemporaneous usages.[74] One example is particularly interesting because it occurred as the Constitutional Convention was underway and, perhaps, with the intention of influencing the proceedings. This was the address of Tench Coxe to an assembly of the Friends of American Manufactures. Coxe delivered the address on August 9, 1787, (only nine days before the suggestions of Pinckney and Madison to the Committee of

73. Lutz speculates that the Framers chose "useful arts" instead of "manufactures" because the latter seems to exclude processes. *See* Lutz, *supra* note 23, at 53-54. Even in Britain, some patents were granted for innovations that were neither industrial nor mechanical. For example, as long ago as the sixteenth century, Britain granted a patent on a system of shorthand. *See* Federico, *supra* note 63, at 297. It also issued patents on insurance schemes—one of them in 1778. *See* 11 HOLDSWORTH, *supra* note 68, at 427 n.7. These are precisely the kinds of patents that muddy the concept of "useful arts" today.

74. Seidel turned to Samuel Johnson's Dictionary of the English Language for the meaning of the individual words "useful" and "art." *See* Seidel, *supra* note 23, at 10 n.11. The 1755 edition of Johnson's Dictionary, no doubt the leading dictionary of the day, broadly defines "useful" as "Convenient; profitable to any end; conducive or helpful to any purpose." SAMUEL JOHNSON, A DICTIONARY OF THE ENGLISH LANGUAGE (Times Books Ltd. 1983) (1755). Johnson assigns "Art" a number of meanings, the most relevant of which are: "1. The power of doing something not taught by nature and instinct; as, to *walk* is natural, to *dance* is an *art*. . . . 2. A science; as, the liberal *arts*. . . . 3. A trade." *Id.* The example for the third definition is from Boyle: "This observation is afforded us by the *art* of making sugar." *Id.* Seidel concludes that "useful arts" refers to the "helpful trades." Seidel, *supra* note 23, at 10; *see also* WALTERSCHEID, *supra* note 19, at 52 ("In 1787 'useful arts' meant basically helpful or valuable trades."). This may be true in a general sense, but it does not answer the hard questions. For example, are accounting, law, education, and advertising "useful arts" because they are "helpful trades?" Or did the compound term "useful arts" (which does not appear in Johnson's Dictionary) have a narrower meaning specifically limited to the industrial or manufacturing arts?

Detail) at the University of Pennsylvania, on the occasion of the establishment of a Society for the Encouragement of Manufactures and the Useful Arts.[75] Coxe did not offer a definition of "useful arts" *per se*, but the tenor of his address suggests that they are intimately related to industry and the production of goods. The following passage, which applauds the progress America had already made in the production of manufactured goods, suggests Coxe's understanding of the phrase:

> Under all the disadvantages which have attended manufactures and the useful arts, it must afford the most comfortable reflection to every patriotic mind to observe their progress in the United States and particularly in Pennsylvania. For a long time after our forefathers sought an establishment in this place, then a dreary wilderness, every thing necessary for their simple wants was the work of European hands. How great—how happy is the change. The list of articles we now make ourselves, if particularly enumerated would fatigue the ear, and waste your valuable time. Permit me however to mention them under their general heads: meal of all kinds, ships and boats, malt and distilled liquors, potash, gunpowder, cordage, loaf-sugar, pasteboard, cards and paper of every kind, books in various languages, snuff, tobacco, starch, cannon, musquets [sic], anchors, nails, and very many other articles of iron, bricks, tiles, potters ware, mill-stones, and other stone work, cabinet work, trunks and Windsor chairs, carriages and harness [sic] of all kinds, corn-fans, ploughs and many other implements of husbandry, sadlery [sic] and whips, shoes and boots, leather of various kinds, hosiery, hats and gloves, wearing apparel, coarse linens, and woolens, and

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75. TENCH COXE, AN ADDRESS TO AN ASSEMBLY OF THE FRIENDS OF AMERICAN MANUFACTURES: CONVENED FOR THE PURPOSE OF ESTABLISHING A SOCIETY FOR THE ENCOURAGEMENT OF MANUFACTURES AND THE USEFUL ARTS, READ IN THE UNIVERSITY OF PENNSYLVANIA, ON THURSDAY THE 9TH OF AUGUST 1787 (Philadelphia, R. Aitkin & Son 1787). The announced objectives of the Society, published as *Plan of the Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts*, 2 AM. MUSEUM 167, 167 (AMS Press 1965) (1787), reinforces the idea that "useful arts" means industrial arts:

> Our distance from the nations of Europe,—our possessing within ourselves the materials of the useful arts, and articles of consumption and commerce,—the profusion of wood and water, (those powerful and necessary agents in all arts and manufactures)—the variety of natural productions with which this extensive country abounds and the number of people in our towns, and most ancient settlements, whose education has qualified them for employments of this nature,—all concur to point out the necessity of promoting and establishing manufactures among ourselves.

Id.

> some cotton goods, linseed and fish oil, wares of gold, silver, tin, pewter, lead, brass and copper, clocks and watches, wool and cotton cards, printing types, glass and stone ware, candles, soap and several other valuable articles with which memory cannot furnish us at once.[76]

If Coxe understood "useful arts" to encompass anything other than techniques for the furtherance of industry, the production of goods, and the satisfaction of material needs, there is no suggestion of it in this encyclopedic list or anywhere else in his address. Similar associations are apparent in a pamphlet written by Joseph Barnes in 1792, complaining of the inadequacies of the early patent system. His work, entitled *Treatise on the Justice, Policy, and Utility of Establishing an Effectual System for Promoting the Progress of Useful Arts*,[77] distinguishes between real property and intellectual property, which he refers to as "mental" property.[78] "[B]y the latter, is understood the *products* of *genius*, which consists in discoveries in science,[79] and in the useful arts; by means of which agriculture, navigation, manufactures, and manual labor are, not only facilitated, but much promoted; and, indeed, to these they owe their present state of perfection."[80] Again, "useful arts" seems to refer to practical knowledge applied in labor, production and industry.[81]

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76. COXE, *supra* note 75, at 17-19.

77. JOSEPH BARNES, TREATISE ON THE JUSTICE, POLICY, AND UTILITY OF ESTABLISHING AN EFFECTUAL SYSTEM FOR PROMOTING THE PROGRESS OF USEFUL ARTS (Philadelphia, Francis Bailey 1792).

78. *Id.* at 4.

79. It is unclear whether Barnes is using "science" in the modern sense, or to refer to learning in general. *See supra* notes 22-23 and accompanying text.

80. BARNES, *supra* note 77, at 4.

81. "Useful arts" continued to be used in the nineteenth century to refer to the "arts" employed in industry and the production of goods. For example, a periodical established in 1821 to circulate information about patented inventions associates the "useful arts" with "mechanics and manufactures":

> We might now sum up, in saying, that as the present is as much an age of discovery as of enterprise, this work may be a means of originating further inventions and improvements, and of bringing them to bear upon the useful arts. Chemistry, which has made greater advances in the last half century, than perhaps all the other sciences taken together, is still unfolding new elements of nature, and giving new principles, applicable both to mechanics and manufactures. In both, it is highly desirable to connect, as fast as possible, these discoveries with our work shops and factories.

AM. J. IMPROVEMENTS USEFUL ARTS & MIRROR PAT. OFF. U.S., Jan.-Mar. 1828 at 16 (Washington, William Greer). Similar usages, though again without any attempt to define the phrase "useful arts," can be found in the preface of J. Leander Bishop's A

In the end, however, such historical information takes us only so far. It is clear enough that the phrase "useful arts" includes machines, manufactures, and the physical techniques of industry. Ships and shoes and sealing wax, and the techniques for producing those things, are "useful arts." But it cannot be said with equal certainty that an accounting method, or a teaching technique, or an election strategy are *not* "useful arts." Perhaps the Framers would have thought this obvious, but, as Prager says of the intellectual property clause, "It is unknown what the authors of our organic law intended, subjectively."[82]

B. "Useful Arts" As "Technological Arts"

In more recent times, courts and scholars have suggested "technological arts" as the modern-day equivalent of the term "useful arts." Patent attorney Robert I. Coulter, writing in 1952, the year of the last comprehensive revision of the United States patent code, may have been the first. Coulter's attempt to define "useful arts" is still the most exhaustive and deeply considered.[83] Coulter's ultimate concern is whether patent method claims involving "mental steps," such as calculating, comparing, and observing, should be considered outside the scope of patentable subject matter (particularly in terms of the pre-1952 statute, in which the categories of patentable subject matter included "useful art" rather than "process").[84] He concludes that such "mental steps" claims should be considered patentable subject matter so long as they fall within the "useful arts" as the phrase is used in the Constitution.[85]

HISTORY OF AMERICAN MANUFACTURES FROM 1608 TO 1860, EXHIBITING THE ORIGIN AND GROWTH OF THE PRINCIPLE MECHANIC ARTS AND MANUFACTURES, FROM THE EARLIEST COLONIAL PERIOD TO THE ADOPTION OF THE CONSTITUTION; AND COMPRISING THE ANNALS OF THE INDUSTRY IN THE UNITED STATES IN MACHINERY, MANUFACTURES AND USEFUL ARTS (Philadelphia, Edward Young & Co. 1868). Some of the "useful arts" or "mechanic arts" discussed by Leander, such as brewing and wine making, are perhaps matters more of technique than of machinery, but all of them are industrial.

82. Prager, *supra* note 46, at 746; *see also* WALTERSCHEID, *supra* note 19, at 59 & n.12 (noting the absence of any historical record commenting on the meaning of the intellectual property clause as it was understood by the Framers).

83. Coulter's work on this issue appeared as a three part series. *See* Robert I. Coulter, *The Field of the Statutory Useful Arts* (pts. 1 & 3), 34 J. Pat. Off. Soc'y 417, 718 (1952) [hereinafter Coulter (pt. 1) and Coulter (pt. 3), respectively]; Coulter (pt. 2), *supra* note 26.

84. *See* Coulter (pt.1), *supra* note 83, at 417.

85. *See* Coulter (pt. 3), *supra* note 83, at 731-33.

According to Coulter, "[i]t seems clear that 'useful arts' (as a unitary technical term) embraced the so-called industrial, mechanical and manual arts of the 18th century."[86] Indeed, that much does seem clear, but how much more than these specific "arts" might the term encompass?[87] Coulter approaches that question by "generalizing outward" from the characteristics of the eighteenth-century industrial and mechanical trades and, in particular, from the kinds of people who practiced those trades.[88] They were, writes Coulter, manual laborers of limited education and intellectual ambitions.[89] Such people, according to Coulter, "had no need of liberal arts colleges, universities, or of schools of fine arts."[90] Instead, their province was "to do practical things in practical ways to satisfy the physical needs of mankind."[91] Coulter distinguishes between "useful arts" practiced by the tradesmen and "cultural arts" practiced at the universities and in some professions.[92] The latter included the seven "liberal arts" of grammar, logic, rhetoric, arithmetic, geometry, music, and astronomy.[93] "Cultural arts" also included the "fine arts," such as painting, sculpture, poetry, and drama.[94] Other arts, such the arts of business, teaching, and politics apparently fell in neither category.[95]

To further define the "useful arts" and to distinguish them from the other "arts" Coulter appeals to traditions as old as antiquity. More than once he refers to the pantheon of Greek and Roman gods and to the conceptual division of "arts" suggested by the patronage of one god or another. He identifies Athena and Hephaestus as the overseers of the "useful arts."[96] Athena

86. Coulter (pt. 2), *supra* note 26, at 496.

87. Coulter believes that the phrase "useful arts" was deliberately broad and that the Framers did not intend to limit it to the *particular* "useful arts" practiced at the time. *See id.* at 496, 499. For a summary of historical perspectives on the term "useful arts," see *supra* Part I.A.

88. Coulter (pt. 2), *supra* note 26, at 496.

89. *See id.*

90. *Id.*

91. *Id.*

92. *Id.* at 494.

93. *Id.*

94. *Id.*

95. *See* Coulter (pt. 1), *supra* note 83, at 418. Coulter admits that "many of the cultural arts are useful in a broad sense, and certainly the arts of business are useful." Coulter (pt. 2), *supra* note 26, at 495-96. See *infra* Part III for further discussion on the classification of the "art" of business.

96. Coulter (pt. 2), *supra* note 26, at 497.

patronized such practical arts as shipbuilding, shoemaking, spinning, and weaving.[97] Hephaestus patronized artisans generally and, specifically, the art of metalworking.[98] Medicine, Coulter reasons, is not a "useful art" as a matter of tradition, but rather one of those uncategorizable arts. Its Greek practitioners looked to Aesculapius for patronage, not to the deities of the manual trades.[99] Moreover, medicine involves ethical issues and a doctor-patient relationship that "requires more than technical skill and learning."[100]

Coulter's observations are valuable, but unfortunately his appeals to history and tradition are made with little reference to historical evidence, particularly in support of his contention that the classically-educated Framers would have understood that "useful arts" excludes "other disparate arts . . . such as the arts of teaching, politics, war, [and] business."[101] Moreover, Coulter's "blue collar" distinction seems better suited to identifying the "useful arts" of the eighteenth century than "expanding outward" to identify the "useful arts" of today. Coulter admits that "[t]he practitioners of the useful arts are no longer merely mechanics, artisans, craftsmen and the like; but include highly educated technologists, engineers, chemists and applied

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97. *See id.*

98. *See id.* Hephaestus's "chief characteristic was usefulness." *Id.*

99. *See* Coulter (pt. 3), *supra* note 83, at 724-25.

100. *Id.* at 724.

101. Coulter (pt. 2), *supra* note 26, at 494. Coulter writes:

> The founding fathers were well-read in the classics .... They were well-aware of the general nature of the occupational activities to which the "useful Arts" relate. They knew that there were a variety of "arts" and that from the days of classical antiquity there were certain arts, originated by inventions, and performed by artisans and the like, which were *useful* in putting the elementary forces and materials of nature to work for the material welfare of mankind .... They well-knew the basic differences between these practical arts and the cultural arts and sciences, recognized from antiquity, and that there were other disparate arts such as those of business, teaching, politics, medicine, etc.

Coulter (pt. 3), *supra* note 83, at 731-32. In general terms, Coulter must be right; anyone can perceive differences between the industrial or mechanical arts and the other "arts" to which he refers. Yet Coulter's implication that the Framers consciously distinguished between these arts and that such a distinction is embodied in their choice of the phrase "useful arts" may be overconfident, at least in the absence of more specific historical evidence. On the other hand, Coulter's ultimate point is that "useful arts" refers to certain *fields of activity*; that is, it is not a term embodying metaphysical concepts of corporeality that might disqualify a process involving "mental steps." *Id.* at 732. Whatever specific disciplines may be included within the "useful arts," the conclusion that the term refers to certain fields of endeavor seems correct.

scientists."[102] As for Coulter's reliance on the ancient pantheon, he notes that Athena was "the special patroness of the philosophers and of all the liberal arts, sciences, and learning in general."[103] Such lack of specialization among the Greek deities places in doubt the significance of their patronage as an indication of divisions among the arts, even if it could be shown that the Framers thought in such terms. On the other hand, Coulter offers a key definition of the "useful arts" as seen through the lens of antiquity:

> It is said that Athena was the first to tame the horse and to bridle and yoke it to the chariot. In this we see the real key to the most fundamental attribute of the useful arts, especially as to procedures. They all relate to controlling the forces and materials of nature and putting them to work in a practical way for utilitarian ends serving mankind's physical welfare.
>
> Probably the best word in common usage today that expresses this idea is "*technology*." *The technological arts are the "useful arts."*[104]

Some of the first judicial decisions to define "useful arts" came from the Court of Customs and Patent Appeals (the "CCPA").[105] Whether through Coulter's influence or otherwise,

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102. Coulter (pt. 2), *supra* note 26, at 499.

103. *Id.* at 498.

104. *Id.*; *see also* Lutz, *supra* note 23, at 54 ("The term 'useful arts,' as used in the Constitution . . . is best represented in modern language by the word 'technology.' ").

105. Prior decisions had broken some ground in defining "useful arts" but primarily through distinguishing a specific "art" (i.e. patentable process) from an intangible concept or principle of nature. Examples include *Cochrane v. Deener*, 94 U.S. 780, 788 (1877), often cited for its definition of "process," and the "Telephone Cases," 126 U.S. 1, 532-33 (1887), which discuss the difference between the unpatentable natural phenomenon of electromagnetism and the potentially patentable application of that phenomenon in telephony. *See also* O'Reilly v. Morse, 56 U.S. 62, 100-01 (1853). Other cases discuss the distinction between the subject matter of patents and the subject matter of copyrights and, thus, may be relevant to the distinction between the "useful arts" and what Coulter calls the "cultural arts." *See, e.g.*, Baker v. Selden, 101 U.S. 99, 102-05 (1879) (holding that a copyright on a book describing an art, system, or manufacture conveys no exclusive right to the art, system, or manufacture itself; such rights can be secured, if at all, only by patent); Brown Instrument Co. v. Warner, 161 F.2d 910, 911 (D.C. Cir. 1947) ("Articles intended for practical use in cooperation with a machine are not copyrightable. Both law and policy forbid monopolizing a machine except within the comparatively narrow limits of the patent system.") (citation omitted); Taylor Instrument Co. v. Fawley-Brost Co., 139 F.2d 98, 99-101 (7th Cir. 1943) (holding that subject matters of patent and copyright do not overlap; a mechanical device belongs exclusively in the domain of patents). However, the CCPA cases seem to be the

they adopted his definition of "useful arts" as "technological arts."[106] Not coincidentally, all of these cases involved inventions implemented through computers.

The first of these cases, the so-called "first *Prater* opinion,"[107] raised the kinds of "mental step" issues that concerned Coulter. Prater had invented a method and machine (which could be either an analog or a digital computer) for determining the proportions of gases in a mixture from the data generated by spectrographic analysis. The inventive aspect consisted of a method of identifying a particular set of equations that would produce the most accurate results from a given set of data.[108] According to the patent examiner, whose decision was affirmed by the PTO Board, the method claims were beyond the scope of patentable subject matter because the novel aspect of the method could be performed in someone's head.[109] The examiner and the Board held the apparatus claims, in so far as they included a programmed digital computer, to be unpatentably obvious if one disregarded the novelty of the mathematical principles involved.[110] The CCPA reversed, rejecting, as Coulter did, the argument that "mental steps" claims are inherently unpatentable.[111] The only issue, the court held, was whether the invention fell within the "useful arts":

> [O]ur present holding . . . is that patent protection for a process disclosed as being a sequence or combination of steps, capable of performance without human intervention and directed to *an industrial technology—a "useful art" within the intendment of the Constitution*—is not precluded by the mere fact that the process could alternatively be carried out by

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first to address directly the scope of the "useful arts" as opposed to other "arts."

106. *In re Musgrave*, 431 F.2d 882 (C.C.P.A. 1970), one of the first and most often cited of these cases, includes a reference to Coulter's writings, but not on the specific point of defining "useful arts" as "technological arts." *See id.* at 889-90.

107. *In re* Prater, 415 F.2d 1378 (C.C.P.A. 1968), *superceded*, 415 F.2d 1393 (C.C.P.A. 1969).

108. *See id.* at 1378-79.

109. *See id.* at 1381-82.

110. *See id.*

111. Over a forceful objection by Judges Rich and Almond, *see id.* at 1390, the court granted the Patent Office a rehearing. The product of that rehearing is the "second *Prater* opinion," *In re* Prater, 415 F.2d at 1393. In that opinion, the court affirmed the rejection of the method claims, but on grounds of indefiniteness rather than unpatentable subject matter. *See id.* at 1404-05. As to the apparatus claims, the court persisted in its reversal of the Patent Office rejection. *See id.* at 1405-06.

mental steps.[112]

In *In re Musgrave*,[113] the CCPA adopted a definition of "useful arts" even closer to Coulter's definition. *Musgrave* was another "mental steps" case, this time involving a method of correcting seismographic data revealing the structure of underground rock formations.[114] The PTO Board ruled the claims unpatentable because the only novelty lay in steps that could be performed by the human mind.[115] Once again the CCPA reversed, in language similar to that found in the first *Prater* opinion:

> We cannot agree with the board that these claims (all the steps of which can be carried out by the disclosed apparatus) are directed to non-statutory processes merely because some or all of the steps therein can also be carried out in or with the aid of the human mind or because it may be necessary for one performing the processes to think. All that is necessary, in our view, to make a sequence of operational steps a statutory 'process' within 35 U.S.C. § 101 is that it be in *the technological arts so as to be in consonance with the Constitutional purpose to promote the progress of "useful arts."*[116]

In a concurring opinion, Judge Baldwin complained that to define a statutory "process" only in terms of the "technological arts" was to create both a new principle of law[117] and a new dilemma:

> First and foremost will be the problem of interpreting the meaning of "technological arts": Is this term intended to be synonymous with the 'industrial technology'—mentioned by Judge Smith [in the first *Prater* opinion]? It sounds broader to me. Necessarily, this will have to be considered a question of law and decided on a case-by-case basis. Promulgation of any all-encompassing definition has to be impossible. This task is now before us.[118]

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112. *Id.* at 1389 (emphasis added).

113. 431 F.2d 882 (C.C.P.A. 1970).

114. *See id.* at 883-86.

115. *See id.* at 885-86.

116. *Id.* at 893 (emphasis added).

117. *See id.* at 894.

118. *Id.* at 895. Judge Baldwin also raised another concern:

> [S]uppose a claim happens to contain a sequence of operational steps which can reasonably be read to cover a process performable both within *and without* the technological arts? This is not too far fetched. Would such a claim be statutory?

Judge Baldwin argued that the case could have been decided on narrower grounds and that the "academic" problem addressed by resort to the "technological arts" could have been left where it belongs—in the hands of law professors.[119]

Musgrave cites no authority for the proposition that "technological arts" and "useful arts" are the same; however, *Musgrave* itself is cited as authority in subsequent opinions. For example, in *In re Foster*,[120] the CCPA addressed another computer-implemented system for improving the analysis of seismographic data, and again it held, quoting *Musgrave*, that the only requirement of 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 'useful arts.' "[121] In *In re Waldbaum*, the CCPA expressed the *Musgrave* formulation in even stronger terms, eliminating the vague reference to "consonance" in favor of a stricter equivalence between "useful arts" and "technological arts":

> With regard to the "mental steps" rejection, whether appellant's process is a "statutory" invention [in terms of § 101 patentable subject matter] depends on whether it is within the "technological arts." *The phrase "technological arts," as we have used it, is synonymous with the phrase "useful arts" as it appears in Article I, Section 8 of the Constitution.*[122]

The *Waldbaum* court may have gone further than *Musgrave* in another sense. In *Musgrave*, the invention concerned seismographic analysis, which can be considered a subset of the technological field of oil and mineral prospecting. In *Waldbaum*, the applicant claimed a more efficient computing algorithm to be used in determining the number of "ones" in certain data sets.[123] Although the invention had "real world" applications, such as in analyzing the traffic on telephone lines,[124] the

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> Would it comply with section 112 [regarding the definiteness of claims]? We will have to face these problems some day.

Id.

119. *Id.* at 894.

120. 438 F.2d 1011 (C.C.P.A. 1971); *see also In re* Bergy, 596 F.2d 952, 958 (C.C.P.A. 1979), *vacated sub nom.* Diamond v. Chakrabarty, 444 U.S. 1028 (1980), *reconsidered*, 596 F.2d 952 (C.C.P.A.), *aff'd*, 447 U.S. 303 (1980).

121. *Foster*, 438 F.2d at 1015 (quoting *Musgrave*, 431 F.2d at 893).

122. *In re* Waldbaum, 457 F.2d 997, 1003 (C.C.P.A. 1972) (emphasis added).

123. *See id.* at 998; *see also In re* Johnston, 502 F.2d 765, 771 n.12 (C.C.P.A. 1974), *rev'd sub nom.* Dann v. Johnston, 425 U.S. 219 (1976).

124. *See Waldbaum*, 457 F.2d at 998.

"field of the invention" in this case was best described as "computing," and it was that "technological art" on which the court relied in overturning the § 101 rejection. Without much discussion, the court stated, "It is clear that appellant's process, which is useful in the internal operation of computer systems, is within the 'useful arts.' "[125] The same thought is expressed, with greater elaboration, in *In re Benson*,[126] where the applicant invented a method for computers to convert binary-coded-decimal (BCD) numbers into ordinary binary numbers. The court observed that, unlike previous computer software cases where "some subsidiary or additional art was involved," in the present case "[t]he claims . . . are directed solely to the art of data-processing itself."[127] Yet, said the court,

> [i]t seems beyond question that the machines—the computers—are in a technological field, are a part of one of our best-known technologies, and are in the 'useful arts' rather than the 'liberal arts,' as are all other types of 'business machines,' regardless of the uses to which their users may put them. How can it be said that a process having no practical value other than enhancing the internal operation of those machines is not likewise in the technological or useful arts?[128]

Whether computers and computer programs are themselves within the "technological arts" is discussed *infra* Part IV. One must first consider the more fundamental question posed by Judge Baldwin in his *Musgrave* concurrence: If it is settled that "useful arts" means "technological arts," what does "technological arts" mean?

C. What Is "Technology?"

Waldbaum refers to "technological arts" as though "technology" is a term so clear and familiar as to need no elaboration. Yet the more one looks at how "technology" has been defined by scholars, the less one is sure what it means. This is particularly true when the question is whether such problematic "arts" as business and education are "technological."

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125. *Id.* at 1003.

126. 441 F.2d 682 (C.C.P.A. 1971), *rev'd sub nom.* Gottschalk v. Benson, 409 U.S. 63 (1972). The *Benson* case is discussed in greater detail *infra* notes 264-82 and accompanying text.

127. 441 F.2d at 686.

128. *Id.* at 688; *see also In re* De Castelet, 562 F.2d 1236, 1241 (C.C.P.A. 1977).

The word "technology" derives from the Greek τεχνη (techne), meaning "skill" or "art."[129] Narrower definitions of "technology" encompass systematic techniques, particularly in an industrial context, used to create physical things or to shape the physical environment for the satisfaction of mankind's practical needs. Some of the most restrictive definitions emphasize the "applied science" aspect of technology. For example, *Chambers' Science and Technology Dictionary* defines "technology" as "[t]he practice, description and terminology of any or all of the applied sciences which have practical value and/or industrial use."[130] Yet it is incorrect, at least in an historical sense, to limit "technology" to the products of a rigorous scientific method. The tools developed by primitive peoples are as likely to be the product of magic[131] as of what we would call science, yet such tools are undoubtedly "technology."[132] Even today, many useful things are devised without any understanding or application of science. As one writer puts it, "[I]t would be ridiculous to suppose that invention has to wait humbly, cap in hand, for science to open the door before it can proceed. Technology is purposive and it tends . . . to be positivist. The criterion is simply, does it work?"[133] Perhaps a field of endeavor

129. L. Ttondl, *On the Concepts of "Technology" and "Technological Sciences," in* CONTRIBUTIONS TO A PHILOSOPHY OF TECHNOLOGY 1, 4 (Friedrich Rapp ed., 1974).

130. CHAMBERS' SCIENCE AND TECHNOLOGY DICTIONARY 888 (1988).

131. Some argue that magic may be considered a primitive "technology" "for with it primitive man attempted to control or at least influence his environment . . . . If we now feel that our ancestors used their magic without much success, let us not fall into the error of equating technology only with *successful* technology." Melvin Kranzberg & Carroll W. Pursell, Jr., *The Importance of Technology in Human Affairs, in* 1 TECHNOLOGY IN WESTERN CIVILIZATION 5 (Melvin Kranzberg & Carroll W. Pursell, Jr. eds., 1967).

132. "Sometimes technology is defined as applied science. . . . But technology for much of its history had little relation with science, for men could and did make machines and devices without understanding why they worked or why they turned out as they did." *Id.* at 5-6. It was only in the nineteenth century that technology came to be associated with applied science. Charles Singer et al., *Preface* to 1 A HISTORY OF TECHNOLOGY vii (Charles Singer et al. eds., 1954).

133. DONALD CARDWELL, THE NORTON HISTORY OF TECHNOLOGY 492-93 (1995). In fact, this is exactly the position taken by the patent laws. They require that an invention have *utility*, 35 U.S.C. § 101 (1994) (patentable inventions must be "useful"), and they require that the patent disclosure *enable* persons skilled in the art to practice the invention, 35 U.S.C. § 112 ¶ 1 (1994), but they do not require that the inventor correctly understand the scientific principles that make the invention work. *See* Newman v. Quigg, 877 F.2d 1575, 1581 (Fed. Cir.) ("[I]t is not a requirement of patentability that an inventor correctly set forth, or even know, how or why the invention works.") (citation omitted), *modified*, 886 F.2d 329 (Fed. Cir. 1989). Invention without understanding is still a contribution to the "useful arts."

cannot be considered "technological" if it is not *systematic*, but few would argue that it must be, in a strict sense, *scientific*.[134]

Other definitions of "technology" emphasize its role in producing whatever is "practical" or "useful."[135] Such definitions are of limited value because they merely substitute one difficult concept for another. In his Nicomachean Ethics, Aristotle observes that all human endeavors aim at some ultimate good.[136] To the extent that they succeed in their goals, all "arts," including those of business, education, politics, and law, are "useful" and "practical" in the broadest sense, as are literature, music, and painting. They all satisfy some human need. Yet it is apparent from the structure of the intellectual property clause

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134. As Cardwell points out, definitions of "technology" that rely upon "science" leave open the question of what is meant by "science." If one defines "science," not as a strict application of the scientific method, but in a broader sense, perhaps even in the eighteenth-century sense of "knowledge in general," *see supra* notes 22-23 and accompanying text, then "science" may be an aspect of all "technology." Yet the broader the concept of "science," the less it adds to our understanding of "technology." *See* CARDWELL, *supra* note 133, at 485-86.

135. For example, *WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY OF THE ENGLISH LANGUAGE* (1971) defines "technology" with reference to applied science and practicality: "2a: the science of the application of knowledge to practical purposes: applied science .... b (1): the application of scientific knowledge to practical purposes in a particular field .... (2): a technical method of achieving a practical purpose." *Id.* at 2348. The definition of "practical" brings one full circle back to "useful": "3: available, usable, or valuable in practice or action: capable of being turned to use or account: useful. *Id.* at 1780. *See also* JOHN KENNETH GALBRAITH, THE NEW INDUSTRIAL STATE 12 (2d. rev. ed. 1971) ("Technology means the systematic application of scientific or other organized knowledge to practical tasks."); CARL MITCHAM, THINKING THROUGH TECHNOLOGY: THE PATH BETWEEN ENGINEERING AND PHILOSOPHY 151 (1994) ("Technologies are bodies of skills, knowledge, and procedures for making, using and doing useful things.") (quoting Robert S. Merrill, *The Study of Technology*, *in* 15 INTERNATIONAL ENCYCLOPEDIA OF THE SOCIAL SCIENCES 576-77 (1968)); ARNOLD PACEY, THE CULTURE OF TECHNOLOGY 6 (1983) (defining "technological practice" as "*the application of scientific and other knowledge to practical tasks by ordered systems that involve people and organizations, living things and machines*").

136. Actions that differ in their immediate goals are often unified in a broader goal, and broader goals similarly unified at an even more general level. Aristotle writes:

> [A]s there are many actions, arts, and sciences, their ends also are many; the end of the medical art is health, that of shipbuilding a vessel, that of strategy victory, that of economics wealth. But where such arts fall under a single capacity—as bridle-making and the other arts concerned with the equipment of horses fall under the art of riding, and this and every military action under strategy, in the same way other arts fall under yet others—in all of these the ends of the master arts are to be preferred to the subordinate ends; for it is for the sake of the former that the latter are pursued.

ARISTOTLE, NICOMACHEAN ETHICS 1 (Sir David Ross trans., Oxford Univ. Press 1966). At the end of this progression is the ultimate goal of "happiness." *See id.* at 11-12.

that the Framers regarded at least the fine arts as distinct from the "useful" arts.[137] One could adopt the opposite extreme and define as "useful" or "practical" only those things that satisfy mankind's most basic *physical needs*, but this would produce too narrow a definition of "technology." "Technology" includes many things that, at best, contribute to the satisfaction of mankind's *desires*. As Kranzberg and Pursell write:

> [Man] cultivates a taste for more exotic foods than those necessary to still the pangs of hunger. He yearns to achieve faster and more lasting communications with others. He wants to travel abroad and be entertained, and to fill his house and his life with beauty as he sees it.[138]

Thus, Rolex watches are the stuff of technology, as are roller coasters and ice cream, even if in many senses these are neither "practical" nor "useful."

Another approach to "technology" is to emphasize the making of *physical artifacts* and the physical alteration of the environment. "Technology should mean the study of those activities, directed to the satisfaction of human needs, which produce alterations in the material world."[139] If, like Coulter, one believes that "arts" such as law, education, and politics differ fundamentally from those properly regarded as "technologi-

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137. *See supra* notes 26-28 and accompanying text.

138. The problem of defining "useful" also arises in the context of separating an unpatentable "disembodied concept" from a patentable application of that concept that, in the phrase adopted by the Federal Circuit, produces "a useful, concrete and tangible result." Kranzberg & Pursell, *supra* note 131, at 6; *see infra* Part II.A.

139. V. Gordon Childe, *Early Forms of Society*, *in* 1 A HISTORY OF TECHNOLOGY, *supra* note 132, at 38. A similar, but somewhat more vague definition of "technology" is "the totality of artifacts and methods humankind has created to shape our relations to the world that surrounds us, modifying it into something that can be used and manipulated to submit to our needs and desires." DAVID ROTHENBERG, HAND'S END: TECHNOLOGY AND THE LIMITS OF NATURE xii (1993); *see also* MITCHAM, *supra* note 135, at 152 (noting the difficulty of defining "technology," but remarking on the "primacy of reference to the making of material artifacts, especially since this making has been modified and influenced by modern science"); Viscounte Caldecote, *Technology, Master or Servant?*, *in* MAN AND TECHNOLOGY: THE SOCIAL AND CULTURAL CHALLENGE OF MODERN TECHNOLOGY 14 (Bruce M. Adkins ed., 1983) ("Technology is concerned with the application of scientific knowledge to the creation of useful things, processes and services;" technology creates "real wealth" when "we add value by brain and muscle power, and through machines, to the raw materials found in nature."). Interestingly, in his nineteenth-century treatise on patent law, Robinson argued that a process having no physical effects could not be patented, "however greatly it may promote the comfort or the welfare of mankind," because it "lies *outside the domain of the industrial arts*." WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 166, at 250 (Sage Hill Publishers 1971) (1890) (emphasis added).

cal,"[140] the distinction between the physical and the abstract is a promising path of analysis. Yet even here the boundaries are elusive. The most abstract of "arts" have their physical manifestations and effects on the material world. The field of law, for example, produces contracts and statutes written on paper,[141] and it alters conditions and conduct in the "real world." At the same time, other activities that seem "technological" have little tangible impact. A scientist who analyzes neutrino emissions from the sun seems involved in a "technological" pursuit, yet his actions have little effect on the neutrinos, and no effect on the sun.

In answer to the last example, one could say that the "technology" lies, not in the analysis, but in the physical techniques and equipment that the scientist employs. One could say that "technology" is, in fact, the endeavor of making and using *tools*.[142] This also holds promise, but definitions of "tool" can differ. The word calls to mind tangible instruments, such as chisels and spectrometers, yet Peter F. Drucker, who has written extensively on the subject of technology and business, argues that "tools" and "technology" are not limited to physical artifacts.

> Language, too, is a tool, and so are all abstract concepts. . . . According to the technologist's definition of 'tool," the abacus and the geometer's compass are normally considered technology, but the multiplication table or table of logarithms is not. Yet this arbitrary division makes all but impossible the understanding of so important a subject as the development of the technology of mathematics.[143]

Drucker defines "technology" in terms of "human work,"[144]

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140. *See supra* notes 86-95 and accompanying text.

141. The idea of a writing as a physical artifact may seem trivial. However, a number of "method of doing business" cases involving printed coupons and tickets show that the issue is not as simple as it may seem. *See infra* notes 376-93 and accompanying text.

142. *See* MCGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY 406 (1997) ("Engineering is the application of objective knowledge to the creation of plans, designs, and means for achieving desired objectives. Technology deals with the tools and techniques for carrying out the plans.").

143. PETER F. DRUCKER, TECHNOLOGY, MANAGEMENT AND SOCIETY 43-44 (1970).

144. *Id.* at 45-46.

> [T]echnology is not about things: tools, processes, and products. It is about work: the specifically human activity by means of which man pushes back the limitations of the iron biological law which condemns all other animals to devote all of their time and energy to keeping themselves alive for the next day, if not for the next

implying that such things as law, education, and politics might be considered "technological" activities. Many broad definitions of "technology"—as in the case of Singer's definition of technology as "the systematic treatment of any thing or subject"[145] or as "the field of how things are commonly done or made"[146]—invite this conclusion.[147] Kranzberg and Pursell object to Singer's definition precisely because "[it] is so broad and loose that it encompasses many items that scarcely can be considered as technology. For example, the passage of laws is something which is 'done,' but the history of law is certainly not the history of technology."[148] On the other hand, some scholars embrace the broad definition, and with it the conclusion that virtually everything we do is "technology." An example of this extreme approach can be found in the writings of Joseph Agassi:

> Usually the word 'technology' is applied to physical engineering, at times to biological technology, especially medicine and agriculture, hardly ever to other fields such as education or psychoanalysis or behavior therapy. Yet there is no reason for this other than certain Baconian prejudices . . . . And if we ever agree to include under the heading of technology any kind of human technique, educational, organizational, or psychological, then we shall have to include Yoga exercises too.[149]

In fact, Agassi argues that "[w]hat we call the arts, or the fine arts—painting and sculpture and music—plus the applied

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hour.

Id. at 45.

145. Singer et al., *supra* note 132, at vii. Singer offers this as the proper etymological meaning of "technology."

146. *Id.*

147. *See also* ALBERT BORGMAN, TECHNOLOGY AND THE CHARACTER OF CONTEMPORARY LIFE 14 (1984) ("[I]n one sense technology is nothing but the systematic effort to get everything under control."). Even no-nonsense scientific dictionaries contain surprisingly broad definitions of "technology"—e.g., "*Systematic knowledge and action*, usually of industrial processes but applicable to *any recurrent activity*." MCGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY, *supra* note 142, at 406 (emphasis added).

148. Kranzberg & Pursell, *supra* note 131, at 5. Mitcham, whose conception of "technology" emphasizes material things, agrees: "[T]echnology can be described as the making and using of artifacts. Human making, in turn, can be broadly distinguished from human doing—for example, political, moral, religious, and related activities." MITCHAM, *supra* note 135, at 153.

149. JOSEPH AGASSI, TECHNOLOGY: PHILOSOPHICAL AND SOCIAL ASPECTS 90 (1985).

arts—whether carpentry or advertisement—are all technology."[150]

The extremes to which one could take this view of "technology" are suggested in Jaques Ellul's *The Technological Society*,[151] in which he writes of the systematizing of all aspects of modern life and culture. Ellul refers to this systematizing force as *"technique,"* which he defines as the *"totality of methods rationally arrived at and having* [as its goal] *absolute efficiency* (for a given stage of development) in *every* field of human activity."[152] This "technique" is something broader than Ellul's own understanding of machine-oriented "technology,"[153] but everything it embraces takes on some of the characteristics of a machine:

> From another point of view . . . the machine is deeply symptomatic: it represents the ideal toward which technique strives. The machine is solely, exclusively, technique; it is pure technique, one might say. For, whenever a technical factor exists, it results, almost inevitably, in mechanization: technique transforms everything it touches into a machine.[154]

"Technique" means a coldly rational, analytical, and systematic approach to any human endeavor. The "technical operation" includes "every operation carried out in accordance with a certain method in order to obtain a particular end."[155] It can extend to such things as economic and managerial organization,[156] psychoanalysis,[157] sociology,[158] and propaganda.[159] It

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150. *Id.* at 49. *See also* MITCHAM, *supra* note 135, at 150 ("[T]echnology has sometimes been defined so as to include even the making of nonmaterial things such as laws and languages—although the implications of such definitions have not been widely thought through or adopted.").

151. JAQUES ELLUL, THE TECHNOLOGICAL SOCIETY (John Wilkinson trans., Alfred A. Knopf 1964).

152. *Id.* at xxv. Regarding Wilkinson's translation, see MITCHAM, *supra* note 135, at 57 & n.21.

153. See ELLUL, *supra* note 151, at xxv, where he states, "The term *technique*, as I use it, does not mean machines, technology, or this or that procedure for attaining an end." Elsewhere he writes that "technique is applied outside industrial life" and "[t]he growth of its power today has no relation to the growing use of the machine." *Id.* at 4. In fact, "[t]echnique has now become almost completely independent of the machine." *Id.*

154. *Id.* at 4.

155. *Id.* at 19.

156. *See id.* at 11-12. "An economic plan is purely an intellectual operation, which nevertheless is a technique" even though "no physical act is involved." *Id.* at 13. "The accountant is no longer a mere agent for registering the movements of funds in an enterprise . . . . [h]e has become a veritable 'profits engineer.' " *Id.* at 166.

would include even "a technique of mastication based on the science of nutrition, or techniques of sport, as in the Boy Scout movement."[160] Indeed, "[t]oday no human activity escapes [the] technical imperative. There is a technique of organization . . . just as there is a technique of friendship and a technique of swimming."[161] It was not Ellul's intention to comment on the meaning of "technology," much less on what advancements should be considered patentable. However, his vision of logic and system applied to all facets of human activity suggests the *potential* scope of a broadly defined "technology," as well as the *potential* scope of patentable subject matter.

There is simply no single, generally accepted definition of "technology." " '[T]echnology' is not a universal term; it does not mean exactly the same thing in all contexts. It is often, and in significant ways, context dependent—both in speech and in the world."[162] It is "used loosely in different contexts and it is not at all clear how it may be understood in general."[163] Certain things, such as industrial processes and physical artifacts, meet any definition of "technology" and might be considered its conceptual core. The courts that have used "technological arts" as a substitute for "useful arts" probably had these things in mind. Judge Rich said as much in his *Waldbaum* concurrence. Referring to the majority's statement that "useful arts" means "technological arts," Judge Rich wrote:

> As the originator of that "test" in In re Musgrave, I hereby express my agreement with the above-quoted statement. The phrase "useful arts" which was written into the Constitution conjures up images of the Franklin stove, horse collars, and buggy whips. The term "technological arts" was selected in

157. *See id.* at 14.

158. *See id.*

159. *See id.* at 14-15. "Here the operation is of a moral, psychic and spiritual character. However, that does not prevent it from being a technique. But what we are talking about is a world once given over to the pragmatic approach and now being taken over by a method." *Id.* at 15. Propaganda is a form of what Ellul calls "human technique." "*Human technique* takes on various forms, ranging all the way from medicine and genetics to propaganda (pedagogical techniques, vocational guidance, publicity, etc.). Here man himself becomes the object of technique." *Id.* at 22.

160. *Id.* at 15.

161. *Id.* at 21-22.

162. MITCHAM, *supra* note 135, at 152.

163. AGASSI, *supra* note 149, at 21; *see also* Kranzberg & Pursell, *supra* note 131, at 4 ("While the influence of technology is both widespread and fundamental, the term cannot be defined with precision.").

> *Musgrave* as probably having a connotation in these times roughly equivalent to that which 'useful arts' had in the eighteenth century. No new legal concept was intended.[164]

Yet the concern raised by Judge Baldwin in *Musgrave*[165] is a genuine concern. How can a court proceed when the invention at issue is not a Franklin stove, horse collar, or buggy whip, but rather an insurance scheme or a pedagogical technique? Are these things "technology?" Judge Baldwin doubted that any "all-encompassing definition" could be found,[166] and certainly no court has addressed the definitional problems discussed here. Judge Baldwin believed that the issue would have to be "decided on a case-by-case basis,"[167] yet such an approach would inevitably be arbitrary and ad hoc without the application of some guiding standards. In fact, the failings of the "enumerationist" approach to defining "technology"—i.e., definition by listing examples of "technology"—have already been noted by scholars.[168]

D. A Provisional Definition of "Useful Arts"

There is something to be said for adopting a broad definition of the "useful arts" corresponding to a broad definition of "technology." Mirroring Ellul's conception of "technique," one could define "useful art" as any field of endeavor in which knowledge is applied systematically toward the achievement of definite goals. Business, politics, pedagogy, and law (at least the practice of law) might qualify as "useful arts" under that definition.[169] Such "useful arts" would have many things in common with the industrial and mechanical arts that have traditionally been the subject of patents, including the application of reason to achieve a goal, the possibility of improvement, the *potential* to benefit society by introducing such improve-

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164. *In re* Waldbaum, 457 F.2d 997, 1003 (C.C.P.A. 1972).

165. *See supra* notes 117-119 and accompanying text.

166. *In re* Musgrave, 431 F.2d 882, 895 (C.C.P.A. 1970).

167. *Id.* at 894.

168. "It is evident that this enumerationist approach is only an auxiliary means for explaining the concept of technology and can be neither complete nor exhaustive." Ttondl, *supra* note 129, at 3.

169. The fine arts might not qualify, either because they are not systematic or because they lack definable goals, but this is a difficult question. At least some branches of the fine arts are highly systematic (certain kinds or music and poetry, for example), and they strive for aesthetic goals, even if the relevance of those goals, or the success of a work of art in achieving them, might be the subject of disagreement.

ments, and the applicability of most, if not all, of the standards now used to evaluate whether an invention is otherwise patentable—e.g., utility,[170] novelty, non-obviousness, enablement, and definiteness.[171] Support for such a broad vision of patentable subject matter can also be found in the legislative history of the 1952 Patent Act. As quoted with approval by the Supreme Court, patentable subject matter "include[s] anything under the sun that is made by man."[172]

Whether such an approach should be adopted comes down to two questions, one a matter of history and the other a matter of policy. The historical question—What did the Framers intend by the phrase "useful arts?"—has already been discussed. As we have seen, the historical record provides no *definitive* answers. Still, Coulter's view that the Framers intended "useful arts" to refer only to material goods and industrial processes seems more likely true than not. Americans of the late eighteenth century were much concerned with the nation's industrial development, particularly in relation to the European nations from which the colonies had imported so much of their raw materials and manufactured goods. The existence of societies like the Friends of American Manufactures and the Society for the Encouragement of Manufactures and the Useful Arts[173]

170. The standard of utility involves its own concept of "usefulness." *See* 35 U.S.C. § 101 (1994) ("Whoever invents or discovers any new and *useful* process, machine, manufacture, or composition of matter . . . may obtain a patent therefor . . . .") (emphasis added). However, that standard is generously applied, and any invention that serves its intended purpose is unlikely to be denied a patent for lack of utility. *See* Tol-O-Matic, Inc. v. Proma Produkt-Und Mktg. Gesellschaft M.b.H., 945 F.2d 1546, 1553 (Fed. Cir. 1991) ("All that the law requires is that the invention should not be frivolous, or injurious to the well-being, good policy, or good morals of society. The word *useful* therefore is incorporated into the act in contradistinction to mischievous or immoral.") (citation omitted). Such things as toys, games, and novelties are patented routinely whether or not they are "useful" in the strictest sense. Hence, if inventions such as advertising techniques pass the constitutional test of "useful arts," they should not be held to lack utility under § 101.

171. Some of these standards would create practical problems for the Patent Office. Whenever it is decided that a type of invention previously treated as categorically unpatentable may indeed be patented, the Patent Office faces a shortage of prior art patents with which to test the novelty and non-obviousness of the claimed invention. This has happened before with software, and it could happen again with "method of doing business" patents. *See infra* Part III.

172. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting Committee Reports accompanying the 1952 Patent Act: S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952)). *Chakrabarty* held that genetically engineered bacteria qualify as patentable subject matter under 35 U.S.C. § 101. *See id.*

173. *See supra* note 75 and accompanying text.

(together with Tench Coxe's remarks[174] on the founding of the latter) are evidence of that concern. In 1790, the House of Representatives directed Treasury Secretary Alexander Hamilton to prepare a Report on Manufactures,[175] including "the means of promoting such as will tend to render the United States, independent on foreign nations for military and other essential supplies."[176] In that Report, Hamilton observes that "[t]he expediency of encouraging manufactures in the United States, which was not long since deemed very questionable, appears at this time to be pretty generally admitted."[177] A healthy manufacturing industry at home would contribute to national security and keep the profits of agricultural surpluses from being transferred abroad.[178]

Hamilton lists the encouragement of new inventions and the introduction of inventions from other countries, "particularly those [inventions] which relate to machinery," as "among the most useful and unexceptionable of the aids, which can be given to manufactures."[179] "The usual means of that encouragement," writes Hamilton, "are pecuniary rewards, and, for a time, exclusive privileges. . . . For the last, so far as respects 'authors and inventors,' provision has been made by Law."[180] Hamilton refers, of course, to the patent system.[181] As Hamilton observes, the grant of exclusive rights by patent was a "usual" means of encouraging industry and "manufactures," as shown by European and colonial practices.[182] It is reasonable to conclude that industry is what the Framers intended to encourage by exclusive rights and that industry is what they meant by the "useful arts."[183]

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174. *See supra* note 74 and accompanying text.

175. Alexander Hamilton, Report on Manufacturers (Dec. 5, 1791), *in* THE REPORTS OF ALEXANDER HAMILTON 115 (Jacob E. Cooke ed., 1964).

176. *Id.* at 115.

177. *Id.* at 115-16.

178. *See id.* at 116.

179. *Id.* at 175.

180. *Id.* at 175-76.

181. And perhaps, by his reference to "authors," to the copyright system as well, though this system has little obvious relationship to the encouragement of "manufactures."

182. *See supra* notes 55-72 and accompanying text.

183. According to Coulter, "[t]here can be no doubt that the promotion of the 'useful Arts' in America was regarded by the founding fathers as a matter of life-and-death importance to the prosperity of the new nation." Coulter (pt. 2), *supra* note 26, at 489. If "useful arts" means industry, then Coulter is probably right.

There is no corresponding evidence that the Framers intended to encourage developments in business methods, political strategies, pedagogical techniques, or similar undertakings. In fact, there is no evidence that they viewed such endeavors as subject to improvement by "inventors." In all likelihood, it did not occur to the Framers to include such things in the patent system. If the Framers had entertained such unconventional thoughts (unconventional in light of the kinds of invention usually rewarded with patents), one might expect some explicit statement to that effect either in the Constitution or in the early patent acts.[184] It is also wise to remember the Framers' general antipathy to monopolies,[185] seen most vividly in the initial reluctance of Thomas Jefferson to endorse any patent system at all.[186] If there is any question as to whether "useful arts" should be interpreted broadly or narrowly, the narrow interpretation, with its correspondingly narrower scope of monopoly, seems most in keeping with the likely intentions of the Framers. It is one thing to extend patent protection to new industries ("anything under the sun that is made by man"[187]); it is something else to extend protection to fields that are not industrial at all. The "burden of persuasion," at least, should be on those who argue for the broader interpretation of "useful arts."

The policy question is whether the benefits of granting exclusive rights to advancements in such fields as education, business, and advertising outweigh the costs. Is the nation ac-

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184. Business methods, political strategies, pedagogical techniques, and so forth, *existed* in the eighteenth century, so they do not stand on the same footing as new technologies, which the Framers could neither have foreseen nor commented upon.

185. *See* Walterscheid, *supra* note 45, at 55-56. The patent laws have been called an "attempt to reconcile this Nation's deep-seated antipathy to monopolies with the need to encourage progress." Diamond v. Chakrabarty, 447 U.S. 303, 319 (1980) (Brennan, J., dissenting) (quoting Deepsouth Packing Co. v. Laitram Corp., 406 U.S. 518, 530-31 (1972); *see also In re* Shoa Wen Yuan, 188 F.2d 377, 380 (C.C.P.A. 1951). Inclusion in the Constitution of a *reason* for patent law

> doubtlessly was due to the fact that those who formulated the Constitution were familiar with the long struggle over monopolies so prominent in English history, where exclusive rights to engage in ordinary business activities were granted so frequently by the Crown for the financial benefits accruing to the Crown only. It was desired that in this country any Government grant of a monopoly for even a limited time should be limited to those things which serve in the promotion of science and the useful arts.

Id.

186. *See supra* notes 47-48 and accompanying text.

187. *Diamond*, 447 U.S. at 309 (quoting S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952)). *See supra* note 172 and accompanying text.

tually benefited by "progress" in such fields? In the case of education, one would guess so. In the case of business, and particularly advertising, one cannot be sure.[188] If such "progress" is desirable, how much would it be encouraged by the grant of exclusive rights? How much would be lost by denying advancements in these fields to the general public even if only for a limited time? These questions might be dismissed as irrelevant by a constitutional literalist, but, in the absence of definitive historical information, they are worth considering. They might even provide some insight into the thoughts and intentions of the Framers. However, no one has marshaled evidence that sheds light on these issues, and it may be that no such evidence *can* be marshaled. Even if we could agree on what we mean by "progress" in these arts, it is difficult to imagine by what experiment it could be measured. Moreover, these arts differ sufficiently from the industrial arts that it seems rash to infer that what encourages progress in the latter must also encourage progress in the former.

Until there is historical or policy-oriented evidence to the contrary, it seems best to adopt a conservative definition of the "useful arts"—perhaps defining them as the products, processes, and tools of industry or as "industrial technology" in the language of the first *Prater* opinion.[189] As Judge Baldwin warned in *Musgrave*, a perfect and all-encompassing definition may be impossible, given the inherent imprecision of language.[190] But it should be possible to extend the field of the "useful arts" to new technologies by analogy to the "Franklin stoves, horse collars, and buggy whips"[191] at its traditional core and to exclude certain arts, such as law, business, politics, and pedagogy, which are fields of human *behavior*—what Mitcham refers to as "human doing" as opposed to "human making."[192] This conservative approach also seems consistent with the intentions of the courts in defining "useful arts" as "technological arts." However, even if we decide that "useful arts" has this narrower meaning, the twentieth century "art" of computer

188. *See generally* Ralph S. Brown, Jr., *Advertising and the Public Interest: Legal Protection of Trade Symbols*, 57 YALE L.J. 1165, 1166-67 (1948).

189. *See supra* notes 107-110 and accompanying text.

190. *See supra* notes 117-119 and accompanying text. One could, for example, quibble over what is meant by "industry."

191. *In re* Waldbaum, 457 F.2d 997, 1003 (C.C.P.A. 1972).

192. MITCHAM, *supra* note 135, at 153.

programming presents special difficulties. Before examining those difficulties in detail, it is worth reviewing briefly the characteristics of that "art."

E. The "Art" of Computer Programming

The fundamental operations of a computer are extremely simple logical and arithmetical operations which, when combined in great numbers and in the right sequence, can accomplish complex tasks like word processing, web browsing, and graphics rendering.[193] Computers are tools of great flexibility, but they do only what they are instructed to do by a computer program.[194] In order to be processed by a computer, the instructions of which a program consists must be expressed in binary code—strings of ones and zeros. Computer programs can be written at this "machine language" level, but it is impractical to do so. Instead, programs are written in "higher level" programming languages such as PASCAL or C. Because these languages are more like human languages, they allow programs to be more easily written, read, and understood by humans.[195] Before they can be used by a computer, higher level programs must be converted by a "compiler" into corresponding strings of binary digits.[196]

The process of writing down program instructions is known as "coding."[197] However, programming does not begin with

193. *See* NICLAUS WIRTH, SYSTEMATIC PROGRAMMING: AN INTRODUCTION 1 (1973).

194. "A computer program is defined as a series of instructions or statements, in a form acceptable to a computer, designed to cause the computer to execute an operation or series of operations." PHILLIP BRUCE & SAM M. PEDERSON, THE SOFTWARE DEVELOPMENT PROJECT 7 (1982). Computer *hardware* components (microprocessors, storage devices, input devices, displays, and so forth) easily qualify as patentable subject matter. An engineer who designs a new disk drive is unquestionably practicing a technological "useful art." *See In re* Benson, 441 F.2d 682, 688 (C.C.P.A. 1971) ("It seems beyond question that the machines—the computers—are in a technological field, are a part of one of our best-known technologies, and are in the 'useful arts' rather than the 'liberal arts' . . . ."), *rev'd sub nom.* Gottschalk v. Benson, 409 U.S. 63 (1972). Only when the invention is embodied in computer *software* or when the invention generally lies in a new use for existing hardware, do questions of patentable subject matter arise.

195. *See* WIRTH, *supra* note 193, at 12-13.

196. *See* J.D. ARON, THE PROGRAM DEVELOPMENT PROCESS 6-7 (1974). A program in its intelligible, programming-language state is known as "source program;" in the form in which it can be executed by a computer, it is known as "object program." *See id.* at 34.

197. *See* RAY TURNER, SOFTWARE ENGINEERING METHODOLOGY 103 (1984) ("Coding is the process of translating the design of a program, module by module, into a form that can be read by a computer and converted by it into an object code which can be

coding any more than house building begins with nailing boards together. In either case, the construction phase is preceded by a planning stage.[198] The planning stage of programming, sometimes referred to as "software design,"[199] is a process of moving from the general to the specific.[200] It begins with the identification of a problem to be solved or a function to be performed by the program.[201] For example, one might begin with the idea of a program for indexing a collection of baseball cards. During the "concept phase" of development,[202] the initial rough idea is refined into a specific plan for what the program will accomplish.

Software designers typically prepare a document called a "functional specification,"[203] detailing their specific ideas about

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executed.").

198. *See id.* at 5 ("Software design is not just 'programming a computer' any more than hardware design is 'hooking up some IC's [Integrated Circuits].' If we characterize the activities in software design and development in a general way, it is clear that programming is only a part of the total process.") For Turner's definition of "programming," see *infra* note 199.

199. *See* TURNER, *supra* note 197, at 5-6. Turner limits the term "programming" to the implementation stage, rather than applying it as well to the design stage, *see id.* at 5, but it is often used in a sense that includes both. *See, e.g.*, ARON, *supra* note 196, at 55 ("*Programming* is a comprehensive term. It includes the activities of analysis, planning, design, etc., as well as coding and debugging."). As the software business has become more complex, the tasks of design and coding have become more distinct; now the person who designs software may do little, if any, of the actual coding. *See* SUSAN LAMMERS, PROGRAMMERS AT WORK 3 (1986).

200.

> [D]esign has to be broken down into chunks that are amenable to human comprehension. This is generally accomplished by attacking the problem at an abstract level and then proceeding to more detailed levels of design. . . . The whole process of development of programs can be viewed as moving from an abstract statement of the problem to a concrete representation of the solution in code that can be executed on the target machine.

Judith C. Enos & R.L. Van Tilburg, *Software Design*, *in* SOFTWARE ENGINEERING 71 (Randall W. Jensen & Charles C. Tonies eds., 1979). "Beginning with a high-level design and proceeding to lower and lower levels of detail is only a natural way of intellectually tackling a large, complex problem. The generic term 'top-down design' has been applied to this process, and all followers of design methodologies profess to follow this general approach . . . ." *Id.* at 72. *See also* ARON, *supra* note 196, at 97 ("The important facet of top-down design is that it establishes the logical *structure* of the solution before it decides on the detailed *elements* of the solution.").

201. "Programs are written to solve problems. The programmer's first act is to obtain a good definition of the problem." ARON, *supra* note 196, at 55. The problem-solving idea may be in response to customer demands, competitive pressures, or simply a design for "a better mousetrap." *See* TURNER, *supra* note 197, at 21.

202. *See* TURNER, *supra* note 197, at 10. This stage of problem analysis is also known as the "requirements definition phase." Enos & Tilburg, *supra* note 200, at 65.

203. TURNER, *supra* note 197, at 10, 13.

what the program is to do.[204] A functional specification for the baseball card program would spell out its various functions: sorting and display of card information alphabetically by player, alphabetically by team, by year issued, by date purchased, by price paid, and so forth. It might specify features like the display of scanned images of individual cards and a link to an Internet site supplying up-to-date price information. It would likely describe elements of the "user interface," such as how the screens should look and the kinds of commands available to the user. It might also cover certain technical requirements, such as whether the program will run on all Windows PCs and whether it will fit on a single CD-ROM.[205] The details of the functional specification reflect the programmer's ambitions, marketing requirements, hardware limitations, and many other considerations.

When the functional specification is complete, the design process enters what has been called the "implementation phase,"[206] or "software design phase."[207] In this phase, the question is not so much *what* the software will do, but *how* it will do it.[208] Here the programmer determines the high-level structure of the program, eventually recorded in a document called a "design specification."[209] A program is a sequence of operations that, in the design phase, are often represented graphically by

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204. *See id.* at 22 ("The output of the Concept Phase is the functional specification (sometimes called a problem specification) which defines, in detail, what the product does and how it interacts with the user, the hardware, and other software.").

205. *See id.* at 13. In chapter five of his book, Turner discusses in some detail the kinds of information likely to be included in a functional specification. *See id.* at 43-54.

206. *See id.* at 14. Issues that arise in the implementation phase may cause the programmer to rethink the functional specification. Hence, there may be some interaction between the processes of design and implementation. *See* ARON, *supra* note 196, at 83.

207. Enos & Tilburg, *supra* note 200, at 66.

208. *See id.* at 69. Turner refers to a "definition phase" preceding actual coding. "The definition phase converts the *what* must be done from the functional specification into the *how* it will be done of the design specification." TURNER, *supra* note 197, at 22.

209.

> The purpose of the design specification is to define an implementation approach for the software product. It defines a system architecture, data structures, and the high-level structure of the program itself (not necessarily the entire program structure). It explains design decisions made and justifies them against the requirements of the functional specification.

TURNER, *supra* note 197, at 14-15. The design specification is also referred to as a "Functional Design Document." *See* BRUCE & PEDERSON, *supra* note 194, at 75.

"flow charts."[210] A flow chart is a diagram showing the order of events and any "branches" that occur when decisions are made. Labeled boxes in a flowchart represent distinct functions, such as "sort cards alphabetically by name of player." The programmer may have to reduce such functions into their own subsidiary components, represented in additional flowcharts.[211] In the example, a subsidiary flowchart might represent the steps necessary to perform the alphabetizing—i.e., locate the memory array in which the names of players are stored, isolate the first letter of each player's last name, convert those letters into numerical equivalents based on the order of the alphabet, use a mathematical operation to sort the names, and so on. A complex program may require several layers of structure to describe its detailed operation.[212]

During the software design phase, the programmer defines the program "modules" that perform the various operations required by the overall design[213] and the program structure, or "architecture,"[214] that determines how these modules interact.[215] The programmer also defines the "data structures" that store the information on which the program operates.[216] The baseball card program would have data structures for storing

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210. *See* ARON, *supra* note 196, at 104-05.

211. *See id.* at 105.

212. *See* Enos & Tilburg, *supra* note 200, at 72.; TURNER, *supra* note 197, at 60, 64-66 (describing the hierarchical nature of "structured design"). "This natural 'divide and conquer' process allows the designer to deal with a small number of subfunctions at one time and to push down or ignore details of implementation not relevant at that level . . . in the . . . hierarchy." *Id.* at 65.

213. *See* TURNER, *supra* note 197, at 58-59. A "module" is "[t]he lowest level of program structure consisting of a group of statements that performs one function or a small number of related functions. [It is] [e]quivalent to a subroutine or subprogram." *Id.* at 3. Turner provides sample module descriptions in Figures 4-3 and 4-4 of his book. *See id.* at 33-34.

214. *See* Enos & Tilburg, *supra* note 200, at 75 ("The architectural design must describe the arrangement (or structure) of the component parts (called modules) that communicate (through interfaces) in proper sequence (control structure) to solve the user's problem.").

215. *See* TURNER, *supra* note 197, at 30; BRUCE & PEDERSON, *supra* note 194, at 71-72.

216. *See* TURNER, *supra* note 197, at 31-32 fig. 4-2 ("Typical Data Structure Definition"). The Functional Design Document must "[i]dentify and name the levels of data base hierarchy (e.g., data base, file, record, array), down to the individual parameter level. For each level of data base hierarchy, the Functional Design Document identifies the name, contents (description and units), and size of the data base components." *See* BRUCE & PEDERSON, *supra* note 194, at 75. "Some interaction between data structure definition and program structure will naturally occur." TURNER, *supra* note 197, at 23.

numerical information, such as the year each card was acquired and the price paid; strings of letters, such as the names of teams and players; and pictures, such as the scanned images of individual cards. The programmer would define data structures with characteristics suited to each kind of information. Coding takes place only after the program structure and design have been determined. In a sense, the text of the program is the final and most specific description of the program's structure as well as the means for causing the computer to execute the programmed instructions.

Programming is not always the formal process that the foregoing suggests, particularly when it is done by an individual rather than by an organized group. However, the hierarchical methodology of moving from idea to code is generally the same. Software designer Charles Simonyi describes programming as follows:

> If we're talking strictly about programming, then let's assume I already know what I want to do. If I don't then there is some aspect of the process that is common to all problem solving: What am I trying to do? What is the goal?
>
> For example, I want a text editor to be menu driven, fast, have a spelling checker, and so on. I need to know the end product before the true programming begins. . . .
>
> . . . .
>
> The first step in programming is imagining. Just making it crystal clear in my mind what is going to happen. In this initial stage, I use paper and pencil. I just doodle, I don't write code. I might draw a few boxes or a few arrows, but it's just mostly doodles, because the real picture is in my mind. I like to imagine the structures that are being maintained, the structures that represent the reality I want to code.
>
> Once I have the structure fairly firm and clear in my mind, then I write the code. I sit down at my terminal—or with a piece of paper in the old days—and write it. . . . The code for the most part writes itself, but it's the data structures I maintain are the key. They come first and I keep them in my mind throughout the entire process.[217]

217. Interview with Charles Simonyi, *in* LAMMERS, *supra* note 199, at 14-15; *see*

Moving from the concept, even the detailed concept embodied in the functional specification, to a specific program architecture requires considerable skill. It is not a mechanical process that always results in the same program, or even a program of equivalent value: "Ten programmers given a functional definition of a program and using *ad hoc* design techniques would produce ten different high-level designs for that program. Each would presumably be a correct design but some would be better designs than others."[218] Better designs result in programs that are faster, that require less memory, and that are more intelligible and, hence, more easily modified and debugged.[219]

Is programming an "industrial technology" or "useful art?" It is not an art the Framers knew, and in one respect it differs from any art they could have imagined. Programmers do not work with physical materials—the stuff of "Franklin stoves, horse collars, and buggy whips."[220] Although the execution of a program depends upon physical hardware and the flow of electrons, these are not the essence of the program itself. As W. Daniel Hillis demonstrated by building a tic-tac-toe-playing computer entirely out of Tinker Toys and string,[221] the hardware is incidental. The essence of a program is *logic*. In the eighteenth century, abstract logic was not the province of artisans; it was the province of mathematicians and philoso-

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also Interview with programmer Gary Kildall, *in* LAMMERS, *supra* note 199, at 58.

> It goes back to the fundamentals of programming: simplifying the problem. Part of the programming process is general problem solving. How do you solve a problem that's complex, whether it's designing a computer program or constructing a building? You start at the point where you think it's too hard to solve, and then you break it down into smaller pieces.

Id.

218. TURNER, *supra* note 197, at 77; *see also* ARON, *supra* note 196, at 89 ("Another truism is that any problem can be programmed in many ways. The wide variation in programmer productivity that is so evident in classroom situations where all the students are given the same problem demonstrates the [truth of this] statement.").

219. *See* ARON, *supra* note 196, at 89-94; TURNER, *supra* note 197, at 77 ("The quality of a design directly affects the cost to implement and maintain it."); EDWARD YOURDON, TECHNIQUES OF PROGRAM STRUCTURE AND DESIGN 6-7 (1975) (discussing the attributes of a "good" program).

220. *In re* Waldbaum, 457 F.2d 997, 1003 (C.C.P.A. 1972).

221. *See* W. DANIEL HILLIS, THE PATTERN ON THE STONE 16-18 (1998). In theory, the electronic transistors now found in computers could be replaced with hydraulic valves, chemical reactions, or Tinker Toy switches, and the programs would still run. *See id.* at 10.

phers.[222] If programming is a branch of engineering, as it is now often regarded, it is still engineering of a singularly intangible kind.[223] Whereas Coulter characterizes "technology" in terms of "controlling the forces and materials of nature,"[224]

> [w]hat especially characterizes the programmer is his withdrawal from nature into the private intellectual world of the program he is writing. Normally, he thinks neither of the keyboard at which he is typing nor of the electrons that are performing the calculations. He concentrates his full attention on the abstract problem, its representations in the programming language, and the logical design of the machine he is using. In this respect, he resembles the mathematician, the philosopher, the theologian, or indeed the chess master, all of whom live more or less completely in intellectual worlds of their own making.[225]

On the other hand, significant parallels can be drawn between the design of a computer program and the design of a steam engine or a clock or any of the kinds of physical tools that were familiar to the Framers. In the words of software designer Gary Kildall, "[A] lot of programming is invention and engineering. It's much like a carpenter who has a mental picture of a cabinet he's trying to build. He has to wrestle with the design and construction to get it into a physical form. That's very much what I do in programming."[226] Like the cabinet builder, the programmer turns an idea into a useful product. The builder's task is to transform physical materials into useful objects within the constraints imposed by nature; "[t]he pro-

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222. *See* BOLTER, *supra* note 2, at 167-68 ("Philosophers and mathematicians have been with us since before Greek times; their abstract labor is familiar. The computer programmer is remarkable because he is the first technological man whose work is divorced from nature in this way.").

223.

> There is one outstanding difference between software engineering and all other branches of engineering. Engineers usually deal with *material* (visible and tangible) objects. . . . Electrical engineering is the most abstract of the classical engineering fields since electricity is not material, but, through the use of appropriate tools, electricity exhibits characteristics that are both visible and tangible. Electricity can thus be dealt with as though it were a physical object. Software, however, is nonmaterial in every sense.

Randall W. Jensen & Charles C. Tonies, *Introduction* to SOFTWARE ENGINEERING, *supra* note 200, at 10.

224. *See supra* text accompanying note 104.

225. BOLTER, *supra* note 2, at 167.

226. Kildall, *supra* note 217, at 65.

grammer's task is to set logic to work in the world, and to do so he must mediate between the problem to be solved and the rigorous and curiously unnatural brand of logic by which the computer operates."[227] The programmer and the builder are each highly skilled,[228] and each turns out a product that, at least in some cases, is practical and valuable.

Kildall argues that programs are "like mechanical devices; the way one piece of code works with another is very similar to the way one gear meshes with another gear. Building code is a little like building a transmission."[229] In fact, logical structures can often substitute for physical structures and vice versa. Computer users are familiar with "virtual" substitutes for a wide variety of useful *things*—clocks, calendars, notepads, typewriters, artist's pallets, and film editors among them. Conversely, Hillis built the logic necessary to play tic-tac-toe out of Tinker Toys and string. Designers of computerized systems often have a choice as to whether certain functions should be embodied in a program or "hard wired" as electronic circuitry.[230] Consequently, any "useful arts" distinction based on

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227. BOLTER, *supra* note 2, at 168. Programming also seems to provide some of the aesthetic satisfaction produced by fine craftsmanship; "[a] programmer may polish his program just as a watchmaker polishes and ornaments his work for display." *Id.* at 173. *See also* FREDERICK P. BROOKS, THE MYTHICAL MAN-MONTH 7-8 (1979).

> The programmer, like the poet, works only slightly removed from pure thought-stuff. He builds his castles in the air, from air, creating by exertion of the imagination. . . . Yet the program construct, unlike the poet's words, is real in the sense that it moves and works, producing visible outputs separate from the construct itself. It prints results, draws pictures, produces sounds, moves arms. The magic of myth and legend has come true in our time. One types the correct incantation on a keyboard, and a display screen comes to life, showing things that never were nor could be.

Id.

228.

> Like the engineers who build computers, the programmer has the character of a professional technologist and often works as a member of a team. Good technical programming for creating new languages, control programs, or programming tools may require years of training and a mastery of mathematics, if not solid state physics.

BOLTER, *supra* note 2, at 166.

229. Kildall, *supra* note 217, at 59. Kildall states that "[d]ata structures, which are the foundations of programs, are mechanical by nature." *Id.* at 62.

230. *See In re* Alappat, 33 F.3d 1526, 1583 (Fed. Cir. 1994) (en banc) (Rader, J., concurring) ("[T]he line of demarcation between a dedicated circuit and a computer algorithm accomplishing the identical task is frequently blurred and is becoming increasingly so as the technology develops. In this field, a software process is often interchangeable with a hardware circuit.").

physicality is disturbingly superficial.[231]

Some programmers view programming as a "science"; others view it as an "art" or a "craft."[232] Most seem to view programming as a subset of *engineering*—a discipline that includes elements of art, science, *and* craft.[233] Like other branches of engineering, programming seems intuitively "technological," however one may debate the meaning of that term. It is commonplace now to refer to the "software industry," and one can imagine that the Framers would have looked with approval on America's successes in that industry, both at home and abroad. It is also an industry that advances by innovation, and, hence, one potentially benefited by the patent system. If programming is indeed a branch of engineering and the basis of a technological industry, perhaps there should be no question that programming is a "useful art." Indeed, the courts, which have become increasingly receptive to software patents,[234] seem to have accepted this conclusion implicitly.

But things are not so simple. As we have seen, the programmer's task is to reduce a general plan into a specific software implementation. Sometimes the general plan is a "technological" one, such as a plan to refine the analysis of seismographic data for use in oil and mineral prospecting. In that case, the programmer's work spans two arguably "technological" fields—prospecting and programming—and the transition may be difficult to define. In other words, it may be difficult to say where the prospector's art ends and the programmer's begins. Yet because both arts are "technological" (conceding for the moment that fashioning program logic is a technological activity), no issue of patentability arises. On the other hand, sometimes the general plan is not part of a "technological" or "useful art," at least according to the conservative

231. *See generally infra* Part IV.C.

232. *See* Interview with programmer Jaron Lanier, *in* LAMMERS, *supra* note 199, at 295 ("I treat programming more as an art than anything else. . . . [Peter Deutsch] said programming was a craft. Then there are some people who think of it as mathematics. It just depends on the person.").

233. *See* Interview with programmer Bob Frankston, *in* LAMMERS, *supra* note 199, at 158 ("The term computer science is overused; I'd rather refer to software engineering or computational engineering or information engineering."); Interview with Adobe Systems founder John Warnock, *in* LAMMERS, *supra* note 199, at 55) ("[Programming is not science, but] more of an engineering discipline; a very good, fruitful engineering discipline."). *Software Engineering* is also the title of a textbook, *see supra* note 200.

234. *See infra* Part IV.A-B.

definition proposed in Part I.D, *supra*. The plan might, for example, involve an accounting technique developed for its beneficial tax consequences. Here the transition from accountant's plan to software implementation may be significant. If the plan itself is not patentable because it does not lie within the "useful arts," does that mean that the implementation must also be unpatentable? Or is a software implementation of any plan inherently within the "useful arts"? Or does it depend on how the programmer characterizes the "invention"? As computerization deepens its incursions into traditionally "non-technological" fields, such as business, education, and the fine arts, these questions will become increasingly important.

In Part IV.C, *infra*, I suggest an approach for dealing with these boundary-challenging inventions. First, however, we must set the stage by reviewing how courts have dealt with software inventions in general and how courts have dealt with the patentability of business methods. The latter is important because many software patents of the most troubling kind arise in the business context.

II. WRESTLING WITH THE ALGORITHM

The course of software patent jurisprudence has never run straight and true. For a number of years, the Patent Office and the courts have struggled with issues of software patentability and have reversed directions, with or without admitting it, on a number of occasions. Sometimes the issue is whether the claimed software invention is too abstract or too much like mathematics to be patentable, and sometimes it is whether the invention embraces "mental steps." Always the problems can be traced back to a characteristic of software already discussed—namely, the way in which it straddles the divide between pure logic and practical machine.

A. The "Mental Steps Doctrine"

The debate over the patenting of "mental steps" began well before the invention of the modern computer. As long ago as 1907, the Commissioner of Patents, in *Ex parte Meinhardt*, [235] ruled that a method involving human measurement and cal-

235. Dec. Comm'r Pat. 237 (1907) (rejecting patent application on a system for scaling and spacing free-hand letters within an area of given size).

culation could not be patented, apparently because the method lacked the physical component of a mechanical or chemical process. The Patent Office Board of Appeals picked up this theme in the 1940s, in *Ex parte Read*[236] and *Ex parte Toth*.[237] In *Read*, the Board denied a patent to a method of determining the speed of an aircraft, or the distance it had traveled, using a pair of mechanically-controlled logarithmic scales. Citing *Meinhardt*, the Board held that the method claims failed to define "a true method" because they did not "define any true manipulative steps, except the moving of one scale relative to the other."[238] The act of reading an instrument is "purely a mental act that cannot be regarded as a true manipulative step."[239] The Board also rejected a separate claim to the *apparatus*, but on grounds of insufficient novelty.[240] Similarly, in *Toth* the Board denied a patent to a claimed method of determining pressure in an oil well. The Board held that steps such as "correcting said indicated pressure" and "determining the well pressure" were "purely mental" and, therefore, not the steps of a patentable process.[241]

These early "mental steps" cases have nothing explicit to say about the constitutional foundations of the patent system. They seem to reflect the definition of "process"[242] articulated in *Cochrane v. Deener*:

> 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.[243]

A mental act does not "transform" any material or reduce it

236. 123 U.S.P.Q. 446 (P.T.O. Bd. App. 1943).

237. 63 U.S.P.Q. 131 (P.T.O. Bd. App. 1944).

238. *Read*, 123 U.S.P.Q. at 447.

239. *Id.*

240. *See id.*

241. 63 U.S.P.Q. at 132.

242. "Process" was then represented in the statutory list of patentable subject matter by the synonymous "art." *See supra* text accompanying note 84.

243. 94 U.S. 780, 788 (1877). Robinson's treatise on patent law similarly defines "art" or "process" as "an act or a series of acts performed by some physical agent upon some physical object, and producing in such object some change either of character or of condition." ROBINSON, *supra* note 139, § 159, at 230. "[T]hough an art embraces so wide a field of inventive skill, it includes only such operations as are capable of producing physical effects." *Id.* § 166, at 249.

"to a different state or thing;" hence, it is not a patentable "process" or "art" as defined in *Cochrane*.[244] More recently, it has been argued that the *Cochrane* language was not intended to be definitive or limiting; it was only intended to make clear that a new process could be patented, regardless of the use of a new machine.[245] Nevertheless, the *Cochrane* formula has had continuing relevance in analyzing the patentability of software.[246]

The Court of Customs and Patent Appeals endorsed the "mental steps" doctrine in *In re Heritage*,[247] where the claimed invention concerned the production of coated fiber boards. Although this seems both a physical endeavor and a "useful art," the method involved testing various coating densities to determine the optimum balance between the thoroughness of coating and the desired acoustical qualities of the finished board.[248] Because coated fiber boards had been manufactured before, the feature relied upon for novelty was the "mental process of making a selection of the amount of coating material to be used in . . . accordance with a predetermined system."[249] The court ruled that "[s]uch purely mental acts [i.e., observation and selection] are not proper subject matter for protection under the patent statutes."[250]

The "mental steps doctrine" may have reached its zenith in

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244. *See Toth*, 63 U.S.P.Q. at 132 ("These acts are purely mental and hence do not come within the definition of an 'art . . . .' "). A literalist might argue that even mental acts cause chemical or electrical alterations in the human brain. This observation is not wholly trivial given the courts' occasional reliance on the physical or electrical changes that occur in a computer executing a particular software program. *See infra*, notes 335-36 and accompanying text. On the other hand, it is implausible to regard biochemical changes in the brain as within the scope of the "useful arts" contemplated by the Framers—unless such changes are accompanied by some kind of action in the material world.

245. *See, e.g., In re* Prater, 415 F.2d 1378, 1387-88 (C.C.P.A.), *superceded*, 415 F.2d 1393 (C.C.P.A. 1969).

> This passage has sometimes been misconstrued as a "rule" or "definition" requiring that all processes, to be patentable, must operate physically upon substances. . . . To deduce such a rule from the statement would be contrary to its intendment which was not to *limit* process patentability *but to point out that a process is not limited to the means used in performing it.*

Id.

246. *See infra* notes 280-81 and accompanying text.

247. 150 F.2d 554 (C.C.P.A. 1945).

248. *See id.* at 554-55.

249. *Id.* at 557.

250. *Id.* at 556.

In re Abrams.[251] The applicant's invention (like the invention in *Musgrave*[252]) concerned a method of petroleum prospecting. Petroleum deposits were detected by pumping down the atmospheric pressure in boreholes drilled for the purpose, then measuring the time that it took for subsurface gasses to seep in.[253] The claimed method included steps such as "measuring," "determining," and "comparing," as well as decidedly physical steps such as "sinking . . . boreholes" and "sealing off . . . said boreholes."[254] Because the only *novel* aspect of the method lay in the "mental steps," the court affirmed the Patent Office's rejection of the claim.[255] Regarding the rationale for its holding, the court said simply, "Citation of authority in support of the principal that claims to mental concepts which constitute the very substance of an alleged invention are not patentable is unnecessary. It is self-evident that thought is not patentable."[256]

The CCPA eventually curtailed the "mental steps doctrine" as expressed in *Abrams*. Significantly, the court's retreat occurred in the context of claimed methods capable of being per-

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251. 188 F.2d 165 (C.C.P.A. 1951).

252. *See supra* text accompanying note 114.

253. *See Abrams*, 188 F.2d at 165.

254. *Id.*

255. *See id.* at 166, 170. The applicant proposed three "rules" for dealing with claimed methods involving mental steps: (1) if *all* of the steps of the method are mental steps, then the method is unpatentable; (2) if the method includes both mental steps and "positive and physical steps," but the novelty of the claim lies only in the mental steps, then the method is unpatentable; (3) if the method includes both mental steps and "positive and physical steps," and the novelty lies in those physical steps (the mental steps only limiting or defining the process), then the method is patentable. *Id.* at 166. The court found that the method claimed in this case fell within Rule 2 and was unpatentable. *See id.* at 170. However, it is unclear whether the court adopted the rules as its own, or whether it merely considered them for the sake of argument. Later CCPA decisions adopt the latter conclusion. *See In re* Musgrave, 431 F.2d 882, 893 (C.C.P.A. 1970); *In re* Prater, 415 F.2d 1378, 1387-88 (C.C.P.A.), *superceded*, 415 F.2d 1393 (C.C.P.A. 1969). These rules, and the debate surrounding them, prefigure the debate over whether a computerized method involving both mathematical operations and physical steps, but in which only the former are novel, should be considered invalid as unpatentable subject matter or for lack of novelty. *See infra* Part IV.

256. *Abrams*, 188 F.2d at 168; *see also In re* Shao Wen Yuan, 188 F.2d 377, 380 (C.C.P.A. 1951) ("This court has deemed it to have been thoroughly established by decisions of various courts that purely mental steps do not form a process which falls within the scope of patentability as defined by statute."); Halliburton Oil Well Cementing Co. v. Walker, 146 F.2d 817, 821 (9th Cir. 1944) ("We think these mental steps, even if novel, are not patentable" (citing Cochrane v. Deener, 94 U.S. 780 (1877) (definition of "art" or "process"))), *aff'd*, 326 U.S. 969 (1946), *modified*, 329 U.S. 1 (1946).

formed either by the human mind *or* by a *machine*—in other words, a computer. The most significant of these cases, *Prater* and *Musgrave*, have already been discussed.[257] In *Musgrave* and the first *Prater* opinion, the court questioned the logical and precedential foundations of the "mental steps doctrine" and found them wanting.[258] The court held that even methods involving "mental steps" satisfy the demands of patentable subject matter, so long as they fall within the constitutional limits of the "useful arts" (defined here as "technological arts," or, in the first *Prater* opinion, as "industrial technology").[259]

Perhaps the development of the computer compelled a reexamination of the "mental steps doctrine." Actions such as "calculating" and "determining," which the *Abrams* court had found self-evidently unpatentable, were no longer entirely within the domain of human thought.[260] When such steps can be performed by *machines*, there is less reason to regard them as distinctly different from the physical process steps that have always been considered patentable. In the second *Prater* opinion, the court held that the "mental steps doctrine," if it were justified at all, did not apply to steps that were to be performed *only* by a machine.[261] In fact, the court argued that computer programs ought to be patentable, even when executed by a preexisting general-purpose computer, because a new program, in effect, creates a *new machine*:[262]

> No reason is now apparent to us why, based on the Constitution, statute, or case law, apparatus *and* process claims broad enough to encompass the operation of a programmed general-purpose digital computer are necessarily unpatentable. In one sense, a general-purpose computer may be regarded as but a storeroom of parts and/or electrical compo-

257. *See supra* notes 107-19 and accompanying text.

258. *See Prater*, 415 F.2d at 1386-89; *Musgrave*, 431 F.2d at 893.

259. *See supra* text accompanying note 112.

260. *See* John Halton, *The Anatomy of Computing*, *in* THE INFORMATION TECHNOLOGY REVOLUTION, *supra* note 2, at 4 ("Now, information can not only be stored, retrieved, communicated, and broadcast in enormous quantities and at phenomenal speeds; but it can also be *rearranged, selected, marshalled,* and *transformed.* Until recently, these activities were the sole province of the human brain.").

261. *See Prater*, 415 F.2d at 1403; *see also In re* Mahony, 421 F.2d 742, 745-46 (C.C.P.A. 1970); *In re* Bernhart, 417 F.2d 1395, 1399 (C.C.P.A. 1969). *Prater* held the applicant's Claim 9 *indefinite* under 35 U.S.C. § 112 because it was *intended* to apply only to operations performed by a computer, but in fact it could be read to cover operations performed by a person with pencil and paper. *See Prater*, 415 F.2d at 1404-05.

262. *See infra* notes 337-57 and accompanying text.

> nents. But once a program has been introduced, the general-purpose digital computer becomes a special-purpose digital computer (i.e., a specific electrical circuit with or without electro-mechanical components) which, along with the process by which it operates, may be patented subject, of course, to the requirements of novelty, utility, and non-obviousness. Based on the present law, we see no other reasonable conclusion.[263]

Reading the foregoing in 1969, one might have predicted that patenting software would become a matter of routine. However, at the same time the "mental steps doctrine" fell aside as a significant barrier to software patents, another issue arose to take its place. That issue was the patentability of "mathematical algorithms," and this time the Supreme Court intervened.

B. The Supreme Court Trilogy

The first case in which the Supreme Court took a hard look at the patentability of computer software was *Gottschalk v. Benson*.[264] The invention in *Benson* concerned a method of converting Binary Coded Decimal (BCD) numbers into pure binary,[265] a method useful in computer programming and probably little else.[266] The Patent Office rejected the claims as describing "mental processes" or "mathematical steps." [267] The CCPA reversed, once again questioning the validity of the "mental steps doctrine" and finding, in any case, that the claims did not cover a process performed by the human mind.[268]

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263. *Prater*, 415 F.2d at 1403 n.29.

264. 409 U.S. 63 (1972).

265. Binary numbers are numbers expressed in base two, using only the ones and zeros that can be processed by a computer. *See supra* text accompanying notes 194-196. Expressed in binary, the decimal sequence "0, 1, 2, 3, 4, 5, 6" is "0000, 0001, 0010, 0011, 0100, 0101, 0110." In Binary Coded Decimal, or BCD, *individual digits* in a multi-digit decimal number are expressed as their binary equivalents. Hence, in BCD the number 13 would be represented as 0001 0011—the binary equivalent of 1, followed by the binary equivalent of 3. In pure binary, the number 13 would be represented as 1101.

266. *See In re* Benson, 441 F.2d 682, 688 (C.C.P.A. 1971), *rev'd sub nom.* Gottschalk v. Benson, 409 U.S. 63 (1972).

267. *Id.* at 684.

268. *See id.* at 686-87. Claim 8 referred to a step performed by a "reentrant shift register," thereby excluding any possibility that the method, as claimed, could be performed in a human mind. *Id.* at 687. Claim 13 included no such reference to apparatus, but the method still called for some kind of "hardware" implementation—whether a digital computer, pencil and paper, or red and blue poker chips. *Id.* at 687-88.

The court sidestepped the "mathematical steps" issue, saying only that the digital computer in which the claimed method would find its practical application was clearly a "technological" device.[269]

On appeal, the Supreme Court held the claims unpatentable, observing that the applicant's claims "were not limited to any particular art or technology,[270] to any particular apparatus or machinery, or to any particular end use."[271] The claims "cover[ed] any use of the claimed method in a general-purpose digital computer of any type."[272] The Court characterized the claimed method as an "algorithm," a procedure for solving a mathematical problem.[273] The algorithm had been optimized for a computer by changing the order of steps that a human would ordinarily use, but the algorithm could be performed with any computer, or even without a computer.[274] Such an algorithm, the Court held, is akin to an "abstract principle," a "fundamental truth," a "phenomenon of nature," or an "abstract intellectual concept."[275] Such things are the "basic tools of scientific

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> Only in the manual performance would it require the operator even to think and then only to the extent necessary to assure that he is doing what the claim tells him to do. In no case is the exercise of judgment required or even the making of a decision as between alternatives.

Id. at 688. *Cf. In re* McNabb, 127 U.S.P.Q. 456, 457-58 (P.T.O. Bd. App. 1959)

> Any method or step in a method which can be manually performed and requires the use of the human eyes for detection or determination of any condition, such as temperature, pressure, time, etc., and/or the use of the hands for the purpose of manipulating, such as turning off or on or regulating a given device in a certain manner or at a certain time, etc., to produce a certain result necessarily involves the human mind and hence can be classed as a mental step. Such steps, however, are not purely mental or interpretive mental steps and are not the kind which are prohibited by the decisions relating to purely mental steps.

Id.

269. *Benson*, 441 F.2d at 688. *See also supra* text accompanying note 263.

270. Except, arguably, the art of digital computers. *See Benson*, 409 U.S. at 64.

271. *Benson*, 409 U.S. at 64.

272. *Id.* One could argue that a general-purpose digital computer is a "particular apparatus or machine." However, as previously discussed, a general-purpose computer can be implemented, at least in theory, with anything from electronic circuitry to Tinker Toys. *See supra* note 221 and accompanying text.

273. *Benson*, 409 U.S. at 65. Strictly speaking, the term "algorithm" can be applied to any procedure described as a sequence of steps. All computer programs are, in this sense, algorithms. The kind of algorithm to which the court referred is more accurately called a "mathematical algorithm." *See In re* Iwahashi, 888 F.2d 1370, 1374 (Fed. Cir. 1989).

274. *See Benson*, 409 U.S. at 63.

275. *Id.* at 67.

and technological work."[276] A practical *application* of such a fundamental truth can be patented; the truth itself cannot.[277]

What concerned the Court, in part, was the preemptive effect of patenting something as general as the applicant's BCD conversion algorithm. The method was described in such "abstract and sweeping" terms that it could cover numerous applications of BCD to binary conversion, both known and yet to be discovered.[278] In what has become known as its "nutshell" summary, the Court explained,

> It is conceded that one may not patent an idea. But in practical effect that would be the result if the 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 preempt the mathematical formula and in practical effect would be a patent on the algorithm itself.[279]

The Court also alluded to the definition of "process" inspired by *Cochrane v. Deener*:[280] "Transformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines."[281]

As the CCPA had observed, the *Benson* algorithm was an unusually "pure" example of abstract mathematics since the applicant had not linked the algorithm to any particular tech-

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276. *Id.*

277. "He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end." *Id.* (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

278. *Id.* at 68. "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." *Id.*

279. *Id.* at 71-72.

280. *See supra* notes 243-45 and accompanying text.

281. *Benson*, 409 U.S. at 70. But a few paragraphs later the Court seems to retract this statement:

> 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 meet the requirements of our prior precedents.

Id. at 71. Ambiguities such as this have made the *Benson* case a source of lively debate.

nological application, nor to any particular hardware, other than a general-purpose computer.[282] While the *Benson* case seemed to close the door on claims to mathematical algorithms *per se*, there was still the possibility of patenting a specific technological *application* of an algorithm. That was the question presented in the second case of the Supreme Court "trilogy," *Parker v. Flook*.[283]

In *Flook*, the invention concerned the catalytic conversion of hydrocarbons.[284] During the conversion process, certain parameters such as temperature and pressure must be monitored to ensure that they do not exceed predetermined "alarm limits" indicating potentially dangerous conditions. During certain stages of the process, such as start-up, the "alarm limits" need to be variable rather than fixed. The applicant claimed a method of "updating" the alarm limits, consisting of three stages: an initial stage of measuring the current values of the relevant parameters (such as temperature), an intermediate stage of recalculating the correct "alarm limits" using an algorithm, and a final stage of changing the alarm limits to reflect the results of the calculation.[285] The only difference between the applicant's method and existing methods lay in the algorithm and the particular formula it used for recalculating the alarm limits.[286] While the computations could be performed by hand, the application "ma[de] it clear that the formula is primarily useful for computerized calculations producing automatic adjustments in alarm settings."[287] The application included no detailed discussion of the catalytic conversion process, the monitoring of the process parameters, the selection of an appropriate margin of safety, or the physical activation of an alarm.[288]

The claim at issue in *Flook* differed in important respects from the claim at issue in *Benson*. In *Flook*, the applicant claimed an algorithm as *applied* in the clearly technological

282. *See In re* Benson, 441 F.2d 682, 686 (C.C.P.A. 1971) ("The claims in this case are directed solely to the art of data-processing itself . . . ."), *rev'd sub nom.* Gottschalk v. Benson, 409 U.S. 63 (1972).

283. 437 U.S. 584 (1978).

284. *See id.* at 585.

285. *See id.*

286. *See id.*

287. *Id.* at 586.

288. *See id.*

field of hydrocarbon processing. The method also involved the gathering of "real world" data. Hence, the *Flook* claim was much less abstract, and arguably less preemptive,[289] than the claim discussed in *Benson*. Although the Patent Office rejected Flook's application, the CCPA reversed, reading *Benson* as applying only to claims that preempt the use of a mathematical formula *per se*.[290] The Supreme Court disagreed, explaining that since the mathematical algorithm was the only *novel* aspect of the method and since algorithms are unpatentable, the claim as a whole failed to describe a patentable "invention."[291] The Court also rejected the argument that "post-solution activity," in the form of changing the alarm limit, distinguished the case from *Benson* by adding a critical element of practical application:

> The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; 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 survey techniques.[292]

The last case in the trilogy, *Diamond v. Diehr*,[293] involved facts curiously similar to those in *Flook*. Diehr's invention con-

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> The patent claims cover any use of respondent's formula for updating the value of an alarm limit on any process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons. Since there are numerous processes of that kind in the petrochemical and oil-refining industries, the claims cover a broad range of potential uses of the method. They do not, however, cover every conceivable application of the formula.

Id.

290. *See In re* Flook, 559 F.2d 21, 23 (C.C.P.A. 1977), *rev'd sub nom.* Parker v. Flook, 437 U.S. 584 (1978).

291. *See* 437 U.S. at 594. Using a somewhat confusing analytical tool, the court treated the algorithm "as though it were a familiar part of the prior art," although this was not actually the case. "Whether the algorithm was in fact known or unknown at the time of the claimed invention, as one of the 'basic tools of scientific and technological work,' it is treated as though it were a familiar part of the prior art." *Id.* at 591-92 (citation omitted) (quoting Gottschalk v. Benson, 409 U.S. 63, 67 (1972)); *see* 437 U.S. at 594.

292. *Id.* at 590.

293. 450 U.S. 175 (1981).

cerned a process for molding and curing rubber.[294] In order to obtain a "perfect cure," a molding press must be opened at a specific time. That time can be calculated using the well-known Arrhenius equation, which takes into account factors like temperature and pressure.[295] Diehr's contribution was to provide a means for repeatedly measuring the temperature *inside* of the press and, using that data and the Arrhenius equation, to continually update the time remaining before the press should be opened.[296] As in *Flook*, this updating process was performed by a computer.[297] When the computer determined that the ideal cure time had arrived, it signaled a device to open the press automatically.[298]

In *Benson* and *Flook*, the Court reacted cautiously to the expansion of patent protection into new areas, at least without a specific congressional mandate;[299] in *Diehr* the Court adopted a far more liberal attitude, in the spirit of *Chakrabarty*.[300] Patentable subject matter, the Court reminded us, was meant to "include anything under the sun that is made by man."[301] Rubber curing is a § 101 "process," even under a definition that requires the "transformation" of a material thing, and rubber curing is an "industrial process[]" of the kind historically eligible for patent protection.[302] The inclusion of a mathematical equation and digital computer as a *part* of that process does not make the process, considered as a whole, unpatentable subject matter.[303] The problem in *Flook*, the Court explained, was that the claimed invention described only the calculation of a number; there was no disclosure in the application relating to the catalytic conversion process as a whole.[304] Here, however, "re-

294. *See id.* at 177.

295. *See id.* at 177-78.

296. *See id.* at 178.

297. *See id.*

298. *See id.* at 179.

299. *See* Gottschalk v. Benson, 409 U.S. 63, 72-73 (1972); Parker v. Flook, 437 U.S. 584, 595-96 (1978).

300. *See supra* note 172 and accompanying text.

301. *Diehr*, 450 U.S. at 182 (quoting S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1423, at 6 (1952)). However, not every discovery is patentable subject matter. "Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas." *Id.* at 185.

302. *Id.* at 184.

303. *See id.* at 185.

304. *See id.* at 186.

spondents . . . do not seek to patent a mathematical formula. Instead, they seek patent protection for a process of curing synthetic rubber."[305] The claim would not preempt all uses of the formula—only use of the formula in a specific industrial context.[306] In an apparent contradiction of the analysis adopted in *Flook*, the Court in *Diehr* held it to be "inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis."[307] "The 'novelty' of any element or steps in a process, or even of the process itself, is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter."[308] Four dissenting justices argued that the "invention" was not a *method of curing rubber* (a technique already known), but an unpatentable *method of calculating* the time to open the press.[309]

Flook and *Diehr* are difficult to reconcile.[310] *Diehr* suggests that the only fault in Flook's claim was a failure to include more references to the conventional process of catalytic hydrocarbon conversion. Yet it seemed that far more was at stake in *Flook* than such a minor lapse in the claim-drafter's art. Given the tensions between *Benson*, *Flook*, and *Diehr* and the contradictory statements found even within the same opinion, it is not surprising that the post-trilogy handling of software patents has been less than straightforward. An exhaustive discussion of the "algorithm" question dealt with in the trilogy is beyond the scope of this work. However, with respect to the

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305. *Id.* at 187.

306. *See id.* However, the Court still said that "[a] mathematical formula as such is not accorded the protection of our patent laws, . . . and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment." *Id.* at 191 (citation omitted). Moreover, "insignificant postsolution activity [as seen in *Flook*] will not transform an unpatentable principle into a patentable process." *Id.* at 191-92.

307. *Id.* at 188.

308. *Id.* at 188-89.

309. *Id.* at 205-09.

> What they claim to have *discovered*, in essence, is a method of updating the original estimated curing time by repetitively recalculating that time pursuant to a well-known mathematical formula in response to variations in temperature within the mold. Their method of updating the curing time calculation is strikingly reminiscent of the method of updating alarm limits that Dale Flook sought to patent.

Id. at 209 (emphasis added).

310. This is true in spite of the Court's insistence that "[o]ur reasoning in *Flook* is in no way inconsistent with our reasoning here." *Id.* at 192 n.14.

"useful arts" question, it is significant that the Supreme Court's acceptance of computer-related inventions depended upon the association of the computer program "algorithm" with an application in a traditional industrial art, such as rubber manufacturing. When the program "algorithm" was claimed on its own, as in *Benson*, the Court rejected the claim as too abstract, or too much a mathematical "principle." The Court did not treat the program as the practical *application* of a mathematical principle *in the "useful art" of computer programming*. Had the Court adopted such an approach, we might have arrived at nearly where we are today on the issue of software patentability and by a much less circuitous route.

C. Software Patents in the Federal Circuit

After *Diehr*, the leading voice on the patentability of software has been that of the Court of Appeals for the Federal Circuit, the successor of the CCPA. The Federal Circuit decisions are, in some respects, as difficult to reconcile as those of the Supreme Court. A few of the former will be discussed here for the light they shed on the "useful arts" inquiry and to illustrate how far we have progressed toward the complete acceptance of software as patentable subject matter.

In *In re Grams*,[311] the court reaffirmed the *Benson* principle that a mathematical algorithm, as such, cannot be patented. The claimed invention in *Grams* was rather abstract; it concerned a method of diagnosing an abnormal condition in a patient by measuring certain parameters through laboratory tests and comparing the results to standard values in a way that detects significant deviations.[312] The analysis relied on what the court termed a "mathematical algorithm,"[313] realized through a computer program. The "critical question" to be answered by the court was "What did [the] applicants invent?"[314] The court held that what they had invented was just an algorithm—a conclusion bolstered by the content of the specification.

> The sole physical process step in Grams' [sic] claim 1 is . . .

311. 888 F.2d 835 (Fed. Cir. 1989).

312. *See id.* at 836-37.

313. *Id.* at 837. The procedure described in the claim did not look "mathematical" since it did not include any equations. *See id.* at 837 n.1. However, the applicants did not dispute the presence of a "mathematical algorithm." *Id.* at 837.

314. *Id.* at 839.

> performing clinical tests on individuals to obtain data. The specification does not bulge with disclosure on those tests. To the contrary, it focuses on the algorithm itself.... From the specification and the claim, it is clear to us that applicants are, in essence, claiming the mathematical algorithm, which they cannot do under *Gottschalk v. Benson.*[315]

Grams differed from *Benson* in at least one respect: the claim in *Grams* included the physical step of performing a "plurality of clinical laboratory tests on the individual."[316] Hence, one could argue, in light of *Diehr*, that the invention as a whole was really a statutory process (conducting laboratory tests) improved by the addition of a computer-implemented algorithm. The court held, however, that merely adding a "data gathering" step to an algorithm does not make the latter patentable subject matter.[317] "No mathematical equation can be used, as a practical matter, without establishing and substituting values for the variables expressed therein."[318]

In another case involving medical diagnosis, *Arrhythmia Research Technology, Inc. v. Corazonix Corp.*,[319] the Federal Circuit reached a contrary result. The invention in *Arrhythmia* concerned the analysis of electrocardiographic signals in order to predict a potentially dangerous heart condition.[320] In the claimed method, the signals were digitized and filtered, and certain characteristics of the signal were then compared to a standard value.[321] The computer performing the analysis could be a programmed general-purpose computer, a special-purpose computer, or "hard wired logic circuitry."[322] While most algorithm patentability cases stem from a Patent Office rejection, in this case an accused infringer raised the challenge. The district court granted summary judgment, finding that the claims failed to recite patentable subject matter under 35 U.S.C. §

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315. *Id.* at 840. *Cf. In re* Iwahashi, 888 F.2d 1370, 1375 (Fed. Cir. 1989) (upholding claim to "a combination of interrelated means" (computer circuitry) configured to execute an algorithm).

316. *Grams*, 888 F.2d at 836.

317. *See id.* at 839-40; *see also In re* Warmerdam, 33 F.3d 1354, 1360 (Fed. Cir. 1994).

318. *Grams*, 888 F.2d at 839 (quoting *In re* Sarkar, 588 F.2d 1330, 1335 (C.C.P.A. 1978)).

319. 958 F.2d 1053 (Fed. Cir. 1992).

320. *See id.* at 1055.

321. *See id.*

322. *Id.*

101.[323]

On appeal, the Federal Circuit reviewed the history of software patentability cases, including the so-called "*Freeman-Walter-Abele* test"[324] developed by the CCPA in response to the holdings of the Supreme Court trilogy. As summarized by the court:

> It is first determined whether a mathematical algorithm is recited directly or indirectly in the claim. If so, it is next determined whether the claimed invention as a whole is no more than the algorithm itself; that is, whether the claim is directed to a mathematical algorithm that is not applied to or limited by physical elements or process steps. Such claims are nonstatutory. However, when the mathematical algorithm is applied in one or more steps of an otherwise statutory process claim, or one or more elements of an otherwise statutory apparatus claim, the requirements of section 101 are met.[325]

The court assumed that a mathematical algorithm formed a part of the claimed process and proceeded to the second step of analysis—whether the process was "otherwise statutory."[326] The challenger argued that the process merely calculated a number, much like the process claimed in *Flook*,[327] but the court found the process more analogous to that discussed in *Diehr*.[328] The answer to the question "What did the applicant invent?" was, in this case, not "an algorithm" but "a method of analyzing electrocardiographic signals."[329] The signals were "not abstractions" because they "related to the patient's heart function."[330] Similarly, the "output [was] not an abstract number, but . . . a signal related to the patient's heart activity."[331] The claim did not preempt all uses of the algorithm, but only

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323. *See id.* at 1054.

324. Named after *In re* Freeman, 573 F.2d 1237 (C.C.P.A. 1978), *In re* Walter, 618 F.2d 758 (C.C.P.A. 1980), and *In re* Abele, 684 F.2d 902 (C.C.P.A. 1982).

325. *See Arrhythmia*, 958 F.2d at 1058. However, the court cautions that the *Freeman-Walter-Abele* test is not the *only* test of patentability, and, while it apparently describes a "safe harbor" for challenged claims, "failure to meet [the] test may not always defeat the claim." *Id.*

326. *Id.* at 1058-59.

327. *See id.* at 1060.

328. *See id.* at 1059.

329. *Id.*

330. *Id.*

331. *Id.*

its use in connection with a specific diagnostic procedure.[332]

The data analyzed by the claimed method was not an abstraction, but neither was the data analyzed in *Flook* or *Grams*. Although the algorithm in *Arrhythmia* could be described as only part of a larger process, the same could have been said in *Flook* and, perhaps, in the more abstract context of *Grams*. The different result reached in *Arrhythmia* may be explained, at least in part, by an increased emphasis on the *physical* aspects of data processing. The steps of the algorithm, observed the court, are "physical process steps that transform one physical, electrical signal into another."[333] The apparatus claims described "a combination of interrelated means" for performing the steps required by the process, including electronic devices like an analog-to-digital converter, a disc memory unit, and a programmed computer.[334] This hardware "transform[s] a particular input signal to a different output signal, in accordance with the internal structure of the computer as configured by electronic instructions. 'The claimed invention . . . converts one physical thing into another physical thing just as any other electrical circuitry would do.' "[335] The mathematical algorithm served to define the "electronic structure and operation of [the] apparatus."[336]

This focus on the physical aspects of computing continued in *In re Alappat*.[337] Alappat had invented a way of smoothing the appearance of lines on an oscilloscope display by illuminating selected picture elements at varying intensities.[338] A software algorithm determined the best way to display a particular line.[339] Alappat did not claim the algorithm directly. Instead, his Claim 15 refers to a "rasterizer" (a component of certain displays) that includes "means" for performing various

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332. *See id.*

333. *Id.* Moreover, "[t]he view that 'there is nothing necessarily physical about 'signals' is incorrect." *Id.*

334. *Id.* at 1060 (quoting *In re* Iwahashi, 888 F.2d 1370, 1375 (Fed. Cir. 1989)).

335. *Arrhythmia*, 958 F.2d at 1060 (quoting *In re Sherwood*, 613 F.2d 809, 819 (C.C.P.A. 1980)).

336. *Arrhythmia*, 958 F.2d at 1060.

337. 33 F.3d 1526 (Fed. Cir. 1994) (en banc).

338. *See id.* at 1537-38. When a display consists of a grid of picture elements in rows and columns, curved or diagonal lines appear "jagged." Alappat's "anti-aliasing" technique adds, in effect, "shades of gray" to produce fuzzier but smoother-looking lines. *Id.*

339. *See id.*

functions required by the algorithm. Such "means-plus-function" claim drafting is permitted by 35 U.S.C. § 112(6),[340] and a "means-plus-function" claim is construed to cover any apparatus that performs the recited functions using structures identical or equivalent to the structures described in the patent specification.[341] The "structures" described in Alappat's specification included conventional computer circuitry, such as an "arithmetic logic circuit," "barrel shifters," and a ROM (Read Only Memory).[342] The Patent Office rejected Alappat's claim as essentially an unpatentable process claim,[343] observing that Claim 15 could be read to cover *any* general-purpose computer (such as the one on which this article was composed), so long as it was programmed to carry out Alappat's procedure.[344] All that Alappat had invented was a mathematical algorithm.[345]

340.

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material or acts described in the specification and equivalents thereof.

35 U.S.C. § 112(6) (1994). This provision relieves the patent applicant of the burden of listing each and every structure that might serve as an element of an equivalent combination.

341. *See* King Instruments Corp. v. Perego, 65 F.3d 941, 945-46 (Fed. Cir. 1995); Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 934 (Fed. Cir. 1987) (en banc). The patent "specification" includes "a written description of the invention, and of the manner and process of making and using it." 35 U.S.C. § 112 ¶ 1 (1994). It must "enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention." *Id.*

342. *Alappat*, 33 F.3d at 1541.

343. *See In re* Alappat, 23 U.S.P.Q.2d 1340, 1344-45 (PTO Bd. Pat. Ap. & Int. 1992), *rev'd*, 33 F.3d 1526 (Fed. Cir. 1994). The Patent Office routinely ignored the limiting effect of § 112(6) and treated such claims as covering *all* structures that perform the recited functions, rather than only structures *equivalent* to those disclosed in the specification. The Federal Circuit finally put a stop to this practice. *See In re* Donaldson, 16 F.3d 1189, 1193 (Fed. Cir. 1994) (en banc). *But cf.*, *In re* Freeman, 573 F.2d 1237, 1247 (C.C.P.A. 1978).

> Though a claim expressed in 'means for' (functional) terms is said to be an apparatus claim, the subject matter as a whole of that claim may be indistinguishable from that of a method claim drawn to the steps performed by the 'means.' . . . [I]f allowance of a method claim is proscribed by *Benson*, it would be anomalous to grant a claim to apparatus encompassing any and every 'means for' practicing that very method.

Id.

344. *See* 23 U.S.P.Q.2d at 1345. "The disclosed ALU, ROM and shift registers are all common elements of stored program digital computers." *Id.*

345. *See id.* at 1346; *see also In re* Alappat, 33 F.3d 1526, 1565 (Fed. Cir. 1994) (Archer, J., concurring in part and dissenting in part).

The majority of the Federal Circuit's *en banc* panel disagreed, holding that the structures described by Alappat, when combined and configured to carry out the steps of the algorithm, formed a patentable "machine."[346] Even though the structures could be found in existing general-purpose computers, the programming could not be ignored: "[S]uch programming creates a *new machine*, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software."[347] Importantly, Alappat's invention was "not a disembodied mathematical concept which may be characterized as an 'abstract idea,' but rather a specific machine to produce a useful, concrete, and tangible result"[348]—i.e., an improved oscilloscope display.

The *Alappat* case resulted in six additional opinions, in which various combinations of judges concurred in, or dissented from, all or a portion of the majority's opinion. Judge Archer, who concurred in part[349] and dissented in part, compared Alappat's "new machine" to a compact disc player playing newly recorded music:

> Music of course is not patentable subject matter; a composer cannot obtain exclusive patent rights for the original creation of a musical composition. But now suppose the new melody is recorded on a compact disc. In such case, the particular musical composition will define an arrangement of minute pits in the surface of the compact disc material, and therefore will define its specific structure. . . .
>
> Through the expedient of putting his music on known structure, can a composer now claim as his invention the structure of a compact disc . . . and obtain a patent therefor? The answer must be no. The composer admittedly has invented or discovered nothing but music. The discovery of music does not become patentable subject matter simply because

346. *Alappat*, 33 F.3d at 1541 ("Claim 15 unquestionably recites a machine, or apparatus, made up of a combination of known electronic circuitry elements . . . ."). "Machine" is one of the categories of patentable subject matter listed in 35 U.S.C. § 101. *See* 35 U.S.C. § 101 (1994).

347. *Alappat*, 33 F.3d at 1545 (emphasis added).

348. *Id.* at 1544.

349. The concurrence related to a jurisdictional issue. *See id.* at 1545 (Archer, J., concurring in part and dissenting in part).

there is an arbitrary claim to some structure.[350]

Similarly, Alappat's superficial claim to "structure" did not reflect the nature of his invention, which was nothing more than a mathematical procedure for converting one set of data to another.[351] His computer, argued Judge Archer, was no more a "new machine" than a player piano that had switched from playing Chopin to Brahms.[352] "What is going on here," he said, "is a charade."[353]

Judge Rader agreed that the majority had overemphasized the status of the invention as a "machine," but, unlike Judge Archer, he concurred in the result.[354] Even if Alappat's invention were viewed as a *process*, it would be a patentable process in Judge Rader's view. The process may have been claimed in terms of a mathematical algorithm, but it was still a "useful art," not an abstraction of the kind condemned in *Benson* and *Flook*.[355]

> The limits on patentable subject matter within section 101 do not depend on whether an invention can be expressed as a mathematical relationship or algorithm. Mathematics is simply a form of expression—a language. . . .
>
> . . . [I]nventors may express their inventions in any manner they see fit, including mathematical symbols and algorithms. Whether an inventor calls the invention a machine or a process is not nearly as important as the invention itself.[356]

Judge Newman also concurred, in an opinion emphasizing the importance of robust patent protection in developing fields

350. *Id.* at 1553-54 (Archer, J., concurring in part and dissenting in part).

351. *See id.* at 1563-64. "Alappat's claimed invention . . . is not the invention or discovery of a machine. The presence of structure on the face of the claims does not *ipso facto* make the claimed invention or discovery one of statutory subject matter." *Id.* at 1561. "The majority's simplistic approach of looking *only* to whether the claim reads on structure and *ignoring* the claimed invention or discovery for which a patent is sought will result in the awarding of patents for discoveries well beyond the scope of the patent law." *Id.* at 1554.

352. *See id.* at 1567.

353. *Id.* at 1564.

354. *See id.* at 1581 (Rader, J., concurring).

355. *See id.* at 1583. Citing Article 1, Section 8 of the Constitution, Judge Rader stated that the Patent Office "has no justification within the Patent Act to ignore algorithmic processes or machines as 'useful Arts' within the scope of section 101." *Id.*

356. *Id.*

of technology.[357]

The *Alappat* decision, however controversial, marked an important milestone in the post-*Benson* expansion of software patent protection. The sharp disagreement among the judges of the Federal Circuit shows how little had been settled by the Supreme Court trilogy and the cases that followed. Whatever its failings, *Alappat* established a reasonably bright line between unpatentable algorithms and patentable applications. All the applicant must do under *Alappat* is draft the claims in terms of the physical hardware that performs the steps of the algorithm, and the result will be a "new machine." This may seem an extreme reading of *Alappat*, which does include some qualifying language,[358] but it is born out in at least two subsequent cases. In *In re Warmerdam*,[359] the Federal Circuit held unpatentable a method claim on constructing a "bubble hierarchy" defining the space around an object.[360] With respect to the *apparatus* claim, the court held that "[c]laim 5 is for a machine, and is clearly patentable subject matter."[361] Yet the apparatus claim said merely, "A machine having a memory which contains data representing a bubble hierarchy generated by the method of any of [unpatentable] Claims 1 through 4."[362] In *In re Trovato*,[363] the Federal Circuit initially rejected an apparatus claim consisting of various "means" for computing a "least cost path" in an abstract "space" representing certain variables.[364] Because of the lack of disclosure of any physical apparatus, the court found the apparatus claim to be merely a "guise" for an

357. *See id.* at 1570-71 (Newman, J., concurring).

358. The majority suggests, obliquely and without explanation, that a claim to a structure might be rejected if it were merely a "guise" for an abstract mathematical process. *See Alappat*, 33 F.3d at 1540-41. Judge Archer seized on this suggestion as a potential opening for the kind of analysis he favored, but criticized the majority for its failure to elaborate. *See id.* at 1568 n.30 (Archer, J., concurring in part and dissenting in part).

359. 33 F.3d 1354 (Fed. Cir. 1994). Although *Warmerdam* appears before *Alappat* in the Federal Reporter, it bears a decision date of August 11, 1994, subsequent to *Alappat*'s date of July 29, 1994. The *Warmerdam* opinion makes explicit reference to *Alappat*. *See id.* at 1358.

360. *See id.* at 1355-56. "Bubble hierarchies" are used in applications such as automatic collision avoidance for industrial robots, but, significantly, the challenged claim did not recite any such specific, technological use. *See id.* at 1355-58.

361. *Id.* at 1360.

362. *Id.* at 1358.

363. 42 F.3d 1376 (Fed. Cir. 1994), *vacated and remanded*, 60 F.3d 807 (Fed. Cir. 1995) (en banc).

364. *Trovato*, 42 F.3d at 1377-78, 1383.

unpatentable algorithm claim.[365] However, the Federal Circuit *en banc*, in a *per curiam* opinion,[366] granted the applicant a rehearing, vacated the earlier opinion, and remanded (*sua sponte*) for further consideration in light of *Alappat* and the Patent Office's *Proposed Examination Guidelines for Computer-Implemented Inventions*[367] (hereinafter, the "Guidelines"). This procedure was unorthodox since the Guidelines do not have the force of law and *Alappat* had been mentioned and distinguished in the prior opinion.[368] The purpose seems to have been to preserve the sense of certainty created by *Alappat*.

The Patent Office blazed its own new path in the Guidelines. For years the Patent Office had taken a relatively hard line on the patentability of software inventions, and its rejections were often reversed by the CCPA or the Federal Circuit.[369] The Guidelines signaled a change in policy, seen most dramatically in the treatment of software inventions claimed as the *physical medium* (such as a floppy disk or ROM) on which the software is stored.[370] In this context, the Guidelines distinguish between "functional descriptive material" and "nonfunctional descriptive material." [371] The former "consists of data structures and computer programs which impart functionality [i.e., which cause a computer to *do* something] when encoded

365. *See id.* at 1382-83. "[A]ll the disclosed means are simply software instructions; no 'structure' appears in the specification as required under § 112, ¶ 6." *Id.* at 1382.

366. *See Trovato*, 60 F.3d at 807.

367. Examination Guidelines for Computer Related Inventions, 61 Fed. Reg. 7478 (1996), *reprinted in* 17 J. MARSHALL L. REV. 311 (1998) [hereinafter Guidelines]. *See Trovato*, 60 F.3d at 807.

368. This was pointed out in a strongly worded dissent by two of the three panelists who took part in the original *Trovato* decision. *See Trovato*, 60 F.3d at 808 (Nies & Michel, JJ., dissenting).

369. See, e.g., the cases discussed *supra* at Part II.A-B.

370. A floppy disk, as a physical object, may be claimed as a "manufacture" under § 101, and a floppy disk on which a new program has been recorded is, in a minute sense, physically different than other floppy disks due to the unique alignment of the magnetic particles that store the information. The Federal Circuit missed a chance to rule on the patentability of floppy disk/program claims in *In re Beauregard*, 53 F.3d 1583 (Fed. Cir. 1995). The Patent Office Board rejected a floppy disk claim as violative of the printed matter doctrine, discussed *infra* at note 403 and accompanying text, but changed its mind before the Federal Circuit could rule. *Beauregard*, 53 F.3d at 1584 ("The Commissioner now states 'that computer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101 . . . .' "). Since there was no longer a controversy, the case was dismissed.

371. Guidelines, *supra* note 367, § 2106(IV)(B)(1).

on a computer-readable medium."[372] Such material is "structurally and functionally interrelated to the medium" on which it is stored, and it will be considered statutory in most cases.[373] "Non-functional descriptive material" includes "music, literary works and . . . compilation[s] or mere arrangement[s] of data" that may be *recorded* on a medium such a floppy disk, but that are not "functional" in the same sense.[374] The latter cannot be patented.[375] These Guidelines take the *Alappat* "new machine" concept even further into the realm of software; this means, in effect, that any "functional" software is likely to be treated as patentable subject matter if the claim is properly drafted.

After *Benson* and *Flook*, the subject-matter door to software patentability seemed firmly shut; now it opens wide. But because the "mathematical algorithm" issue no longer bars most software patents, there must be a renewed focus on any limits still imposed by the "useful arts" stricture of the Constitution. The analysis of the former issue lends some insights into the latter. For example, an emphasis on physical hardware, storage media, and "electrical signals" may be as relevant to identifying "technology" as to distinguishing between an abstract principle and a concrete application. Before undertaking that analysis, however, we must add a final piece to the puzzle. Many of the newer software patent applications concern innovations in business, a field that is not a "useful art" as defined *supra* in Part I.D. Hence, it is worth reviewing briefly the treatment of business methods, and tools for doing business, as patentable subject matter.

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372. *Id.*

373. *Id.*

374. *Id.* Distinguishing between what is "functional" and "nonfunctional" may prove difficult. For example, is software that plays a predetermined melody "nonfunctional" like a compact disk? What if the software generates its own melodies using an algorithm? Moreover, the line between program and data is not always crystal clear. One of the characteristics of the standard von Neumann computer architecture is the common treatment of instructions and data. *See* BOLTER, *supra* note 2, at 39

> The genius of the von Neumann machine is that the program (operating instructions) and the data are stored in the same binary code and loaded together into the memory, and this coding means that the program can be altered as easily as the data, indeed, that there is no logical difference between the two.

Id.

375. Guidelines, *supra* note 367, § 2106(IV)(B)(1).

III. PATENTING BUSINESS

Courts were considering the patentability of business systems long before the dawn of the "information age." Such systems were often claimed in terms of the printed documents by which they were implemented. In *Hotel Security Checking Co. v. Lorraine Co.*,[376] the plaintiff's patent claimed a "method of and means for" preventing theft by restaurant waiters.[377] Numbered slips kept track of the orders filled by each waiter for comparison to the cash receipts at the end of the day; any waiter who pocketed a customer's payment would be discovered.[378] The claims referred in a general way to the composition of the printed forms and the manner in which they were to be used.[379] The court observed that the system was "not a machine, manufacture, or composition of matter"; at best, it was an "art."[380] Yet the term "art" did not embrace a "mere abstraction," which a "system of transacting business" would be if "disconnected from the means for carrying [it] out."[381] The physical "means" in this case consisted of printed forms, pen and ink, which the court held insufficient to support patentability. Apart from the manner of their use, they were not *new*.[382] As to their use, the court wrote, "[t]he fundamental principle of the system is as old as the art of bookkeeping."[383] Unfortunately, the court's reliance on novelty rendered moot the more interesting subject matter issue: Was the claimed system a patentable "means" or an unpatentable "abstraction?"[384]

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376. 160 F. 467 (2d Cir. 1908).

377. *Id.*

378. *See id.* at 467-68.

379. *See id.* at 468-69.

380. *Id.* at 469. On the meaning of "art" as a category of patentable subject matter, see *supra* Part I.B.

381. 160 F. at 469.

382. *See id.*

383. *Id.*

384.

> If at the time of Hick's application, there had been no system of bookkeeping of any kind in restaurants, we would be confronted with the question whether a new and useful system of cash-registering and account-checking is such an art as is patentable under the statute. This question seems never to have been decided by a controlling authority and its decision is not necessary now unless we find that Hicks has made a contribution to the art which is new and useful. We are decidedly of the opinion that he has not . . . .

Id. at 472. *See also* United States Credit Sys. Co. v. American Credit Indem. Co., 59 F. 139 (2d Cir. 1893) (finding nothing novel in printed forms to be used by insurer in clas-

In *Cincinnati Traction Co. v. Pope*,[385] the invention concerned time-limited transfer tickets for railways and the like. The claims described a perforated ticket, a portion of which could be torn off if the ticket were issued in the morning. This prevented a passenger with a morning ticket from using it to transfer in the afternoon.[386] The defendant argued that the patent claimed only "a method of transacting business, a form of contract, a mode of procedure, a rule of conduct, a principle or idea, or a permissive function, predicated upon a thing involving no structural law."[387] Although considering it a close question, the court disagreed, finding the ticket a "manufacture"[388] because of its physical structure.[389] Other cases involving coupon books and similar printed items reached the same result. For example, in *Rand, McNally & Co. v. Exchange Scrip-Book Co.*,[390] the patent involved transportation tickets issued in increments of money instead of miles, which allowed the same tickets to be conveniently used for different modes of transportation.[391] The ticket itself consisted of a ribbon or strip of perforated paper folded into a book.[392] The court rejected the argument that the claim was for nothing more than a business method:

> The ticket patented is not a method at all, but a physical tangible facility, without which the method would have been impracticable, and with which it is practicable. And this is the status of thousands of like facilities that, once designed and put into use, have become the first of a new business method;

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sifying risks, but failing to reach the issue of whether the patentee's business method could be patentable subject matter).

385. 210 F. 443 (6th Cir. 1913).

386. *See id.* at 444-46.

387. *Id.* at 446 (citation omitted).

388. "The term 'manufacture,' as used in the patent law, has a very comprehensive sense, embracing whatever is made by the art or industry of man, not being a machine, a composition of matter, or a design." *Id.* (citation omitted).

389. *See id.*

390. 187 F. 984 (7th Cir. 1911); *see also* Thompson v. Citizens' Nat'l Bank, 53 F. 250, 255 (8th Cir. 1892) (holding bank books with perforated and foldable pages to constitute patentable subject matter); Benjamin Menu Card Co. v. Rand, McNally & Co., 210 F. 285, 286 (N.D. Ill. 1894) (holding a perforated combination of menu card and meal check to be patentable subject matter; "[t]he fact that the structure may be of cardboard with printed matter upon it does not exclude the device from patentability.").

391. *See* 187 F. at 984-85.

392. *See id.* at 986.

and patents on such facilities have been sustained.[393]

On the other hand, in *In re Moeser*,[394] the Court of Appeals for the District of Columbia held that the Patent Office properly rejected claims to a type of insurance contract involving payments for burial. Although the contracts would be printed on paper, the court found "no physical construction or combination that can convert it from a mere contract into a tangible device or manufacture."[395] Moreover, "[t]he form of such contracts or proposals for contracts, devised or adopted as a method of transacting a particular class of this business, is not patentable as an art."[396]

In *Guthrie v. Curlett*,[397] the patent claimed a "consolidated tariff index," which combined tariff information for a number of railroads into one convenient source and conveyed the information by a system of symbols.[398] The court held that the invention was not a "manufacture" but an "art," and not the kind of art protected under the patent laws.[399] Patent law, said the court, is "prosaically practical" and allows only protection of the *means* for carrying out an idea.[400] One can monopolize a business system only by patenting such means.[401]

> In this case, however, no *means* are suggested for making a *consolidated* index, except the employment of symbols. There was a time, say that of Cadmus, when the alphabet was patentable; but we decline to see anything now patentable in suggesting that a railway be called A or canned goods C.
>
> The patentee may and does *call* what he produces a manufacture, to wit, a book of so many leaves and a given amount of print thereon; but the question is not what an interested party calls it, but what *is* it, and we consider the only possibly novel part of it, what might be called the *plot* of the work—i.e., the story revealed, and that can be copyrighted, but not

393. *Id.*

394. 123 U.S. Pat. Off. Official Gazette 655 (D.C. Cir. 1906).

395. *Id.* at 656.

396. *Id.* The court also held that if the contracts were patentable subject matter, the patent could still be denied for lack of novelty. *See id.*

397. 10 F.2d 725 (2d Cir. 1926).

398. *Id.* at 725-26.

399. *Id.* at 726.

400. *Id.*

401. *See id.*

patented.[402]

These cases come to different conclusions, but they ask the same question: Is the invention an abstract *idea* about doing business, or is it a tangible *means*, equivalent to a time clock or a cash register, which is patentable subject matter even if it happens to be *used* in business.[403]

The Patent Office Board maintained a similar distinction in *In re Murray*,[404] where the applicant claimed an accounting method. The steps of the method included "entering" data and "sorting," "correlating," and "sub-totaling" expenditures,[405] giving it the character of an unpatentable "mathematical algorithm."[406] But the Board also held the claims unpatentable as a "method of doing business":

> Considering the claimed method as a whole, it becomes apparent that appellant is seeking patent protection on a method of conducting business, or providing a banking service, between a financial institution and its customers . . . .
>
> While it may in some situations be problematic to ascertain what falls within the penumbra of the judicially pr[o]scribed "method of doing business," we find no such difficulty in the present case. We are convinced that the claimed accounting method . . . is, on its very face, a vivid example of

402. *Id.* at 726-27. The court distinguished *Cincinnati Traction*, *see supra* text accompanying notes 385-89, observing that "a ticket is a form, made once and used any time; it may truthfully be called a physical facility, as much so [as] the punch that cancels it." *Id.* at 727. The index, however, must repeatedly change since the only constant is the method of compiling it. *See id.*

403. Tickets, forms, and indexes also raise issues under the "printed matter" exception to patentability, which holds that a new writing does not create a new and patentable "manufacture." *See In re* McKee, 64 F.2d 379 (C.C.P.A. 1933); *In re* Russel, 48 F.2d 668, 669 (C.C.P.A. 1931). One could not patent a novel, even though the book is a tangible item and "new" (*physically* and conceptually) because of the author's text. On the other hand, if there is a *functional* relationship between the printed matter and the "substrate," the combination may be patentable. One such case involved measuring cups that were deliberately mislabeled for the convenience of cooks making fractional recipes. *In re* Miller, 418 F.2d 1392 (C.C.P.A. 1969). The Patent Office Guidelines draw a similar distinction between "functional descriptive material" and "non-functional descriptive material" stored on a computer-readable medium. *See supra* notes 369-75. The printed matter rule may reflect an intuitive understanding of the difference between the subject matter of copyright and patent law and, perhaps, of the "useful arts" limitations of the latter. It may also have some relation to the "mental steps" doctrine, discussed *supra* at Part II.A.

404. 9 U.S.P.Q.2d 1819 (Pat. Off. Bd. App. & Int. 1988).

405. *Id.* at 1820.

406. *Id.* at 1821.

> the type of "method of doing business" contemplated by our review court as outside the protection of the patent statutes.[407]

Echoing the method/means distinction, the Board acknowledged that "an apparatus or system[408] capable of performing a business function may comprise patentable subject matter," even if "a method of doing business generated by the apparatus or system is not."[409]

The issue of business system patentability came before the CCPA on several occasions, but each time the court relied on alternative grounds, leaving the subject matter question for another day.[410] In *dicta*, however, the court did lend support to the "business methods exception."[411] Such *dicta* continued after the CCPA became the Federal Circuit. In *Grams*, for example, the court declared that "mathematical algorithms join the list of non-patentable subject matter not within the scope of section 101, *including methods of doing business*, naturally occurring phenomenon, and laws of nature."[412] Judge Rich, one of the

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407. *Id.* at 1820 (footnote omitted).

408. It is not clear what the Board meant by "system." A "system" can mean an abstract method or a physical apparatus. The Board did make specific reference to the computer "system" at issue in *Paine, Webber, Jackson & Curtis v. Merrill Lynch*, 564 F. Supp. 1358 (D. Del. 1983), discussed *infra* at notes 498-511 and accompanying text.

409. *Murray*, 9 U.S.P.Q.2d at 1821.

410. *See, e.g., In re* Fox, 471 F.2d 1405, 1406 (C.C.P.A. 1973) ("We affirm on grounds of obviousness and will not discuss the non-statutory subject matter issue."); *In re* Howard, 394 F.2d 869, 872 (C.C.P.A. 1968) ("Our affirmance . . . [on grounds of lacking novelty] makes it unnecessary to consider the issue of whether a method of doing business is inherently unpatentable."); *In re* Wait, 73 F.2d 982, 983 (C.C.P.A. 1934) ("[E]ven conceding, without holding, that some methods of doing business might present patentable novelty, we think such novelty is lacking here . . . ."); *see also In re* Wiechers, 347 F.2d 608, 611 (C.C.P.A. 1965) (finding that the Patent Office rejection relied on novelty and, therefore, that subject matter issue was not before the court). In *In re Patton*, the court pronounced business systems unpatentable, but only as a prelude to discussing whether the applicant's structures were novel. *See In re* Patton, 127 F.2d 324, 327-28 (C.C.P.A. 1942).

411. *See, e.g., In re* Chatfield, 545 F.2d 152, 157 (C.C.P.A. 1976) ("Some inventions, however meritorious, do not constitute patentable subject matter, e.g., . . . methods of doing business . . . ."); *Patton*, 127 F.2d at 327 ("[A] system of transacting business, apart from the means for carrying out such a system, is not within the purview of [patentable subject matter] . . . .").

412. *In re* Grams, 888 F.2d 835, 837 (Fed. Cir. 1989); *see also In re* Alappat, 33 F.3d 1526, 1541 (Fed. Cir. 1994) (en banc).

> We further note that *Maucorps*[, 609 F.2d 481 (C.C.P.A. 1979),] dealt with a business methodology for deciding how salesmen should best handle respective customers and *Meyer*[, 688 F.2d 789 (C.C.P.A. 1982),] involved a 'system' for aiding a neurologist in diagnosing patients. Clearly, neither of the alleged 'inventions' in

drafters of the 1952 Patent Act as well as a CCPA and Federal Circuit judge of long tenure, remarked in a 1960 article that "one of the greatest inventions of our time, the diaper service" could not be patented.[413] Patent law treatises also support the business methods exception.[414] In section 706.03(a) of the *Manual of Patent Examining Procedure* (MPEP), the Patent Office formalized the rejection of claims to business methods.[415]

But the exception has long had its critics. In 1934, patent attorney George E. Tew acknowledged the exception as "probably settled by long practice and many precedents" but denounced "the absence in decided cases of any logical or statutory reason . . . why [methods of doing business] are unpatentable."[416] More recently, commentators have criticized the exception as logically unsound, inconsistently applied, and unsupported by the cited precedent.[417] These critics found an

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those cases falls within any § 101 category.

Id.

413. Rich, *supra* note 22, at 393-94.

> Of course, not every kind of an invention can be patented. Invaluable though it may be to individuals, the public, and national defense, the invention of a more effective organization of the materials in, and the techniques of teaching a course in physics, chemistry, or Russian is not a patentable invention because it is outside of the enumerated categories . . . [in § 101]. Also outside that group is one of the greatest inventions of our time, the diaper service."

Id.

414. *See, e.g.*, CHISUM ON PATENTS, *supra* note 45, § 1.03[5] ("The decisions hold that business 'plans' and 'systems' are not patentable . . . ."); ERNEST BAINBRIDGE LIPSCOMB III, LIPSCOMB'S WALKER ON PATENTS § 2.17 (3d ed. 1984).

> As instances of the non-patentability of ideas, mention may be made of the various systems of doing business, such as modes of bookkeeping and hotel checking systems. It has been held that a 'system' or method of transacting business is not an 'art,' nor does it come within any other designation of patentable subject matter . . . .

Id.

415. "Though seemingly within the category of process or method, a method of doing business can be rejected as not within the statutory classes." MANUAL OF PATENT EXAMINING PROCEDURE § 706.03(a) (1994).

416. Tew, *supra* note 17, at 607. While conceding, if not approving, the existence of the rule, Tew suggests a

> distinction . . . between a method *of* doing business and a method *used* in doing business, because many patentable processes, those found in telegraphy and telephony for example, are used in doing business, and in a larger sense substantial portions of the whole field of patentable processes are used in doing business of some sort.

Id. at 608.

417. *See* del Gallo, *supra* note 17, at 435 ("[T]he 'business method exception' . . . has always been a chimera. . . . The so-called 'business method' cases, without exception, have been decided on grounds other than subject matter eligibility such as nov-

ally in Judge Newman of the Federal Circuit who, in her dissenting opinion in *In re Schrader*,[418] called for the abolition of the business methods exception in its entirety. Calling the exception "fuzzy" and "an unwarranted encumbrance to the definition of statutory subject matter in section 101," she proposed that it be "discarded as error-prone, redundant, and obsolete."[419] She dismissed the cases cited in support of the exception, finding that they had been decided, or could have been decided, on other statutory grounds such as novelty or obviousness.[420] At best, those cases "simply reaffirm that the patent system is directed to tangible things and procedures, not mere ideas."[421] Nothing would be served, she felt, by perpetuating a rule as "poorly defined, redundant and unnecessary" as the business methods exception to patentable subject matter.[422]

The Patent Office eventually concurred. In its 1996 Guidelines,[423] the Patent Office reversed its former position, stating: "Office personnel have had difficulty in properly treating claims directed to methods of doing business. Claims should not be categorized as methods of doing business. Instead, such claims should be treated like any other process claims . . . ."[424] The Patent Office deleted its former negative remarks in section 706.03(a) of the MPEP.[425] In the *State Street* case,[426] discussed extensively *infra* at Part IV.B, the Federal Circuit finally addressed the business methods exception head on. Like the commentators, the court found the precedent weak and the rationale unconvincing. Business methods, the court held, should be judged by the same standards of patentability as any other methods.[427] Taking its cue from Judge Newman, the court

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elty, definiteness or obviousness."); E. Robert Yoches & Howard G. Pollack, *Is the "Method of Doing Business" Rejection Bankrupt?*, 3 FED. CIR. B.J. 73, 83-84 (1993).

418. 22 F.3d 290 (Fed. Cir. 1994). The case is discussed in detail *infra* notes 512-518 and accompanying text.

419. *Id.* at 298.

420. *See id.*

421. *Id.*

422. *Id.*

423. *See supra* notes 369-375 and accompanying text.

424. Guidelines, *supra* note 367, § 2106.

425. *See* MANUAL OF PATENT EXAMINING PROCEDURE, *supra* note 415, § 706.03(a).

426. State St. Bank & Trust Co. v. Signature Fin. Group, 149 F.3d 1368 (Fed. Cir. 1998).

427. *See id.* at 1377. "Whether the claims are directed to subject matter within § 101 should not turn on whether the claimed subject matter does 'business' instead of something else." *Id.*

seized the "opportunity to lay this ill-conceived exception to rest."[428]

Critics of the business methods exception are right to expose the weakness of the precedent usually relied upon to support it. As already discussed, most if not all of the "precedent" can be dismissed as *dicta*. Yet, as with most ideas in patent law that have since been declared "obsolete," there was a kernel of truth in the exception, however ill-expressed. Judge Newman identified that kernel as the difference between "tangible things and procedures" and "mere ideas."[429] Reference to what is "tangible" recalls the *Cochrane v. Deener* definition of "process,"[430] which seems genuinely outmoded in an age of information.[431] A better expression of the principle rests on the distinction between those arts that are technological "useful arts" and those that are not. A patent on a non-technological[432] method of conducting business should be rejected, not because it is "intangible" (some technological arts, such as cryptography, are quite "intangible") or an "abstract idea" (some business plans are so detailed and practical that they are hardly "abstract"), but because it is not within the "useful arts." On the other hand, an apparatus or method *used* in a business should be patentable if it is the product of a technological "useful art." An improved telephone for executives should be patentable, as should a new method of carbonating a profitable beverage. This distinction follows the method/means dichotomy expressed, for example, in *Murray*,[433] while affording it a firmer logical and constitutional basis. Rather than abandon the business methods exception entirely, it would be better to recast it in terms of the "useful arts."

It is curious that the author of the opinion "laying to rest" the business methods exception was Judge Rich, who years before commented on the unpatentability of the diaper service.[434] He might have explained what caused him to change his mind, or, if he had not changed his mind, what distinguishes the dia-

428. *Id.* at 1375.

429. *In re* Schrader, 22 F.3d 290, 298 (1994).

430. *See supra* notes 243-246, 280-281 and accompanying text.

431. *See infra* Part IV.C.

432. *See supra* Part I.C-D.

433. *See In re* Murray, 9 U.S.P.Q.2d 1819, 1821 (Pat. Off. Bd. App. & Int. 1988); *supra* notes 404-409 and accompanying text.

434. *See* Rich, *supra* note 22, at 393-94; *supra* note 413 and accompanying text.

per service from any other business plan. In *State Street*, the Federal Circuit seized its chance to slay the business methods exception, but it lost a chance to address the more fundamental "useful arts" issue. Other opponents of the business methods exception, in an academic or judicial context, also overlook the "useful arts" question. But it is a critical issue. Those who advocate the abandonment of the business methods exception say that it is unprecedented, unsupported by congressional action, and contrary to the "anything under the sun that is made by man"[435] spirit of § 101. Those criticisms, however, have no force if the principle behind the business methods exception is of *constitutional* dimensions.[436] Even if the exception is erased as far as § 101 is concerned, the language of Article I Section 8 still must be reckoned with.

The *State Street* court observed, in a footnote, that "[a]ny historical distinctions between a method of 'doing' business and the means of carrying it out blur in the complexity of modern business systems."[437] This is a valid point, particularly if "modern business systems" refers to computers. Computer software is both a *plan* for doing something and a *tool* for doing it,[438] a situation that complicates, not only a method/means distinction, but also a technological/non-technological distinction, at least where the plan itself has no claim to technological status. This brings us to the heart of the matter: In an age where computers are becoming a dominant tool even in the non-technological arts, what kinds of computer-implemented inventions should or should not be patentable under the rubric of "useful arts"?

IV. COMPUTERS AND THE NONTECHNOLOGICAL ARTS

Patent attorneys often keep a collection of unusual patents to amuse themselves and colleagues. Some of these are simply strange ideas, like the patent on the cow-shaped pitcher that "moos" when the cream is poured.[439] But some of the most star-

435. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952)).

436. *See supra* notes 29-33 and accompanying text.

437. State St. Bank & Trust Co. v. Signature Fin. Group, 149 F.3d 1368, 1376 n.13 (Fed. Cir. 1998). The remark is an uncredited quotation of Judge Newman's *Schrader* dissent. *See In re* Schrader, 22 F.3d 290, 298 (1994).

438. *See supra* Part I.E.

439. U.S. Patent No. 5,213,234. Many patents in a similar vein can be found in

tling patents in such collections are those that challenge one's conception of the "useful arts." A notorious example discloses a method of lifting a box.[440] Another claims a "method of putting."[441] Such patents are "collectable" because they are exceedingly rare and, perhaps, reflect inevitable slips in the Patent Office machinery that processes a tremendous volume of patent applications. A far more serious challenge to the concept of "useful arts" has arisen as applicants claim non-technological ideas in terms of the computers used to implement them. At first glance, some of these patents seem equally out of place—for example, U.S. Patent No. 5,809,484, which concerns a plan for funding an education through investors who ultimately receive a share of the student's future income. Described at this level, the invention hardly seems what the Framers had in mind. In fact, however, the patent claims a "method and apparatus" for implementing the plan, and the specification bristles with impressive technical descriptions of computer hardware and software.[442] Perhaps such "means" should be patentable even if the abstract idea itself would not be.

Such patents have not been the subject of as rich a jurisprudence as those raising the specter of the "mathematical algorithm." For the most part, the relevant cases deal with computer-implemented business schemes, culminating in the recent *State Street* decision of the Federal Circuit.

A. The Road to State Street

Computer technology and printed paper technology, reminiscent of *Hotel Security*[443] or *Guthrie v. Curlett*,[444] came together in *In re Johnston*.[445] The invention concerned automated record-keeping systems of the kind used by banks. Such sys-

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RICK FEINBERG, PECULIAR PATENTS, A COLLECTION OF UNUSUAL AND INTERESTING INVENTIONS FROM THE FILES OF THE U.S. PATENT OFFICE (1994). More are reproduced on-line. *See, e.g.*, Michael J. Collins, *Wacky Patent of the Month* (visited Sept. 28, 1999) <http://www.colitz.com/site/wacky.htm>; IBM, *Gallery of Obscure Patents* (visited Sept. 28, 1999) <http://www.patents.ibm.com/gallery>.

440. U.S. Patent No. 5,498,162.

441. U.S. Patent No. 5,616,089.

442. U.S. Patent No. 5,809,484.

443. Hotel Sec. Checking Co. v. Lorraine Co., 160 F. 467 (2d Cir. 1908).

444. 10 F.2d 725 (2d Cir. 1926); *see supra* notes 397-403 and accompanying text.

445. 502 F.2d 765, 771 n.12 (C.C.P.A. 1974), *rev'd sub nom.* Dann v. Johnston, 425 U.S. 219 (1976) (relying on obviousness rather than unpatentable subject matter).

tems employ digital computers, optical character readers, and paper checks printed with magnetic, machine-readable codes.[446] The applicant proposed adapting such a system to assist individuals with their own financial record keeping, tracking expenditures according to category much as personal accounting software like Quicken does today. The customer would indicate on each check a code number corresponding to an expense category—the number either in machine readable form or handwritten and converted by the bank. After processing, the expense data would be stored in the bank's computer and used to prepare detailed reports for the customer.[447] The application included diagrams showing the interrelationship of various hardware components, a detailed software flow chart,[448] and a complete printout of a program to be used with an IBM general-purpose computer.[449]

The claims described the invention as a "record-keeping *machine* system for financial accounts," including, among other things, input and output devices, a data processor, a control system, and a memory.[450] The bookkeeping aspects of the invention were incorporated in the claims by reference to the "records" stored in the memory, the record-handling capabilities of the control system, and the organizing and listing capabilities of the "output record producing means."[451] The Patent Office Board held that the claims were "not directed to improved record keeping machinery, but rather to a broad system of keeping financial records."[452] The "sweeping" references to automation were "only . . . a dress for claims that spell out, in effect, the relationship of a bank and its customers, not any particular configuration of business machinery."[453] The Board rejected the claims for obviousness, indefiniteness, and failure to claim patentable subject matter.[454] With respect to the last ground, the Board declared that computer-related inventions are patent-

446. *See* 502 F.2d at 765-66.
447. *See id.* at 766.
448. *See supra* notes 210-212 and accompanying text.
449. *Johnston*, 502 F.2d at 767.
450. *Id.*
451. *Id.*
452. *Id.* at 768.
453. *Id.*
454. *See id.* at 768-69.

able subject matter only if within the "technological arts."[455] The Board observed that "the term 'technological arts' should [not] embrace processes of using machines so as to dominate practices in the 'liberal arts,' such as social or political sciences, humanities, music and art."[456] Claims to such processes "would allow the intrusion of the patent system into the social sciences . . . [and] would exceed the constitutional grant of authority to issue patents."[457] Such was the case here, according to the Board, because the effect of the "machine" claim would be to prevent banks from using their own computers to expand into the business of customer bookkeeping.[458]

In an opinion prefiguring *Alappat*,[459] the CCPA focused on the literal language of the claims, which described the invention as a "machine system."[460] Such a "machine system," the court held, is clearly within the "technological arts."[461] "[W]e are not aware of, nor can we locate, any dictionary which would define a *machine* system as within the purview of the 'liberal arts.' "[462] Contrary to the understanding of the Board, the claims covered only an apparatus, not a system of banking or a method of bookkeeping, and they would not prevent banks from expanding their services *except* through the use of such an apparatus.[463]

Judge Rich dissented, unsatisfied with the majority's reliance on *apparatus* claims to distinguish *Benson*. Whether the claims describe an apparatus or a process,

> [t]he point is that the machine or apparatus and process claims are really directed to the same invention, of which ap-

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455. *Id.* at 769.

456. *Id.*

457. *Id.*

458. *See id.*

459. *See supra* notes 337-357 and accompanying text.

460. *Johnston*, 502 F.2d at 770. Because the claims described an *apparatus*, the court held that the "mathematical algorithm" rule of *Benson* did not apply. *Id.* at 771. *See supra* notes 264-282 and accompanying text.

461. 502 F.2d at 771.

462. *Id.* Citing *Waldbaum*, the court reaffirmed that "[t]he phrase 'technological arts,' . . . is synonymous with the phrase 'useful arts' as it appears in Article I, Section 8 of the Constitution." *Id.* at 771 n.12. The court did not agree with the Board that banking is a "social science." *Id.* at 771 n.13. This does not, however, settle the question of whether banking is a "technological art."

463. *See id.* at 771. Of course, if the apparatus were claimed solely in terms of the service it enabled or were limited only to computers performing that service, another bank would have no other "apparatus" to which it could possibly turn.

pellant's main brief says:

> . . . this invention is being sold as a computer program to banks and to other data processing companies so that they can perform these data processing services for depositors."
>
> What could more clearly reveal the reality that the invention is a program—software—and that that is what appellant wants to protect by the appealed 'machine system' claims? Appellant did not invent a machine—i.e., "hardware."[464]

Judge Rich discussed the argument that a new computer program makes a "new machine"—the same argument that, years later, would figure prominently in his *Alappat* majority opinion. He "[did] not deny[] the validity of this principle,"[465] but "knowing the *invention* to be a new program," he could not distinguish the case from *Benson* based only on the superficial form of the claim.[466] "Benson et al. had a program invention too and they could have cast their claims in machine system form just as appellant did. Every competent patent draftsman knows how to do that."[467]

In *In re Deutsch*,[468] the applicant claimed a method of operating manufacturing plants by monitoring certain data, such as materials and energy cost, and using that data to optimize the production and coordination of multiple plants. The method could be implemented through a general-purpose computer or, possibly, through other means such as a hard-wired, special-purpose computer.[469] Relying on *Benson* and its prohibition of mathematical "algorithms," the Patent Office Board rejected the claims as consisting of unpatentable subject matter.[470] The CCPA reversed, holding that the applicant's claimed invention was not an algorithm, but a system of operating manufacturing plants; "[t]he 'processing' programs, if such they are, are incidental to the invention."[471] Whether the claim described a non-

464. *Id.* at 773 (Rich, J., dissenting) (omission in original).

465. *Id.* He did, however, remark cryptically that the "new machine" principle "partakes of the nature of a legal fiction when it comes to drafting claims." *Id.*

466. *Id.*

467. *Id.*

468. 553 F.2d 689 (C.C.P.A. 1977).

469. *See id.* at 692-93.

470. *See id.* at 691-92.

471. *Id.* at 692.

statutory "method of doing business" was discussed at oral argument.[472] The court held that it did not because it did not "merely facilitate business dealings."[473] In addition to that puzzling remark, the court stated: "That translation of business data into mathematical language intelligible to computers is employed in carrying . . . out [the claimed invention] does not make a method of automatically controlling a system of manufacturing plants a method of 'doing business.' "[474] Although the system used business data to make, in effect, business decisions, the court treated the claimed invention as a tool used *in* business, rather than as a system *of* doing business. The court held that it was "within the *technologically useful art* of controlling and optimizing a system of manufacturing plants to a particular end use, . . . [and] a statutory 'process' within the purview of 35 USC 101."[475]

The CCPA reached a contrary conclusion in *In re Maucorps*.[476] The patent application in *Maucorps*, entitled *Computing System for Optimizing Sales Organizations and Activities*, described a computer-implemented scheme for calculating the number of sales representatives that an organization should have, how they should be managed, and how frequently they should visit their customers.[477] The calculations involved complex mathematical formulas, but the claims described the invention as a "computing system" apparatus comprised of "means for calculating" the relevant values.[478] The application included a high-level hardware schematic as well as a computer program printout.[479] The program could be implemented through a general-purpose computer, or it could be permanently hardwired into a special-purpose machine.[480] The examiner and the Patent Office Board rejected the claims as unpatentable subject matter, and the CCPA affirmed.[481] The court did not discuss whether the invention claimed a method of do-

472. *Id.* at 692 n.5.
473. *Id.*
474. *Id.*
475. *Id.* at 693 (emphasis added).
476. 609 F.2d 481 (C.C.P.A. 1979).
477. *Id.* at 482.
478. *Id.* at 482-83.
479. *See id.* at 483-84.
480. *See id.* at 483.
481. *See id.* at 484-86.

ing business; instead, like the Patent Office Board, the CCPA rejected the claims under *Benson* as having been drawn to an unpatentable mathematical "algorithm." Although the claims literally described an apparatus, this time the court did not hold the form of the claim dispositive. "Labels," it said, "are not determinative in § 101 inquiries."[482] The form of the claim as a process or apparatus is "often an exercise in drafting."[483] The CCPA's successor would emphasize the role of "means-plus-function" claiming in defining a patentable *apparatus*,[484] but here the court observed that the format "cannot rescue appellant's claims from the requirements of § 101, because § 112[(6)] does not authorize the claiming of apparatus entirely in terms of 'means for' performing a *non-statutory* method."[485] By "non-statutory method" the court probably referred to the method of solving a mathematical algorithm, but the same observation could apply to a method of doing business, should the latter be regarded as a "non-technological art."

Of all of the CCPA's attempts to distinguish between a technological means and a non-technological end, *In re Toma*[486] is one of the most interesting. The applicant claimed a computer-implemented method of translating from one human language to another. The method involved the steps of (1) loading the text to be translated (the "source text") into a computer memory; (2) "transforming" the text by attaching to each word coded information indicating the dictionary meaning of the word in the "target language" as well as syntactical clues to the intended meaning; and (3) synthesis of the "transformed" source text into a grammatical target language translation.[487] In order to make the most efficient use of memory, translation codes for common words were stored in the computer's "core memory."[488] Rather than duplicate those codes each time the word appeared, the "transformed" text simply referred to the location in the core memory where the relevant codes could be found.[489]

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482. *Id.* at 485.
483. *Id.* (quoting *In re* Johnson, 589 F.2d 1070, 1077 (C.C.P.A. 1978)).
484. *See supra* notes 337-357 and accompanying text.
485. *Maucorps*, 609 F.2d at 486.
486. 575 F.2d 872 (C.C.P.A. 1978).
487. *Id.* at 874.
488. *Id.*
489. *See id.* (referring to "memory offset address linkages").

The Patent Office rejected the claims as non-statutory subject matter, basing its decision, in part, on *Benson's* treatment of algorithms.[490] The examiner also found that claims to a method of translation were not within the "technological arts."[491] In the examiner's view, translation was a "liberal art" that could not be transformed into a "technological art" merely because it was accomplished through a machine; "as far as computer-related inventions are concerned, *only* those inventions which 'enhance the internal operation of the digital computer' are in the 'technological' or 'useful' arts."[492] The Board's treatment of this issue was, according to the CCPA, too "perfunctory" to indicate approval or disapproval of the examiner's views.[493]

The CCPA disagreed with the examiner, holding that the claimed method "for enabling a *computer* to translate . . . languages" was a "method of operating a machine" and was within the "technological arts."[494] The court stressed that what the machine did was fundamentally different than what a human translator would do. While it was "convenient to describe the steps of the program as if they were being performed by a human translator, in fact, nothing of the kind is happening."[495] In reality, "the computer [would be] carrying out a series of unthinking, abstract mathematical operations" without regard for the *meaning* of the data.[496] The result might be translation, but the computer would still be only a calculating machine, and it should be treated as such for purposes of the subject matter inquiry.

> The "technological" or "useful" arts inquiry *must* focus on whether the claimed subject matter (a method of operating a machine to translate) is statutory, not on whether the product of the claimed subject matter (a translated text) is statutory, not on whether the prior art which the claimed subject matter purports to replace (translation by human mind) is statutory, and *not* on whether the claimed subject matter is presently perceived to be an improvement over the prior art, e.g.,

490. *See id.* at 875-76.
491. *Id.* at 877.
492. *Id.*
493. *Id.*
494. *Id.*
495. *Id.* at 874.
496. *Id.*

whether it "enhances" the operation of a machine.[497]

The court appears to say that *anything* done by a computer is inherently "technological." Even if the computer is writing haiku or offering moral advice, it is always a machine. In the context of the facts presented in *Toma*, it is difficult to argue. The invention was not so much a method of translation as it was a method of *automating* translation, including steps designed for the most effective use of computer memory. Whether the invention actually *improved* on other methods and, in that respect, "enhanced" the operation of a machine, the invention clearly lay within the sphere of computer science or software engineering, not translation. Suppose, however, that an applicant discovered the key to deciphering a previously untranslatable ancient language. If the applicant claimed a method of operating a "machine" (i.e., a general-purpose computer), but the method were described only in terms of his translating insights, would the claimed invention still be a "technological" invention? The rhetoric of *Toma* suggests that it might, but the facts did not put that question squarely before the court.

A Delaware district court relied substantially on the *Toma* rhetoric in *Paine, Webber, Jackson & Curtis, Inc. v. Merrill Lynch, Pierce, Fenner & Smith, Inc.*,[498] in which the patented invention concerned a "securities brokerage-cash management system."[499] The system combined a brokerage securities account, a money market fund, and a credit card charge account. The components were not new, but combining them into a single account yielded "synergistic" advantages.[500] For example, profits generated by the securities account could be reinvested automatically in the money market account rather than remaining in the securities account as "idle cash."[501] Similarly, the credit available on the charge card could be adjusted according to the customer's resources in the other components of

497. *Id.* at 877-78. The "enhancement" concept recalls earlier CCPA cases holding that "a process having no practical value other than enhancing the internal operation of [digital computers]" are within the "technological arts." *In re* McIlroy, 442 F.2d 1397, 1398 (C.C.P.A. 1971) (citation omitted) (modification in original). Of course, this does not mean that *only* processes "enhancing the internal operation" of a computer are statutory.

498. 564 F. Supp. 1358 (D. Del. 1983).

499. *Id.* at 1363.

500. *Id.* at 1362.

501. *Id.*

the account.[502] All of the transactions in the combined account could be reflected in a single monthly statement.[503]

Today, all banking and similar transactions are administered by computers, and the claimed system in *Paine Webber* was no exception. The claims referred to a "system for processing and supervising a plurality of composite subscriber accounts," including various "means" for performing the necessary functions.[504] These included, for example, a "brokerage account data file means" for storing current information, a "manual entry means" for entering investment orders, a "data receiving and verifying means," and a "short term investment updating means."[505] The patent specification did not describe apparatus corresponding to any of these "means," but it included a flow chart illustrating the steps to be performed by the computer.[506]

The accused infringer moved for summary judgment under § 101, arguing that the patent claimed a "method of doing business." The patent disclosure, it maintained, "reveal[ed] that the invention fits squarely into the business system category and has nothing to do with machinery, technology, process, manufacture, or composition of matter."[507] The court, however, declined to focus on what it called the "product" of the patent claims—the financial management account. Instead, as required by *Toma*, it focused on "the method by which the . . . [system] operates."[508] The patent claims, it held, were similar to those discussed in *Toma* and *Johnston*.[509]

> The product of the claims of the '442 patent effectuates a highly useful business method and would be unpatentable if done by hand. The CCPA, however, has made clear that if no *Benson* algorithm exists, the product of a computer program is irrelevant, and the focus of analysis should be on the operation of the program on the computer. The Court finds that the '442 patent claims statutory subject matter because the claims allegedly teach a method of operation on a computer to

502. *See id.*
503. *See id.*
504. *Id.* at 1364.
505. *Id.*
506. *See id.* at 1363-64.
507. *Id.* at 1365.
508. *Id.* at 1369.
509. *See id.*

> effectuate a business activity. Accordingly, the '442 patent passes the threshold requirement of Section 101.[510]

The court could have relied upon the program flow charts and any programming insights (as opposed to accounting insights) that they revealed. Such insights could have been considered a part of the claimed invention by virtue of § 112(6),[511] bringing the invention, as a computer programming technique, within the realm of the technological "useful arts." However, the court did not find it necessary to do this. It seemingly interpreted the lesson of *Toma* in the broadest sense: any invention claimed as a computer system is inherently "technological," even if the patent discloses nothing about the computer or its programming.

In *In re Schrader*,[512] the Federal Circuit could have conveyed its own interpretation of *Toma*, but it chose another path. Schrader claimed an improved system for conducting auctions, wherein participants could bid on any item or *combination* of items offered for sale. In a real estate auction, one buyer might bid on Black Acre, another on White Acre, and a third on the combination of Black Acre and White Acre. Using the claimed method, the seller could determine which bid or combination of bids to accept in order to maximize profits.[513] The claims to this "method of competitively bidding" did not make explicit reference to a computer, but it is likely that a computer would be used for the necessary data storage, calculations, and display.[514] The court rejected the claims as drawn to an unpatentable "mathematical algorithm," even though the references to mathematics were, at best, generalized and indirect.[515] The court did not discuss whether the invention was "technological" under *Toma* or whether more explicit references to a computer could have made it so. However, in her dissent (in which she also advocated the abolition of the "methods of doing business" exception relied upon by the Patent Office Board[516]), Judge Newman referred to processes handling data, including data representing bids, as "processes . . . employed in

510. *Id.*
511. *See supra* note 340.
512. 22 F.3d 290 (Fed. Cir. 1994).
513. *See id.* at 291-92.
514. *Id.* at 291.
515. *See id.* at 293-96.
516. *See supra* notes 418-422 and accompanying text.

technologically useful arts."[517] Schrader's method, she wrote, "requires the performance of specified steps and procedures, including calculations, to achieve a *technologically useful result*."[518] Her intention was to argue that the claims were not unpatentably *abstract*, but it is unclear what she meant by "technologically useful." Is auctioneering a "technological art"? Is applied mathematics? Or is "technology" involved because of the assumed use of a computer? These issues would confront the Federal Circuit again in the *State Street* case.

B. State Street

In *State Street Bank & Trust Co. v. Signature Financial Group*,[519] the patent describes a system for managing a portfolio of mutual funds, using a "Hub and Spoke" configuration. The "Spokes" consist of individual mutual funds managed by one centralized entity, or "Hub," organized as a partnership. Each "Spoke" owns an interest in the "Hub."[520] This pooling of assets allows economies of scale, lowered administrative costs, and beneficial tax consequences.[521] The system is, however, complex to administer.[522] All gains and losses of the "Hub" portfolio are allocated to each "Spoke" on a pro rata basis. Moreover, each "Spoke" mutual fund is also an investment vehicle, so that, as their values fluctuate, partnership interests in the "Hub" portfolio must be constantly adjusted.[523]

As one would expect, the accounting is performed by a computer programmed to store the financial data and perform the required calculations.[524] This computer, or "data processing system," is the invention described by the claims. The claims,

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517. *Schrader*, 22 F.3d at 297 (Newman, J., dissenting).

518. *Id.*

519. 927 F. Supp. 502, 504 (D. Mass. 1996), *rev'd*, 149 F.3d 1368 (Fed. Cir. 1998), *cert. denied*, __U.S.__, 119 S. Ct. 851 (1999).

520. *See* U.S. Patent No. 5,193,056 [hereinafter '056 Patent] cols. 1:43-2:30, 4:36-61.

521. *See id.* col. 2:3-66.

522. *See id.*, col. 2:67-68.

523. *See id.* cols. 2:67-3:30.

524. "A new and unique data processing system and method is necessary to enable accurate daily allocations to be made among each of the funds in a portfolio." *Id.* col. 3:23-25. "The present invention provides a data processing system and method for monitoring and recording the information flow and data, and making all calculations, necessary for maintaining a partnership portfolio and partner fund (Hub and Spoke) financial services configuration." *Id.* col. 4:36-41.

however, define that system solely as a collection of "means" for performing the functions required. Claim 1 is representative:

> A data processing system for managing a financial services configuration of a portfolio established as a partnership, each partner being one of a plurality of funds, comprising:
>
> (a) computer processor means for processing data;
>
> (b) storage means for storing data on a storage medium;
>
> (c) first means for initializing the storage medium;
>
> (d) second means for processing data regarding assets in the portfolio and each of the funds from a previous day and data regarding increases or decreases in each of the funds, [sic] assets and for allocating the percentage share that each fund holds in the portfolio;
>
> (e) third means for processing data regarding daily incremental income, expenses, and net realized gain or loss for the portfolio and for allocating such data among each fund;
>
> (f) fourth means for processing data regarding daily net unrealized gain or loss for the portfolio and for allocating such data among each fund; and
>
> (g) fifth means for processing data regarding aggregate year-end income, expenses, and capital gain or loss for the portfolio and each of the funds.[525]

Such "means-plus-function" claim language requires one to turn to the patent specification to identify the "structures" that perform those functions.[526] Yet the descriptions of *physical* structure in this patent consist of no more than cursory references to computers, floppy disk storage media, and CRT displays of the kind that accompany most desktop computers.[527]

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525. *Id.* col. 13:22-45.

526. 35 U.S.C. § 112(6) (1994), discussed *supra* note 340 and accompanying text.

527. *See, e.g.*, '056 Patent, *supra* note 520, col. 6:48-56 ("The portfolio/fund accountant makes use of a personal computer 44 programmed with software 50 . . . . The personal computer . . . is capable of producing printed output 46 and storing data on data disk 52. which preferably is a floppy disk, although other types of storage media may be used."); col. 7:59-60 ("a main menu is displayed, for example, on the CRT of a personal computer"). Figure 4 includes simple cartoon drawings of personal computers,

Most of the patent disclosure relates to a set of flow charts[528] outlining the *process* of administering a "Hub and Spoke" mutual fund portfolio.[529] A key aspect of that process appears to be a "book capital account" for each fund, which tracks daily shareholder purchases and redemptions, the fund's proportional share of the portfolio's administrative expenses, and the fund's share of realized and unrealized gain or loss.[530]

After licensing negotiations broke down, State Street filed suit against patent owner Signature Financial Group, seeking declaratory judgment of invalidity, unenforceability, and noninfringement.[531] On State Street's motion for summary judgment, the Massachusetts District Court held the patent invalid under § 101 for failing to claim patentable subject matter. After reviewing the Supreme Court trilogy,[532] as well as the CCPA and Federal Circuit "mathematical algorithm" cases, the court concluded that the patent claimed a non-physical abstract mathematical algorithm of the kind rejected in *Schrader*[533] and *Maucorps*.[534]

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and a featureless cylinder representing the "data disk."

528. *See id.* figs. 5-11. Figure 1 is a block diagram showing the overall organization of a "Hub and Spoke" fund portfolio. Figures 2-3 illustrate the administrative cost savings that can be realized through the "Hub and Spoke" management structure. Figure 4 is a high-level organizational chart showing the relationships of the shareholder, investment advisor, transfer agent, portfolio/fund accountant, and portfolio administrator, with cartoon representations of a generic computer network.

529. As described in the "Summary of the Invention,"

> The data processing system determines the percentage share (allocation ratio) that each fund has in the portfolio, while taking into consideration daily changes both in the value of the portfolio's investment securities (as determined by market prices) and in the amount of each fund's assets (as determined by daily shareholder purchases and redemptions). The system also allocates to each fund the portfolio's daily income, expenses, and net realized and unrealized gain or loss, calculating each fund's total investments based on the concept of a book capital account, thus enabling determination of a true asset value of each fund and accurate calculation of allocation ratios between the funds. The data processing system also tracks all the relevant data, determined on a daily basis for the portfolio and each fund, so that aggregate year-end income, expenses, and capital gain or loss can be determined for accounting and for tax purposes for the portfolio and for each fund.

Id. col. 4:44-61.

530. *See id.* col. 3:52-61.

531. State St. Bank v. Signature Fin. Group., 927 F. Supp. 502, 504 (D. Mass. 1996), *rev'd*, 149 F.3d 1368 (Fed. Cir. 1998), *cert. denied*, __U.S.__, 119 S. Ct. 851 (1999).

532. *See supra* Part II.B.

533. *In re* Schrader, 22 F.3d 290 (Fed. Cir. 1994); *see supra* notes 512-518 and accompanying text.

534. *In re* Maucorps, 609 F.2d 481 (C.C.P.A. 1979); *see supra* notes 476-485 and

> Like the business-related systems in *Schrader* and *Maucorps*, the '056 Patent claims an invention that essentially performs mathematical calculations on data gleaned from pre-solution activity and stores and displays the results. As with *Schrader's* bids, the fact that those numbers represent financial constructs, such as the Hub and Spoke configuration, does not save Signature's patent. The claims do not recite any significant pre- or post-solution activity. Neither does the invention measure physical objects or phenomena as in *Arrhythmia*[535] or *Abele*[536] nor does it physically convert data into a different form as in *Alappat*.[537]

The court also found the claims so broad that, in effect, they covered the "Hub and Spoke" arrangement itself, rather than any particular "data processing system" for implementing such an arrangement.[538] This, the court held, rendered the claims unpatentable as a "method of doing business."[539]

The Federal Circuit reversed, in an opinion written by Judge Rich. It held that Signature's claims describe a "machine" and illustrated the point by reproducing claim 1 with the "structures" of the specification incorporated in brackets:

> A data processing system for managing a financial services configuration of a portfolio established as a partnership, each partner being one of a plurality of funds, comprising:
>
> (a) computer processor means [a personal computer including a CPU] for processing data;

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accompanying text.

535. Arrhythmia Research Tech., Inc. v. Corazonix Corp., 958 F.2d 1053 (Fed. Cir. 1992); *see supra* notes 319-336 and accompanying text.

536. *In re* Abele, 684 F.2d 902 (C.C.P.A. 1982).

537. State St. Bank v. Signature Fin. Group, 927 F. Supp. 502, 515 (D. Mass. 1996) (footnotes inserted by author), *rev'd*, 149 F.3d 1368 (Fed. Cir. 1998). *In re Alappat*, 33 F.3d 1526 (Fed. Cir. 1994) (en banc), is discussed *supra* notes 337-357 and accompanying text.

538. *State Street*, 927 F. Supp. at 516.

> If Signature's invention were patentable, any financial institution desirous of implementing a multi-tiered funding complex modelled on a Hub and Spoke configuration would be required to seek Signature's permission before embarking on such a project. This is so because the '056 Patent is claimed sufficiently broadly to foreclose virtually any computer-implemented accounting method necessary to manage this type of financial structure.

Id.

539. *Id.* at 516 ("[P]atenting an accounting system necessary to carry on a certain type of business is tantamount to a patent on the business itself. . . .").

(b) storage means [a data disk] for storing data on a storage medium;

(c) first means [an arithmetic logic circuit configured to prepare the data disk to magnetically store selected data] for initializing the storage medium;

(d) second means [an arithmetic logic circuit configured to retrieve information from a specific file, calculate incremental increases or decreases based on specific input, allocate the results on a percentage basis, and store the output in a separate file] for processing data regarding assets in the portfolio and each of the funds from a previous day and data regarding increases or decreases in each of the funds, [sic, funds'] assets and for allocating the percentage share that each fund holds in the portfolio;

(e) third means [an arithmetic logic circuit configured to retrieve information from a specific file, calculate incremental increases and decreases based on specific input, allocate the results on a percentage basis, and store the output in a separate file] for processing data regarding daily incremental income, expenses, and net realized gain or loss for the portfolio and for allocating such data among each fund;

(f) fourth means [an arithmetic logic circuit configured to retrieve information from a specific file, calculate incremental increases and decreases based on specific input, allocate the results on a percentage basis and store the output in a separate file] for processing data regarding daily net unrealized gain or loss for the portfolio and for allocating such data among each fund; and

(g) fifth means [an arithmetic logic circuit configured to retrieve information from specific files, calculate that information on an aggregate basis and store the output in a separate file] for processing data regarding aggregate year-end income, expenses, and capital gain or loss for the portfolio and each of the funds.[540]

The court held this data-processing "machine," consisting of

540. State St. Bank & Trust Co. v. Signature Fin. Group, 149 F.3d 1368, 1371-72 (Fed. Cir. 1998) (alterations in original).

the structures recited in the specification or their equivalents, to be "proper statutory subject matter under § 101."[541] The court did, however, consider the "mathematical algorithm" issue. Such algorithms, the court held, are unpatentable "to the extent they are merely abstract ideas"—i.e., if they are not "reduced to some type of practical application" producing "a useful, concrete and tangible result."[542] The distinction between a patentable algorithm and an unpatentable algorithm lies in a "useful" application.[543] The court found such an application in the Signature patent.

> Today, we hold that the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete and tangible result'—a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.[544]

As long as the invention has "practical utility," it is statutory whether categorized as a machine or process, and "even if the useful result is expressed in numbers, such as price, profit, percentage, cost, or loss."[545] As for the "business methods" doctrine, the court "[took] this opportunity to lay this ill-conceived exception to rest."[546]

For all of its reliance on the "useful" nature of the claimed invention, the court did not discuss whether an accounting scheme is a "useful art" in the constitutional sense (i.e., a "technological" art) and, if not, whether Signature's claim to a "system" for implementing an accounting scheme *is* within the "useful arts," given the patent's disclosure of very little other than the scheme itself. Consequently, while *State Street* ap-

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541. *Id.* at 1372.

542. *Id.* at 1373 (citation omitted).

543. *Id. See also* AT&T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 1357 (Fed. Cir. 1999) ("[A] mathematical algorithm may be an integral part of patentable subject matter such as a machine or process if the claimed invention as a whole is applied in a 'useful' manner"). However, as previously discussed, it is no simple matter to define what is "useful." *See supra* text accompanying notes 135-137.

544. *State Street*, 172 F.3d at 1373.

545. *Id.* at 1375.

546. *Id.* at 1375.

pears to be a landmark case in the development of the law of statutory subject matter, particularly as it affects accounting methods and methods of doing business, it leaves serious questions unanswered.

C. Scylla and Charybdis

The easiest approaches to the *State Street* situation are the most extreme. One could simply conclude that computer programming is not a "useful art," as the Framers imagined those arts, because programming is too abstract and intangible. Programming consists of logic and mathematics, not the material goods—the "horse collars" and "buggy whips"[547]—that the Framers intended our patent laws to cover. Hence, any computer-related invention dependent on new *software* is beyond Congress's power to include within the scope of patentable subject matter. The only allowable computer patents are those describing new *hardware*, such as a new tracking mechanism for a mouse, a new transistor design, a new memory card, and so forth. This approach has the advantage of simplicity, but, as has already been suggested,[548] it would not reflect well the Framers' policy in the establishment of the patent authority. Programming is an industry comparable to those that the Framers sought to promote. It produces useful goods that are improved through the process of invention, to the ultimate benefit of consumers and the national economy. Sometimes the intangible goods produced by the software industry are interchangeable with material goods produced by traditional hardware industries. It is unlikely that the Framers would have wanted to exclude such an important industry from the patent system, and there is no compelling policy reason to do so.

Nor should software be required to transform a tangible object into "a different state or thing" before it is patentable, as suggested by the narrow *Cochrane v. Deener* definition of "process."[549] Certainly software inventions that are a part of a larger transformative process—such as the rubber curing process in *Diehr*—should be patentable subject matter. But there are other software inventions that have little or no physical effects, yet are equally utilitarian. Techniques of computer cryp-

547. *In re* Waldbaum, 457 F.2d 997, 1003 (C.C.P.A. 1972).

548. *See supra* Part I.A.

549. Cochrane v. Deener, 94 U.S. 780, 788 (1877).

tography, for example, are unquestionably technological, though they operate solely in the realm of mathematics and data.[550] Users of the Internet are familiar with the benefits of search engine algorithms and algorithms for detecting computer viruses. Those algorithms are *tools* for the analysis, manipulation, and transformation of data; in a sense, they are "buggy whips" for the information age. Such things should be considered to be at the core of patentable subject matter, without straining to rely on the tangible aspects of the computer hardware. The silicon and wire of the computer circuits, the electrons that course through those circuits, the mouse and keyboard that provide input, and the monitor or paper that displays the results are all physical entities. A new computer program even produces new physical effects measurable on a microscopic scale, such as a new pattern of electrical charge stored on a floppy disk. But to consider these things the key to patentable subject matter is to confuse the medium with the message. When an inventor conceives of a new program algorithm, the essence of the invention rests in the logic, not in the incidental physical details of the computing system on which it is implemented. As scientists conceive of computers based on quantum mechanics, beams of light, or DNA, the irrelevance of the hardware becomes increasingly apparent.

At another extreme, one could argue that anything "useful" is the product of a "useful art," hence an accounting scheme, an advertising gimmick, a pedagogical method, a system of meditation, or even a method of presenting a legal argument may be patented as a "process,"[551] leaving only purely abstract ideas, like a mathematical formula applied to no "useful" purpose, as unpatentable subject matter. As already discussed,[552] the Framers most likely did not have in mind such a broad interpretation of the "useful arts," nor is it clear on policy grounds

550. *But cf.* Berardini v. Tocci, 190 F. 329, 332-33 (S.D.N.Y. 1911). *Berardini* held that a "code message" for directing money transfers by telegraph was really a *system* for encoding message and that it was not a patentable "art," in the sense explained in *Hotel Security Checking Co. v. Lorraine Co.*, 160 F. 467 (2d Cir. 1908), *supra* notes 376-384 and accompanying text. The patented invention was not a *means*, but only abstract "advice[— i]t is for an art only in the sense that one speaks of the art of painting, or the art of curving the thrown baseball. Such arts, however ingenious, difficult, or amusing, are not patentable within any statute of the United States." *Berardini*, 190 F. at 333.

551. This is assuming, of course, that the process meets the other requirements of patentability, such as novelty and nonobviousness.

552. *See supra* Part I.A.

that such a diverse range of human ingenuity should be brought within the realm of patent law. It seems increasingly the modern viewpoint that anything of value should be regarded as property, but this was not necessarily the Framers' view, particularly when "property" means "monopoly."[553] The courts have held that "useful arts" includes only what is "technological,"[554] and even the advent of the information age provides no reason to depart from that conclusion. One may have to expand one's definition of "technology" to embrace the more intangible tools of computer programming, but, unless one abandons the probable intentions of the Framers, "useful arts" and "technology" cannot be limitless.

An intermediate approach might grant that there are non-technological arts beyond the scope of patentable subject matter, but the *tools* (at least the physical tools) used to implement those arts are potentially patentable. In many cases, this is certainly correct. For example, one should be able to patent a new musical instrument, artist's paint brush, cash register, or teacher's chalkboard, regardless of the ultimately non-technological application to which those tools are put. The manufacture of musical instruments, paint brushes, and so forth, are industries of the most traditional, industrial kind; there is no doubt that the Framers would have considered those industries "useful arts." Patenting a new physical implement to be used in a non-technological art does not raise the same issues as patenting a new process in those same arts. The invention is technological in character because, in a sense, it deals with the *manufacture* of a new implement, and manufacturing is at the center of the useful arts, historically and conceptually. The "art" of a patent on a new trumpet is not the art of music, but the art of trumpet manufacturing. Similarly, one could argue that a computer system, or a computer program, should be patentable subject matter because systems and programs are designed by the practitioners of the technological art of computer science, even if these technological tools ultimately are employed for non-technological ends.

This argument is an appealing one, at least as long as the inventor claims the technological tool in terms of what it *is*—that is, in terms of the specific attributes that are the product of its manufacture or design. When a claim describes a tool in

553. *See supra* notes 47-48 and accompanying text.

554. *See supra* Part I.B.

its manufacture or design. When a claim describes a tool in terms of how it is to be *used*, as is commonly done under § 112(6) of the Patent Act,[555] the problems with this tool/use distinction become apparent. Consider the following claim, which might have been composed by the first salesman to conceive of the idea of telephone marketing:[556]

> A communications system for soliciting business from potential customers through person-to-person conversation, comprising:
>
> A remote signaling means for alerting a potential customer of one's desire to converse;
>
> A remote communications sending means for transmitting a voice communication to said customer, for the purpose of soliciting said customer's business;
>
> A remote communications receiving means for receiving from said customer a response to said solicitation; and
>
> A means for terminating communications to and from said customer.

The patent specification, disclosing the "structures" supporting each "means" element, might describe an ordinary telephone system.

If we assume that the applicant did not invent the telephone, and if we further assume that telephone solicitation is not a technological "useful art" (even if it *is* a profitable business technique), should the "communications system" claimed by the applicant be considered within the "useful arts" because it is a "machine"? The applicant might support that conclusion by annotating his claim in the manner found in the *State Street* opinion:

> A communications system for soliciting business from potential customers through person-to-person conversation, comprising:
>
> A remote signaling means [a telephone with a ringing mechanism] for alerting a potential customer of one's desire to

555. *See supra* note 340 and accompanying text.

556. I first created this example for use in the *State Street* amicus brief discussed *supra* in the first footnote.

converse;

> A remote communications sending means [a telephone transmitter and telephone wire] for transmitting a voice communication to said customer, for the purpose of soliciting said customer's business;
>
> A remote communications receiving means [a telephone receiver and telephone wire] for receiving from said customer a response to said solicitation; and
>
> A means [a telephone cradle switch] for terminating communications to and from said customer.

Something seems amiss, however. What the applicant invented is not an apparatus, but a new method of using it. The apparatus and the method are in different arts—the former in the technological art of electronics, and the latter in the non-technological art of business relations. Nevertheless, two principles of patent law suggest that the claim does describe a patentable machine. The first holds that the applicant's *claim*, not the detailed disclosure of the specification, defines the "invention."[557] Here, the claim literally describes a machine. Second, courts often stress that patentable subject matter under § 101 should not be confused with novelty under § 102 (or the related question of non-obviousness under § 103).[558] Subject matter and novelty have been described as separate "doors" through which an applicant must pass to meet the objective of patentability.[559] The door of patentable subject matter cannot be barred because

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557. *See* Bell Communications Research, Inc. v. Vitalik Communications Corp., 55 F.3d 615, 619 (Fed. Cir. 1995) (quoting Yale Lock Mfg. v. Greenleaf, 117 U.S. 554, 559 (1886) ("[T]he language of the claim defines the scope of the patented invention . . . .").

558. *See In re* Bergy, 596 F.2d 952, 962-63 (C.C.P.A 1979), *vacated sub nom.* Diamond v. Chakrabarty, 444 U.S. 1028 (1980), *reconsidered*, 596 F.2d 952 (C.C.P.A.), *aff'd*, 447 U.S. 303 (1980).

> Falling into a category [of patentable subject matter under § 101] does not involve considerations of novelty or nonobviousness and *only* those two considerations involve comparison with prior art or inquiry as to whether all or any part of the invention is or is not in, or assumed to be in, the prior art or the public domain. *Prior art is irrelevant to the determination of statutory subject matter under § 101.* An invention can be statutory subject matter and be 100% old, devoid of any utility, or entirely obvious.

Id.; *see In re* Freeman, 573 F.2d 1237, 1243 n.2 (C.C.P.A. 1978) ("Considerations of novelty or obviousness are of no effect whatever in determining whether particular claims define statutory subject matter under 35 U.S.C. § 101.").

559. *See, e.g.*, *Bergy*, 596 F.2d at 960-62.

the telephone is not *new*—novelty is a separate question. Similarly, one cannot extract from the claim the "point of novelty"—the thing that separates the claimed invention from its predecessors—and consider that the applicant's "actual invention."[560] The invention is what the claim says it is, and the claim must be judged *as a whole*.

The claim might be allowed to pass through the § 101 subject matter "door" because it describes a machine, but stopped at the § 102 "door" of novelty on the ground that telephones are already known. This approach presents two problems. First, no patent claim element or claim language may be ignored.[561] To treat the claim as anticipated by prior telephones would be to disregard the claim language describing the (for the sake of argument) new and nonobvious use of the telephone.[562] Second, if telemarketing as described in the claim really is new, it is perverse to rely on novelty as the ground for rejecting the claim. The real problem, to borrow a trope attributed to Samuel Johnson, is this: the claimed invention is both new and technological, but the part that is new is not technological, and the part

560. *In re* Taner, 681 F.2d 787, 791 (C.C.P.A. 1982). "The court in *Diehr* rejected the 'point of novelty' analysis saying '[t]he "novelty" of any element or steps in a process . . . is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter . . . .'" *Id.* (quoting Diamond v. Diehr, 450 U.S. 175, 189 (1981)) (alterations in original).

561. *See* Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 29 (1997) ("Each element contained in a patent claim is deemed material to defining the scope of the patented invention . . . .").

562. One could hold that prior telephone systems anticipated the claim on the ground that such systems and their component parts were always *capable* of performing the recited functions even if they were never used in that manner. *See In re* Schoenwald, 964 F.2d 1122, 1124 (Fed. Cir. 1992) (holding that discovery of a new use for a known composition cannot support a claim to the composition itself). Yet patent law does allow one to claim, as a *process*, a newly discovered, non-obvious use for an existing machine or composition of matter. *See* 35 U.S.C. § 100(b) (1994) (defining "process" as including "a new use of a known . . . machine"); *In re* King, 801 F.2d 1324, 1326 (Fed. Cir. 1986); Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 875 (Fed. Cir. 1985), *overruled in part, on unrelated grounds, by* Nobelpharma AB v. Implant Innovations, Inc., 141 F.3d 1059, 1068 (Fed. Cir. 1998). Rather than treat telephones that were never used in this manner as anticipating prior art, it would be better, in the absence of any new structure, to treat the invention as a new method, rather than as a new machine, and to require the method to stand or fall on its own "technological" credentials. *See Freeman*, 573 F.2d at 1247 ("Though a claim expressed in 'means for' (functional) terms is said to be an apparatus claim, the subject matter as a whole of that claim may be indistinguishable from that of a method claim drawn to the steps performed by the 'means.' "). However, the Federal Circuit has resisted such attempts to recharacterize claims. *See In re* Alappat, 33 F.3d 1526, 1540-41 (Fed. Cir. 1994) (en banc).

that is technological is not new.[563] Yet, as long as we insist that subject matter and novelty are entirely separate issues, and as long as we allow the applicant unfettered freedom to define the nature of the invention, it is difficult to articulate a ground for rejecting or invalidating such a claim. Either the black letter rules of patent law must give a little, or we must resign ourselves to patents on some essentially non-technological inventions.

It is, of course, not telephones but computers that present the hardest issues. A non-technological insight may be claimed via the conventional "computer system" that is essential to implement it. The "means-plus-function" claim format,[564] which allows the claim to include explicitly only functional limitations, makes this approach particularly convenient for the applicant. In the case of a computer, one can argue not only that the claimed invention is a "machine," but that it is a "new machine," either because of the microscopic physical changes wrought by new programming or, more convincingly, because of the change in the computer's *functioning* when it executes new software. The standard digital computer of today is what is called a "von Neumann machine," after computer theorist John von Neumann.[565] In a von Neumann machine, the computer program is stored in the same binary code and located in the same memory as the data on which the program operates.[566] Consequently, the von Neumann machine is infinitely malleable: changing the function of the machine only requires an easy alteration of the code stored in the computer's memory.[567] In a very real sense, a new program *does* make a "new machine":

> Each program in effect makes the computer into a different machine, one with a new purpose, without any change in the

563. When asked to review a manuscript, Johnson said, "Your manuscript is both good and original, but the part that is good is not original and the part that is original is not good." *See* THE DAVID & CHARLES BOOK OF QUOTATIONS 326 (Robert I. Fitzhenry ed., 1986).

564. *See supra* note 340 and accompanying text.

565. *See generally*, WILLIAM POUNDSTONE, PRISONER'S DILEMMA 76-77 (1992).

566. *See* BOLTER, *supra* note 2, at 39, 47-49.

567. *See id.* at 39 ("[T]he computer is not a fixed mechanism."); *see also id.* at 49. In fact, computers are so flexible that they can be programmed to write their own programs. Bolter writes that "[t]he equivalent process in a steam engine would be to throw the gears into the furnace along with the coal and expect the engine to produce by itself a design for a new machine." *Id.* at 40.

> wiring. The same physical equipment may serve first to calculate the orbit of a spacecraft, then to alphabetize a list of names, then to determine averages and deviations of a statistical sample. Since each of these tasks calls for a logically different Turing machine,[568] the physical equipment that can accomplish them all is a universal Turing machine. Thus logic and electronics meet precisely at this point: the von Neumann computer.[569]

If it is accurate to think of a re-programmed computer as a "new machine," then it is reasonable to regard that new machine as an addition to a technological art. This can best be seen by imagining the program implemented through a special-purpose physical computer—perhaps made from the Tinker Toys and string of Hillis's computer[570] or from mechanical cogs and wheels. If the *State Street* algorithm could be implemented in a machine made from cogs and wheels, as theoretically it could, and the desired mutual fund management could be accomplished at the pull of a lever, why should such a new machine be denied its status as "technological" any more than a new cash register or adding machine? And if the cog-and-wheel version is "technological" and the product of a "useful art," why not the electronic version? Yet, one could argue that the *State Street* claims are no more "technological" than the hypothetical telemarketing claim. The computer technology is prior art; only the non-technological accounting scheme is new.

One way of dealing with such claims is to "pierce the veil" of the claim language to determine what it is the applicant or patentee "actually invented."[571] If the "actual invention" repre-

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568. A "Turing machine" is an idealized computing mechanism named after computer pioneer Alan Turing. *See* HILLIS, *supra* note 221, at 62-64.

569. BOLTER, *supra* note 2, at 49 (footnote added by author); *see also id.* at 39-40.

> A programmer is a designer who has the remarkable advantage of being able to test his design as soon as it is specified. For the design *is* the program, written in a suitable language such as PASCAL, and he need only submit the program to the computer to find his machine realized.

Id.

570. *See* HILLIS, *supra* note 221, at 16-18.

571. *See In re* Alappat, 33 F.3d 1526, 1562 (Fed. Cir. 1994) (en banc) (Archer, J., concurring in part and dissenting in part).

> [S]atisfaction of § 101, and eligibility for the patent reward in general, requires a judgment that the applicant for the patent has actually invented or discovered something in the useful arts and for that reason is deserving of exclusive patent rights. To determine whether the applicant has invented or discovered something within the patent law, it makes no sense for the sole question to be, "Does the applicant happen to recite structure in the claims or not?"

sents an advancement in the technological art of computing, then the patent serves the purpose of "promot[ing] the Progress of . . . [the] useful Arts," as the Constitution requires.[572] On the other hand, if the "actual invention" represents an advancement only in a non-technological art, such as accounting, then the patent should be rejected as drawn to unpatentable subject matter. This idea is a promising one, but it can be applied in vastly different ways. The narrowest application would grant patents only to advancements that improve the internal operation of a computer, such as an innovative program structure that permits a computer to operate faster or make better use of its memory. Such advancements clearly *are* advancements in the technological art of computing. On the other hand, an algorithm that merely performs a new function would be denied a patent if that function did not have independent technological credentials.[573] For example, a program that implemented an entirely new accounting scheme would be unpatentable, even if it were the first of its kind, if it did not, in any other sense, produce a *better computer*.

This, however, is a too narrow a view of programming technology and, hence, too confining a definition of patentable subject matter. A designer who exercises his programming talents to create new accounting software is engaged in a technological endeavor as much as a watchmaker who designs a new watch. If the product of the programmer's endeavor is a different kind of program, then the program should be as patentable as the watchmaker's different kind of watch. The program should not have to be faster or more efficient than other programs, any more than the watch has to keep better time.[574] What *should* be required is that the claimed invention reflect the *programmer's art* rather than the non-technological art in whose service the

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Id.; *see In re* Grams, 888 F.2d 835, 839 (stating that the "critical question" is not "What does the claim say," but "What did [the] applicants invent?" (quoting *In re* Abele, 684 F.2d 902, 907 (C.C.P.A. 1982))).

572. U.S. CONST. art. I, § 8.

573. If the program functioned as a part of a larger technological endeavor, such as a method of rubber manufacturing, then the invention would not have to depend on the art of computing for its technological status.

574. Neither "utility" nor any other concept of patent law requires that a patentable invention be *better* than other alternatives. *See* Demaco Corp. v. F. Von Langsdorff Licensing Ltd., 851 F.2d 1387, 1390 (Fed. Cir. 1988). "An invention need not be the best or the only way to accomplish a certain result, and it need only be useful to some extent and in certain applications . . . ." Stiftung v. Renishaw PLC, 945 F.2d 1173, 1180 (Fed. Cir. 1991).

programmer's art is employed. If the program is one that implements an accounting scheme, the claim, in substance, should be about the programming, not about the accounting. If the claim formally refers to a "data processing system" or "a software programming method," but the substance of the claim refers only to the requirements of the accounting scheme, then the claim does not reveal the "nuts and bolts" of the program which may legitimately claim technological status.

As previously discussed, a program can be described at various levels of generality, mirroring the typical evolution of a software development project.[575] At the most general level, a program can be described by its overall goal. Or a program can be described in terms of its logical structure, elements of which can themselves be described more or less generally. Ultimately, a program can be described by its own code, which sets forth, in minutest detail, what the computer executing the program is to do. Copyright law employs a corresponding "levels of abstraction" analysis for deciding which aspects of a program are uncopyrightable "ideas" and which aspects are protectable "expression."[576] If a program accused of infringing another program's copyright is similar only when described at the most general level, the similarity may be too abstract, and may capture too much of the program's *function* to permit copyright law to intervene. Such similarities are similarities of idea. On the other hand, if the similarities are more detailed, and are not dictated by the ultimate functional requirements of the program, then such similarities may be considered protectable "expression."[577] A similar analysis sheds light on whether a claim to a computer-implemented endeavor embodies the technological aspects of the computer program. A claim so general that it describes only non-technological goals fails to capture the technological aspects of the program. On the other hand, a claim that describes specific aspects of the program logic has likely crossed the divide between the non-technological vision and the craft of computer programming. In a sense, the tech-

575. *See supra* Part I.E.

576. Computer Assoc. Int'l v. Altai, Inc., 982 F.2d 693, 706-07 (2d Cir. 1992).

577. *See id.* at 707-11 (following "levels of abstraction" dissection of copyrighted program, program attributes dictated by efficiency, the computing environment, or the general "idea" of the program should be "filtered" and discarded before the programs are compared for substantial similarity).

nology is in the details.[578]

When a patent claims a software implementation of a non-technological plan, the validity of the claim under § 101, and under the "useful arts" clause of the Constitution, should depend on whether the claim includes enough substantive details relating to program logic or data structures that the invention is one within the technological art of computer programming. Expert testimony, similar to that which helps to identify the "art" of an invention in the obviousness context,[579] may be of assistance. If the claim, in substance, speaks in non-technological language of non-technological concepts, it should be considered a claim to a non-technological invention. On the other hand, if the claim speaks in the programmer's language of the programmer's art, then the claim should be considered one to a "useful art."

Often the line may be difficult to draw. For example, the same series of steps might describe the details of the accounting scheme and, in a general sense, the structure of the program that implements it. If the claim says "add quantity x to quantity y and store the result," one could characterize this as a description of steps in an accounting scheme or as a description of program architecture. It is the nature of computer programs that plan and implementation blend. However, the sequence of program design provides some guidance. As discussed *supra* in Part I.E, the first stages of program design typically culminate in a "functional specification," a document describing *what* the program is supposed to do.[580] It includes some details, but they are, in a sense, external details relating to the program's function—what features it will have, what the user interface will be like, what relation the output will bear to the input, and so forth. The next phase of software design leads to a "design specification."[581] This document describes *how* the goals of the functional specification will be achieved. This

578. Although the analysis may be similar, the divide between idea and expression for copyright law purposes will probably differ from the divide between non-technology and technology for patent law purposes. Program attributes which are specific enough to be *technological* may be too *functional* to count as copyrightable expression. In fact, it may be that *only* such functional details have patentable novelty and utility.

579. *See, e.g.*, Wang Labs., Inc. v. Toshiba Corp., 993 F.2d 858, 864 (Fed. Cir. 1993).

580. *See supra* notes 203-205 and accompanying text.

581. *See supra* notes 206-209 and accompanying text.

document records high-level program architecture and information on the nature of the data structures. Although it is not a precise demarcation, the transition from "functional specification" to "design specification" roughly indicates when, from a programmer's perspective, the party who envisions a program's function turns over the development process to the engineer who implements it.[582] An accountant's skills would be adequate to prepare a functional specification for an accounting program; the accountant only has to imagine, in detail, *what* he would like the program to do. A programmer's skills are necessary for a design specification because only a programmer can describe, in a programmer's language, *how* it will be done. The distinction between "what" and "how" is not an easy one, but it seems the right distinction to make.

The "how" aspects of a program may be captured in a claim by explicit description of program architecture, or by invoking § 112(6) and relying upon the specification to disclose the "structures" covered by the claim.[583] The latter would likely be more practical for applicants, and it would still bind the claim to its technological foundations. Another programmer who discovered an alternative, non-equivalent logical structure could design around the claim, avoiding the patented technology while still achieving the same non-technological goals.[584] Today soft-

582. At least figuratively speaking. The functional specification and the design specification may be prepared by the same person, if it is a person with the skill and knowledge necessary to envision the features of the program *and* to implement them.

583. One could argue that § 112(6) contemplates as "structures" only physical entities, in which case it might be more appropriate to employ the seldom-seen "step-plus-function" provision, based on the following language of § 112(6):

> [a]n element in a claim for a combination may be expressed as a . . . step for performing a specified function without the recital of . . . acts in support thereof, and such claim shall be construed to cover the corresponding . . . acts described in the specification and equivalents thereof.

35 U.S.C. § 112(6) (1994). One of the reasons the step-plus-function format is so rare may be the difficulty of distinguishing between a "step" and an "act." However, it would seem possible to have a claim describing, for example, the "steps" required by a non-technological accounting method and to construe that claim to cover only the program logic "acts" described in the specification and their equivalents.

584. That is not to say that such design-around alternatives are *necessary* in order for the claim to be valid. In the mathematical algorithm arena, courts have considered the preemptive effect of a claim as a measure of the "abstractness" of the invention. Whether it is correct or incorrect in that context, it is a poor measure of technology. Some non-technological schemes may be unachievable without a particular technological tool, so the *effect* of the patent on the tool may be to grant broad exclusive rights in non-technological fields. But that does not mean that a claim to the tool itself transcends the "useful arts."

ware inventions are often claimed in terms of the *physical* components of the computer system. The *State Street* claims, with their references to storage "means" and processing "means" are of this variety. As long as the physical components are *new*, one cannot object that the invention, as claimed, is not technological. Computer hardware is an eminently technological field.

This brings us to the subject of novelty, which the courts have insisted is an entirely separate question from that of patentable subject matter.[585] That separation cannot be so strictly maintained that courts or the Patent Office turn a blind eye to the character of the applicant's invention. Specifically, an application should not slip past the § 101 "door" by relying on one aspect of the claimed invention and the §§ 102-103 "doors" by relying on an *entirely different* aspect. There should be a single concept, or a single "invention," that is in the "useful arts," new *and* non-obvious. A new plan for using an existing technology is not always a technological advancement. A composer who imagines a new rhythm to play on the trumpet has imagined nothing technological, even though the trumpet itself *is* technological. The same is true of the salesman who imagines a new marketing technique to be carried out by telephone, or the accountant who imagines a new accounting scheme to be implemented, as such schemes typically are, on existing computer systems. A patent claim that, in substance, describes only a non-technological advancement should be held beyond the scope of the "useful arts," even if it makes general references to existing technology. "Existing technology" includes conventional general-purpose computer systems, as well as media, such as floppy disks, on which programs are stored.

On the other hand, new programming does create a "new machine," and, as long as the claim describes the substance of the programming in the language of programming, the claim is within the useful arts. Whether the claim should also be considered *novel* or *nonobvious* is a difficult question that can be treated only briefly. It has been suggested[586] that the obviousness of a program implementing a non-technological plan should be judged as if a programmer of ordinary skill were al-

585. *See supra* notes 558-560 and accompanying notes.

586. *See* Vincent Chiappetta, *Patentability of Computer Software Instruction as an "Article of Manufacture": Software as Such as the Right Stuff*, 17 J. MARSHALL J. COMPUTER & INFO. L. 89, 172-74 (1998).

ready aware of that non-technological plan. For example, if a program implements a new accounting scheme, one should ask whether the program would have been obvious *given* the needs of the new accounting scheme. This seems an unfairly restrictive approach to non-obviousness. Even unpatentable, non-technological insights may lead to new technologies, which *should* be patentable. For example, if the composer's conception of a new rhythm led him to invent a *new trumpet* on which it could be played, nothing should prevent the composer from patenting the trumpet. The same would be true if the salesman's marketing innovations led to the invention of a physically different telephone. To assume that the new rhythm or new marketing plan is already known is contrary to fact, and it adopts too narrow a view of invention. Inventions are often inspired by non-technological aspirations, and, even if the inventor's leap of imagination is non-technological, one should not discount the new and technological result. In the computer programming context, one should not assume that the non-technological plans inspiring a new program were already known if, in fact, they were not.

The most difficult issue of nonobviousness in the programming context is whether program architecture or data structures (which we shall now assume to be technological in character) are new if they are *structurally* or *mathematically* the same as those of prior programs, but the *meaning* is new. Assume, to take a trivial example, that existing programs included steps of adding quantity x to quantity y and storing the result in memory. Is a program that calls for the same operations, but in which x and y stand for different entities (e.g., share prices instead of shipping weights), a *new* program? This issue may be worthy of an article of its own, and I will not attempt to unravel it here. Whether or not the structure is new, however, it *is* technological.

V. CONCLUSION

As we enter a new millennium, it is fitting to contemplate how far American industry has progressed since the days of "horse collars and buggy whips," or the kinds of manufactures recited by Tech Coxe in 1787. Industrial power and wealth are moving increasingly into the "information industries" rather

than the "smokestack" industries of the past.[587] The largest corporation in the world, in terms of market capitalization, is Microsoft.[588] The United States is justifiably proud of its leadership in the "information industries," and much that is accomplished in those industries is richly technological. If we accept the principle that patent rights encourage the progress of technology, as governments around the world have concluded for centuries, then we must ensure that the patent system continues to function, even in areas of technology that the Framers would hardly have recognized. On the other hand, we cannot allow the patent system to devour realms of human ingenuity that are not at all within the confines of the "useful arts." Technology has made inroads into many aspects of life, but, in spite of Ellul's vision, we have not yet reached the point where technology is all. The patent system is *only* a vehicle for promoting technological development. We cannot predict the consequences if, through artful claiming, progress in essentially non-technological endeavors is swept within the domain of the patent system.

I have suggested a general approach to the identification of a "technological" or "useful arts" invention when a non-

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587. The shift was apparent even in the mid-1980s. *See* Vincent E. Giuliano, *The Mechanization of Office Work*, *in* THE INFORMATION TECHNOLOGY REVOLUTION, *supra* note 2, at 298 ("Information-related activities are becoming ever more important in American society and the American economy; the majority of workers are already engaged in such activities, and the proportion of them is increasing."); Halton, *supra* note 260, at 3 ("The world is undergoing a major social and economic change, a Second Industrial Revolution, through the new information-processing technology of communications and computers."); Yoneji Masuda, *supra* note 2, at 620 (forecasting a new "information society" in which *"the production of information values and not material values will be the driving force* behind the formation and development of society"). Ellul also writes of a "new industrial revolution" based on the computer. *See* JACQUES ELLUL, THE TECHNOLOGICAL SYSTEM 25 (1980).

> [F]or several years now, people have been speaking of a fourth industrial revolution [after those based on coal, electricity, and atomic energy]: the one launched by the computer.... The dominant factor is no longer a growth of potential or exploited energy, but rather an apparatus of organization, information, memorization, and preparation for decision-making, to replace man in a huge number of intellectual operations.

Id.

588. *See* Weber et al., *Call It the Net Effect*, BUS. WK., July 12, 1999, at 50.

> How much has the Net changed things? Only a decade ago, Japanese banks, a Swiss confectioner, and even a Philadelphia utility company were vastly more popular with investors than Microsoft Corp.... Today, after riding the personal-computer wave right on into the Internet boom, Microsoft has vaulted to No. 1 in our annual rankings.

Id. at 50.

technological vision leads to new programming for a conventional general-purpose computer. The implementation of non-technological ideas may lead to significant progress in the "useful art" of computer programming, and such progress should be promoted, as the Framers would have intended, by the conveyance of exclusive rights for limited times. However, the patent claim should reflect the art of programming; it should reflect the substantive details that belong to the programming art and that enable the *technological implementation* of the non-technological plan. The claim should deal with the *how* of the invention, not the *what*. As I have suggested, the distinction between *how* and *what* cannot be a bright one due to the nature of computer programming, and particular cases can be decided only on their own facts. If the courts and the Patent Office adopt the proposed distinction, at least patent applicants will have an increased incentive to emphasize their *technological* programming insights, both in drafting claims and in preparing the detailed disclosures of the specification. This in itself will contribute to the progress of "useful arts" in the information age.