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Legal Protection for Computer Programs, 1 Computer L.J. 1 (1978)

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LEGAL PROTECTION FOR
COMPUTER PROGRAMS

By Susan Hubbell Nycum*

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INTRODUCTION

Innovations in digital computer programming are ubiquitous in the United States today. In many cases such innovations require a substantial investment. At the same time, the fruits of that investment, which are essentially knowledge, can be exploited by others at a relatively small marginal cost once available. Consequently, investors are concerned with legal protection of proprietary rights in the software innovations they finance. This article examines one legal approach to the protection of proprietary interests in software—the patent system.

Digital computer programs have been written for more than twenty
years. For at least thirteen years the Patent Office has been examining patent applications containing explicit references to programming innovations. The availability and effectiveness of patents on these programs has been vigorously debated in the secondary literature for more than a decade. The question of patent availability has been litigated for nine years and has been the subject of two Supreme Court decisions.

This article provides an overview of what has developed from that lengthy experience. More particularly, the following discussion covers:

(a) In what sense, and under what circumstances, patent protection is available for digital computer programs;
(b) Whether, and under what conditions, such protection *ought* to be available; and,
(c) Whether the questions in (b) should be resolved within the patent adjudication system, *viz.*, the Patent Office and the courts, or by congressional action.

The discussion is intended to be comprehensible to the non-attorney. Therefore, because the doctrines and procedures of the patent law are central to the issues addressed, this article is arranged to provide an accumulative, conceptual foundation for the conclusions reached in the last section. Section I is a capsule presentation of the elements of patent law and practice relevant to the later material. In Section II, legal issues specific to patents on programming innovations are introduced in a topical discussion and then examined in the dynamic context of the judicial process. The nonlegal, policy considerations arising in the debate are recounted in Section III. Section IV provides an evaluation and analysis of the experience that inventors have had with the program patent question. The article concludes in Section V with a summary of the factors relevant to future consideration of the program patentability issue.

I. **AN OVERVIEW OF PATENT LAW**

A. **Introduction**

The United States patent system is based on federal statutes and administered exclusively by federal institutions. The Patent Act of 1952,¹ the latest in a series of reenactments since 1790, was enacted by Congress pursuant to Article I, section 8 of the United States Constitution.²

³

2. U.S. Const. art. I, § 8, cl. 8:

   The Congress shall have Power . . . To promote Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries; . . .
The clause is both a grant of power and a limitation. This qualified authority... 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. Nor may it enlarge the patent monopoly without regard to the innovation, advancement or social benefit gained thereby. Moreover, Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available. 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.”

The Patent Code is the foundation of the patent system, but statutory language is an inadequate guide to the “law” of patents, most of which has developed through the judicial and administrative institutions responsible for applying the statutes. At present, the law is comprised of the relevant statutes, interpretations of those statutes and their predecessors by the federal courts, and the regulations and practices of the Patent Office.

B. Requirements for Patentability

1. Substantive Requirements

The Patent Code specifies several qualities required of an invention before it is eligible for patent protection. These substantive requirements may be classified under the following labels: patentable subject matter, novelty, utility, originality and nonobviousness. An invention which satisfies these requirements is said to be patentable.

Patentable Subject Matter. Section 101 of the Patent Code provides that: “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title.” “Process,” “machine,” “manufacture,” “composition of matter” and “new and useful improvements” constitute the categories of patentable subject matter. The statutory content of “process” is amplified in section 100(b).

4. Id. at 5-6, 148 U.S.P.Q. at 462.
10. Id. § 101 (1970).
11. The term “process” means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material. Id. § 100(b) (1970).
“apparatus” is used interchangeably with “machine” in the patent law.12

These categorical labels are legal “words of art”; that is, their meaning can only be understood by reference to the court decisions which have added or subtracted phenomena from these categories over the history of patent adjudication. In the course of this development, the courts have enunciated various rules for including or excluding phenomena. One such rule, which will receive extensive consideration in the following section, is that “mental processes” are not patentable subject matter (or, as it is alternatively expressed, are “nonstatutory subject matter”).13 Another is that a patentable “process” must “act upon or change materials to a different state or thing.”14 In sum, the content of the subject matter categories cannot be viewed as coextensive with the phenomena denoted by the definition of the terms in everyday use or even in the specialized usage of technical communities.

**Novelty.** The requirements of “novelty” are spelled out in section 102.15 An innovation which has been previously “known or used” is said to have been “anticipated” by the prior invention.16 “Known,” “used,” and “prior invention” are all words of art and have meanings peculiar to patent law.

**Nonobviousness.** Section 103 states the only standards of inventive quality in the code.17 There is an elaborate doctrinal structure that shapes the content of “prior art,” “obvious,” and “ordinary skill.” Nevertheless, the application of section 103 is ultimately a subjective decision based on the overall impressions of a judge.18

**Utility and Originality.** “Utility”—the quality of being use-
ful—and "originality"—the requirement that the patent applicant be himself the inventor of the claimed invention—have not been of importance in the program patent context.

2. Procedural Requirements

Section 111 lists among the required components of the patent application a specification. The term "specification" is then defined and described in section 112. The basic description, or "disclosure," of the applicant's invention is set forth in the first part of the specification in accordance with the requirements of the first paragraph of section 112.

Section 112 further requires that "[t]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." The claims are of critical importance, since they define the scope of the patent when infringement is at issue. Phenomena capable of infringing the patent are said to be "covered" by the claims. Assuming that the claims are properly drafted, they cover the invention disclosed in the specification. When a particular phenomenon is legally determined to be described by the language of a claim, the claim is said to "read on" that phenomenon, whether or not the applicant intends that the claim "cover" it. Parts of the invention can be mentioned, or "recited," in the claims themselves, in which case they act as "limitations" and

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21. The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to 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.
22. Id.
24. The use of the terms "cover" and "read on" can be illustrated by the following example: Imagine that a person invents a new type of aircraft which satisfies the substantive requirements for patentability. Suppose further that he fully discloses the invention according to the requirements of the first paragraph of section 112 and then offers as his only claim "a heavier-than-air flying machine." The claim "reads on" a large number of "old" aircraft, over which the applicant is not entitled coverage since they "anticipate" his invention. Therefore, the claim will be rejected for failing to "point out and distinctly claim the subject matter which the applicant regards as his invention" (35 U.S.C. § 112 (1970 & Supp. V 1975)), although the claim does properly "cover" the invention which he has disclosed.
confine the set of phenomena upon which the claims are readable.25

Finally, the third paragraph of section 112 provides for the "means-plus-function" form for machine claims.26 All of the machine claims in the cases considered in this article have been so claimed.

C. Scope of Patent Protection

A patent grants "the right to exclude others from making, using or selling the invention throughout the United States" for a period of seventeen years commencing with the date of issue.27 That right is often characterized as a "monopoly."28 However, it is a very limited monopoly inasmuch as it makes no explicit provision for the patentee's right to make, use, or sell his invention, but gives the patentee only the right to exclude others from the use of his invention.29 In fact, the ability of a patentee to exploit his "monopoly" is heavily hedged by legal constraints, particularly those imposed by the antitrust laws.30

At a trial of alleged infringement, the court will construe the patentee's claims narrowly in light of his disclosed invention, and then inquire whether the alleged infringing phenomenon is covered by the claims.31 Various doctrines have been announced as guides in this procedure. One is the "doctrine of equivalents," whereby an apparatus claim will be held infringed if the defendant's device "performs substantially the same functions in substantially the same way."32 It can readily be seen, however, that infringement proceedings are ultimately governed by the same types of subjective judgment that determines the outcome of nonobviousness issues under section 103.

D. Patent Procedure33

A person seeking patent coverage for an invention first drafts an

25. 4 A. DELLER, DELLER'S WALKER ON PATENTS § 241 (2d ed. 1965).
26. 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.
29. Id.
31. 4 A. DELLER, DELLER'S WALKER ON PATENTS § 225 (2d ed. 1965).
33. For a more rigorous discussion of the procedures applicable to the prosecution of a patent application in the Patent and Trademark Office, see generally, I.
application and files it with the Patent Office. The drafting of the specification involves substantial strategy, since the applicant's interest lies in maximizing the breadth of his claims while minimizing disclosure of his invention. It is typical for a specification to contain a series of progressively broader claims. In program-related cases, both apparatus and process claims are frequently drawn to the same invention.\textsuperscript{34}

When the Patent Office receives an application, it is assigned to an examiner who reviews it for conformity to the substantive and procedural requirements of the law. Part of that reviewing process includes a search of the Patent Office files for prior art relevant to section 103 requirements. Frequently, the examiner has objections to an application, in which case he rejects it and returns it to the applicant for alternation and resubmission. The process continues until the examiner either approves the application or enters a final rejection. If the application is approved, the patent issues and the application is thereafter open to public inspection. A final rejection may be appealed to the Patent Office Board of Appeals.

If the applicant is not satisfied with the decision of the board, he can appeal to either the Court of Customs and Patent Appeals or the United States District Court for the District of Columbia.\textsuperscript{35} Either the Patent Office or the applicant can petition the United States Supreme Court for review of an adverse decision in the C.C.P.A.; however, at this level, for the first time in the appellate process, the appellant does not have an absolute right to a hearing.\textsuperscript{36}

Once a patent has issued, the patentee can sue for infringement in any United States district court and have the ordinary appeal to the courts of appeals.\textsuperscript{37} Again, the final appeal available is by petition for certiorari to the United States Supreme Court.\textsuperscript{38}

II. THE LEGAL ISSUES

A. Introduction

The first significant judicial consideration of program-related inventions occurred in the 1968 case of \textit{In re Prater and Wei}.\textsuperscript{39} It was


\textsuperscript{35} 35 U.S.C. §§ 141, 145 (1970). All appeals in program-related cases, however, have been to the Court of Customs and Patent Appeals [hereinafter cited as "C.C.P.A."].


\textsuperscript{37} Id. § 1338(a) (1970).

\textsuperscript{38} Id. §§ 1254, 2101 (1970).

\textsuperscript{39} 415 F.2d 1378, 159 U.S.P.Q. 583, 2 CLSR 8 (C.C.P.A. 1968), superseded by, 415
preceded by a lengthy public debate in which a variety of patent law issues associated with computer programs were raised and argued. That debate, already vigorous by 1968, was stimulated rather than resolved by the *Prater* case and only began to wane following the last round of commentary on the Supreme Court's decision in *Gottschalk v. Benson*.41

This section considers the law of program patents. It begins with a topical introduction to the issues appearing in the debate, followed by a chronological discussion of the case law, which provides a dynamic perspective of patent law development. Finally, the legal issues are reexamined in light of this case law. Inasmuch as this discussion must necessarily neglect many issues, it does not constitute a definitive guide to the law of program-related patents. A full appreciation of this law requires a careful reading of the decided cases in light of the history and development of patent law as a whole. However, the following essential points should emerge from the discussion that follows:

1. the contours of the major legal issues raised by attempts to gain patent protection for program innovations;
2. the reasons why a question such as "Are programs patentable?" may not be answerable;
3. an indication of the type of argument entailed by a judicial resolution of the program patent question; and,
4. some understanding of the relevant dynamics of judicial behavior.

### B. Patents on Programs Per Se

The patentability question began as an inquiry into whether patents could be obtained for computer programs claimed as such. In 1966, the Report of the President's Commission on the Patent System recommended that patents not be granted for "programs."42 Another view was that machine processes or configurations were preferable subjects for claims and that claims directed to "programs" were both unnecessary and undesirable.43

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40. The bulk of this public debate is contained in articles which appeared in a myriad of computer and legal publications. A listing of these articles appears in the Bibliography in this issue.
42. REPORT OF THE PRESIDENT'S COMMISSION ON THE PATENT SYSTEM 13 (1966) [hereinafter cited as *REPORT*].
43. Those who seek protection of inventions embodied in computer programs
Partly because litigated claims have all been drafted to machine processes or configurations, the issues raised by claims to programs per se remain obscure. They are nonetheless of continuing interest, since patent coverage of program inventions may yet be broadly granted or withheld on such terms.

1. **Definitional Problems**

Use of the term “program” involves several types of definitional ambiguities. A “program” can denote a spectrum of phenomena ranging from the formulation of problem-solving techniques to hardware-related implementations.\(^4\)

One source of confusion lies in the distinction between the abstract and concrete conceptions of computer programs. In the abstract approach, each metamorphosis is characterized as a set of abstract rules, and the definition therefore inherently emphasizes the goals and problem-solving methods of the programmer. The concrete approach, by contrast, focuses on the physical media characteristic of each metamorphosis, such as writings of equations, flowcharts, coding forms, punched cards, magnetic tapes, and the programmed computer itself.\(^5\)

A further source of confusion is exemplified by a program contained in a deck of punched cards, which has been described as both “records of signal combinations” and “the means by which those signal combinations are introduced into the computer memory.”\(^6\) The first perspective stresses the physical pattern of the alterations in the recording medium unique to the particular program; the second refers as much to the medium itself as to its unique configuration.


4. The set of abstract rules to be given a computer to solve a particular problem can pass through four distinct metamorphoses. Each stage can be referred to as a “program”; in addition, this term can encompass the entire set of metamorphoses. The metamorphoses contemplated in this definition include the “algorithm,” the “source program,” and the “object program.” Puckett, *The Limits of Copyright and Patent Protection for Computer Programs*, 16 ASCAP Copyright L. Symp. 81, 138-39 (1968).

5. Illustrative of the concrete approach is one writer’s characterization of a program listing as a “functional diagram of a logic machine.” Nimtz, *The Data Processing Revolution*, in PATENT RESOURCES GROUP, SOFTWARE PROTECTION BY TRADE SECRET, CONTRACT, PATENT 125, 127 (1969) [hereinafter cited as PATENT RESOURCES GROUP].

of divergent definitions of "algorithm" and "program" appearing in the program patentability debate. An "algorithm" has been characterized variously as:

1. "... conclusions based upon a precise or mathematical premise and line of reasoning."\(^{47}\)
2. "... a statement of a conclusion based on a sequence of steps involving mathematical, logical, mental, or natural rules or principles."\(^{48}\)
3. "... a method, recipe, or set of rules that can be used for solving a problem with the aid of a general purpose digital computer."\(^{49}\)
4. "... a prescribed set of well-defined rules or processes for the solution of problems in a finite number of steps."\(^{50}\)
5. "... any self-consistent set of ordered steps specifying definable operations upon data and leading to a particular result."\(^{51}\)

Definitions of "program" have varied from the anthropomorphic to the mechanistic. Among the former are those which seem to suggest that computers are sentient beings:

1. "... a set of instructions for communicating the mental concept."\(^{52}\)
2. "... a detailed set of instructions telling the computer what to do."\(^{53}\)
3. "... a set of instructions to a computer as to how it should manipulate information and data."\(^{54}\)
4. the "packaging" of an "idea."\(^{55}\)

Still stressing the abstract qualities of programs, but without anthropomorphic overtones, are such definitions as:

1. "... a series of instructions which control or condition the operation of a data processing machine."\(^{56}\)


\(^{48}\) Comment, Process Patents for Computer Programs, 56 Calif. L. Rev. 466, 483 (1968).


\(^{52}\) Brief for Honeywell, Inc., supra note 50, at 7.


\(^{55}\) Brief for IBM, supra note 49, at 23.

\(^{56}\) Report, supra note 42, at 12.
"... a set of steps that serve to specify changes in the state of the component parts of a digital computer." 57

Finally, programs have been characterized as digital computer machine states and processes:

(1) "... the coded sequence of instructions recorded in binary notation in the magnetic cores of the computer memory." 58

(2) "... a series of operations performed by a computer." 59

The absence of definitional uniformity has been viewed with concern by many patent proponents. Some commentators have criticized the "indiscriminate" use of the term "program" and have called for new terms to replace those contaminated by nonrigorous connotations. 60 It has also been said that "[t]he myth that a computer program is a non-machine device may stem in part from the intellectual process of and the techniques used by computer programmers," 61 and that "human beings tend to project the properties of the thing symbolized into the symbol itself." 62

Difficulties in securing program patents were considered by a panel at the 1965 Conference of the International Federation of Information Processing. "The most important single development of the panel and the discussion that followed was the clear delineation of the need to define further the concepts of 'software' and 'program'" 63 The opinion of the panel was that a definition of the term "program" by the software industry was preferable to a judicial definition. 64

It is certainly reasonable to suppose that a clear definition of a "program" would be a prerequisite to a patent on a program claimed as such. However, expectations that the problem can be solved by definitional exercises within the software industry reflect serious misconceptions of the patent law process. 65

2. Legal Problems

When a program is viewed from an abstract perspective, it is dif-

61. Id. at B-84.
62. Nimtz, supra note 45, at 126.
64. Id.
65. See notes 5-38 supra and accompanying text.
ficult, if not impossible, to separate the “set of abstract rules” or “set of instructions” from the underlying algorithm. Therefore, patent claims drawn to cover programs defined as such would have to overcome a series of judicial doctrines tending to block patents on “ideas” and closely related phenomena. It was stated in LeRoy v. Tatham that a “principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.” In Mackay Radio & Telegraph Co. v. Radio Corporation of America, the Supreme Court said that “a scientific truth, or the mathematical expression of it, is not a patentable invention.” Is an algorithm a “fundamental truth” or “the mathematical expression of it”? Several of the definitions quoted above speak of algorithms as “principles” or “rules.” Although algorithms are probably more usefully seen as normative rather than as descriptive, it seems inconceivable that a claim to the process of squaring ‘c’, multiplying the square by ‘m’, and assigning the product to ‘e’ would pass the Mackay test if $e = mc^2$—a description of a natural relationship—would not.

Inasmuch as patents are only issued for useful innovations, a reasonable reading of patent law doctrines cannot support the contention that they apply only to descriptions of principles and not to their applications. What has not been made clear is whether an algorithm of the type embodied, for example, in a programmed sort routine, would fall under the ban of cases such as LeRoy and Mackay. Such algorithms are at least of a different order of generality from that of $e = mc^2$ and are heavily conditioned by the manmade devices upon which they are implemented. However, the intellectual process of perceiving and exploiting physical relationships is very similar in both instances.

The alternative to claiming a “program” abstractly conceived as “a set of instructions” is to claim a physical device which has been configured in a particular way. A digital computer embodying a program may be seen as a uniquely configured device, but it is unlikely that it would ever be referred to as a “program” per se. A more familiar use of “program” in this connection is in reference to printed program listings or coded input media. Claims drawn to “programs” thus conceived, however, would have to surmount a series of doctrinal hurdles associated with the media of recordation, whether or not the word “program” appeared in the patent application.

66. 55 U.S. (14 How.) 156 (1852).
70. See text accompanying notes 48-50 supra.
71. Claims covering the configuration or operations of a programmed computer have avoided mention of “programs.” See note 43 supra.
At the coding stage of program development, a patent applicant would encounter the "printed matter" doctrine, which says that a patentable invention cannot result from the mere reduction of an idea to written or printed form.\textsuperscript{72} It has been suggested that the "printed matter" cases all turn on a user's contemplation of the writing while practicing the invention, and the mere fact that a person \textit{could} interpret whatever markings appear does not automatically invoke the doctrine.\textsuperscript{73} Whether a coding form is intended for "contemplation" by a keypunch operator cannot be predetermined, since the term "contemplation" would receive a legal definition if an appropriate case arose. But optical character recognition technology may obviate further human observation of these writings.

An uninterpreted card deck\textsuperscript{74} has the same characteristics as a coding form prepared for optical scanning: it is readable but usually unread by human beings. The patentability of card decks may receive some support from \textit{Cincinnati Traction Co. v. Pope},\textsuperscript{75} where a patent was upheld on a transfer ticket with a novel detachable coupon. The court stressed that the claims were limited to the structure of the ticket.\textsuperscript{76} However, it is unclear whether each novel pattern of holes punched in a succession of cards would be seen as a different "structure."

A configured, magnetic recordation device, such as a tape or disc, may also be referred to as a "program." Magnetic embodiments seem to be outside the scope of the "printed matter" doctrine entirely, since they are not directly readable by humans. However, it may be even more difficult to distinguish different "structures" in these media than in the case of punched cards, since the magnetically encoded information is invisible to the human eye.

There are other forms of pre-input, program embodiments, but those mentioned above reveal the essential legal uncertainties peculiar to this type of claim. Even were patents on such devices available, their usefulness to the patentee would be questionable. Some commentators have wondered whether patents on listings, for example, would protect...
more than the descriptions contained therein or amount to any more than copyright protection. The significance of patents on these devices would also depend on whether alternative embodiments would be considered "equivalents" in infringement litigation. There is reason to believe that the class of such equivalents would be narrowly defined by the courts.

C. Patents on Program-Related Inventions

The law of patents on computer programs has developed exclusively in the context of applications claiming not programs as such, but rather processes or machines embodying program inventions. An example of this approach is Claim No. 9 in the Prater and Wei application. The only point of novelty of this claim is in the algorithm, and the only economical mode of practice is by digital computer. Yet, the claim makes no mention of a "program."

One reason for an indirect approach to program protection has been the long-standing hostility of the Patent Office to patents on "programs." Another related motive for focusing on the computer

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77. Nimtz, supra note 58, at 205.
78. Kayton, supra note 73, at B-41, reprinted in 9 JURIMETRICS J. at 137.
79. See notes 31-32 supra and accompanying text.
81. In mass spectrographic analysis where, from a given sample of material there is generated a spectrum function having peaks therein spaced along a mass scale with respect to which the relationship between concentration, contribution factor of each of the m constituents of the mixture and the magnitude of each of the n peaks in said spectrum is represented by a set of m linear algebraic equations and where n is an integer greater than m, the method of selecting for analysis a set of m peaks least susceptible to error in concentration determination which comprises dividing each said contributing factor for each peak by a normalizing function, successively generating a determinant function for each said set of peaks, successively generating output indications of the magnitudes of said determinant functions, and selecting therefrom the determinant function of greatest magnitude for identification of said peaks least susceptible to error. Prater II, 415 F.2d at 1397, 162 U.S.P.Q. at 544-45, 2 CLSR at 37-38 (emphasis omitted).
82. The applicants specified that their preferred mode of practice was by analog computer and only mentioned digital computer practice as an alternative. Id. That choice was questionable in 1961, when the application was filed. Today, the manipulation of large systems of equations by analog computations is almost unimaginable.
83. Id. at 1397 n.18, 162 U.S.P.Q. at 544 n.18, 2 CLSR at 37 n.18. Inventions so claimed will be referred to hereinafter as "program-related inventions" to distinguish them from claims explicitly directed to programs per se.
84. See note 539 and text accompanying note 541 infra.
itself has been to avoid the unfavorable doctrines discussed in the preceding section, by placing a greater conceptual distance between the inventions as claimed and the thought processes associated with them. The history of such claims in the courts since 1968 reveals that this approach has been only partially successful in avoiding doctrinal obstacles, and not at all successful in avoiding Patent Office opposition.\footnote{See notes 258-397 infra and accompanying text.}

For the sake of clarity, the following discussion of the legal issues raised by indirect claims to program innovations is organized according to the four major requirements for patentability defined by the Patent Code: patentable subject matter (sections 100(b) and 101), non-anticipation (section 102), nonobviousness (section 103), and adequate claiming and disclosure (section 112).\footnote{These sections of the Patent Code are reprinted in the Appendix in this issue, and discussed at notes 5-18 supra and accompanying text.} Other patent issues, such as the scope of claims in an infringement context, have been discussed in the secondary literature and are mentioned below, although they have not yet received judicial treatment in a program context.\footnote{But see note 403 infra.}

1. **Patentable Subject Matter: Sections 100(b) and 101**

The pertinent categories of subject matter are "processes" and "machines", as listed in section 101 and amplified by section 100(b)'s "new use of a known machine" subcategory of "process." As the general patent law discussion above indicated, "process" and "machine" are legal words of art, with ambiguous and constantly shifting boundaries.\footnote{See text accompanying notes 11-14 supra.} Some of the phenomena beyond the pale of patent protection—for example, "phenomena of nature"—have been excluded on the basis of intrinsic qualities attributed to them by the courts. Despite repeated assertions by the C.C.P.A. to the contrary, however, the "subject matter" test also includes criteria vindicating other judicial policies.

The courts, and notably the Supreme Court, feel obliged to examine the relationship between the claimed application and the constitutional charge that patents promote, rather than merely be within, the "useful arts."\footnote{See note 2 supra. See also text accompanying note 4 supra.} "Nonstatutory subject matter" can therefore be understood in some cases as meaning "too much." This was notably true in the Supreme Court decision in *Gottschalk v. Benson*,\footnote{409 U.S. 63, 175 U.S.P.Q. 673, 3 CLSR 256 (1972).} where the claimed process was clearly a machine process and at least Claim 8 could not be read on any other mode of practice.\footnote{See note 326 infra.}
a. "Process" Claims

An early article in the program patent debate provided the following sample format for claiming program inventions as "processes" without explicit reference to a "program":

The method of summing signals which comprises the steps of extracting a first set of signals from a memory and storing the signals thus extracted in a register, adding a second set of signals to the signals previously stored in said register, and entering the resultant signals into said memory.93

Most of the earlier cases involved process claims, and there was a substantial body of opinion that the apparatus claim format was inferior. Process claims were said to provide easier disclosure and broader coverage.94 One observer even speculated that apparatus claims might not be available.95 Process claims were routinely upheld in the C.C.P.A. over Patent Office subject matter objections until two claims covering processes were rejected by the Supreme Court in Benson.96 In a somewhat murky opinion, the C.C.P.A. relied on the authority of Benson in rejecting the next process claims presented for its review.97 None have been litigated in the Supreme Court since Benson.

The legal doctrines debated in the context of the process approach are nevertheless of continuing interest for the following reasons: (1) it is not clear that Benson will support a blanket rejection of future process claims to program-related inventions, at least in the C.C.P.A.; (2) the Patent Office has asserted theories developed in this context as objections to program-related inventions claimed as apparatus; and (3) the debate constitutes a revealing example of patent law argumentation.

At least three different perspectives on the "process" associated with programs are available. One approach characterizes programming as the method of constructing a "special purpose" machine.98 Another

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93. Hamlin, Computer Programs Are Patentable, 7 COM. ACM 581, 581 (1964). If this example looks familiar to readers of the Benson and Tabbott claims, it is because Mr. Hamlin was Patent Attorney Director of Bell Telephone Laboratories, Inc., the real party in interest in the Benson case. See also, Comment, supra note 57, at 131.


95. See Comment, supra note 48, at 480. Numerous apparatus claims have since been upheld by the C.C.P.A., however. See, e.g., In re Bernhart, 417 F.2d 1395, 163 U.S.P.Q. 611, 2 CLSR 359 (C.C.P.A. 1969), discussed in notes 290-99 infra and accompanying text.


98. Hamlin, supra note 93, at 582. See also text accompanying notes 71 supra & 181-86 infra.
approach is to claim a process taking place solely within an already programmed computer. Finally, either or both of these approaches can be combined in a claim also reading on additional process steps, such as industrial activity.

None of the litigated claims reads on the process of programming a computer alone.\textsuperscript{99} Six of the claims in the reported cases read on strictly internal computer operations and were upheld by the C.C.P.A.\textsuperscript{100} However, this was the type of claim rejected by the Supreme Court in \textit{Benson}.\textsuperscript{101} Seven other claims in the cases read on computer processes combined with non-computer processes. One of these claimed the programming of a computer in conjunction with an external process (it was rejected for reasons unrelated to section 101).\textsuperscript{102} The remainder claimed among the process steps the operation of a computer; and of these, two were upheld,\textsuperscript{103} two were rejected for non-section 101 reasons,\textsuperscript{104} and two fell under the cloud of \textit{Benson} and were rejected as nonstatutory subject matter.\textsuperscript{105}

A special form of process claim is permitted by section 100(b)—the "new use of a known machine." If the computer were the "machine," its role would plainly have to be joined with noncomputer steps to fit the literal wording of section 100(b).\textsuperscript{106} One could imagine a claim for the

\textsuperscript{99} The United States Supreme Court in \textit{Benson} so characterized the claims before it, but the claims plainly read on the operation of a computer. See, e.g., Claim Nos. 8 & 13, 409 U.S. 63, 73-74, 175 U.S.P.Q. 673, 677, 3 CLSR 256, 263-64 (1972), reprinted in note 326 infra.


\textsuperscript{101} 409 U.S. 63, 73, 175 U.S.P.Q. 673, 677, 3 CLSR 256, 263 (1972).


\textsuperscript{104} Claim Nos. 9 & 17, \textit{Prater II}, 415 F.2d at 1397, 162 U.S.P.Q. at 544-45, 2 CLSR at 37-38.


\textsuperscript{106} Such a claim (Claim No. 19) was upheld in \textit{In re Foster}, 438 F.2d 1011, 1013-14, 169 U.S.P.Q. 99, 100, 2 CLSR 994, 996-97 (C.C.P.A. 1971). Claim No. 19 states:

\begin{quote}
In the processing of geophysical data to compensate for the effect of distortion present in obtaining said geophysical data and to emphasize the characteristics of the geological formations producing said geophysical data, the new use of computing apparatus, said computing apparatus being interconnected to include:
\end{quote}
"new use" of an input medium; that is, the programming of a digital computer to achieve a defined computer state, although the medium might be vulnerable to the "printed matter" doctrine and hence not a "machine." Commentators have been ambivalent about claims cast as "new uses." One concern has been the ability vel non of such a claim to meet the test of being "non-analogous" to prior uses. In Foster and other cases, the C.C.P.A. has upheld "new use" claims, but it is not clear that this claim format offers any special advantages if subject matter challenges arise.

Program-related processes, however claimed, have been attacked as nonstatutory on the basis of theories that can be classified under the headings of the "mental steps" doctrine, the "function of a machine" doctrine, end use problems and the "preemption" doctrine. Each of these doctrines will be analyzed in turn.

(1) "Mental Steps" Doctrine

The "mental steps" doctrine, which had a rather inauspicious beginning under that label in Halliburton Oil Well Cement Co. v. Walker, experienced a series of novel elaborations in the hands of the Patent Office as the foundation of its attack on program-related process

a smoothing filter for smoothing the spectrum of the signal applied to the input,

an inverter producing as an output coefficients of a filter which is the inverse of the signal applied to the input, and

an inverse filter,

said new use comprising:

applying said geophysical data to said correlator to produce as an output a signal having a distortion component representing said distortion and a reflectivity component representing said characteristics of said geological formations,

applying said last-named signal to said smoothing filter to smooth the spectrum of said signal thereby separating said distortion component from said reflectivity component,

applying the output of said smoothing filter, representing said distortion component, to said inverter to produce as an output of said inverter the coefficients of a filter which is the inverse of said distortion component,

applying said coefficients to said inverse filter to provide an inverse filter having filtering which is the inverse of the distortion operator, and

applying said geophysical data to said inverse filter to produce an output emphasizing said characteristics of said geological formations.

The other claim, Claim No. 4, was rejected for reasons unconnected with the fact that it was cast in a conventional process claim form. Id.

107. See notes 72-73 supra and accompanying text.
108. References to the nonanalogous use problem can be found in Comment, supra note 48, at 480, and Hamlin, supra note 93, at 581.
110. 146 F.2d 817, 64 U.S.P.Q. 278 (9th Cir. 1944). See also, the analysis by Judge Smith in Prater I, 415 F.2d at 1386, 159 U.S.P.Q. at 591, 2 CLSR at 20-21.
claims. A quotation from Prater I provides an appropriate introduction to the continuing attempts by the Patent Office to bootstrap a variety of patentability disqualifications onto the “mental steps” bar:

The examiner’s position before the board, as set forth in his Answer, includes a rejection of the method claims for failure to comply with 35 U.S.C. 101, 102 and 112. A sequence of initial steps of reasoning adopted by the examiner in this rejection, is: (1) that if the invention is to fall within a statutory class under section 101 it must be as a ‘process’; (2) that the claims are readable upon a mental process; and (3) claims to a mental process are unpatentable (in support of which proposition the examiner quotes portions of In re Abrams, 188 F.2d 165, 38 CCPA 945 (1951)). The examiner then proceeds with development of the rejection in two alternative forms.

In the first form of the rejection under 35 U.S.C. §§ 101 and 102, the examiner argues, on the one hand, that if the novel part of a claim is readable on subject matter which is unpatentable because it is outside the statutory classes of patentable subject matter, then the claim as a whole is unpatentable under 35 U.S.C. § 101; and, on the other hand, if the claim reads on the physical process of a person marking paper during calculation by hand, then the claim is unpatentable under 35 U.S.C. § 102.

In the second form of the rejection, under 35 U.S.C. §§ 101 and 112, the examiner argues that if the claim covers subject matter outside the statutory classes (as well as subject matter within the statute) then the claim fails to particularly point out and distinctly claim the invention, as required by 35 U.S.C. § 112.111

The roots and preprogram history of the “mental steps” doctrine have been traced exhaustively elsewhere.112 The thrust of the earlier cases was that a process which specifically claimed steps disclosed as performed mentally—and particularly if requiring interpretive procedures—was nonstatutory subject matter. On the other hand, these early cases established that “[a] method is not per se unpatentable because its practice requires that the operator thereof must think,”113 an observation perhaps too obvious to mention.

Program-related processes do not, in fact, require human thought, interpretive or otherwise, in performing those steps associated with the computer. The real focus of the “mental steps” doctrine in this area has been upon process claims which are readable in some fashion on mental implementation (or its equivalent—pencil-and-paper practice). Early

111. Id. at 1381, 159 U.S.P.Q. at 586-87, 2 CLSR at 14 (emphasis in original).
hopes that the "mental steps" objection could be avoided by the disclosure of fully automatic machines\textsuperscript{114} were not fulfilled, as the Government's \textit{Prater} argument revealed.\textsuperscript{115} Of course, claims that definitely read on nonstatutory subject matter will necessarily fail.\textsuperscript{116} Therefore, attempts to rescue programs from rejection on this ground have followed two basic approaches: on the one hand, denying that the mental processes in question are or ought to be relevant to the subject matter issue and, on the other hand, asserting that claims to a program-related process do not read on mental activity.

The line of reasoning on the irrelevance of mental processes is as follows: (a) infringement is a tort; (b) torts require "acts" and harm to the patentee; (c) mental practice, which is neither an "act" nor harmful, cannot infringe; and (d) mental practice should therefore not be an issue, since "monopolization" by patent necessarily entails the power to bring infringement actions.\textsuperscript{117} In a similar vein, it has been argued that claims reading on mental practice in the abstract should nevertheless stand if no person would, in fact, practice the invention mentally.\textsuperscript{118} The \textit{Prater} invention provides an obvious example of such a claim, since the claimed process involved selecting one subset of ten equations from among 184,756 possible subsets.\textsuperscript{119}

A more adventurous task is to argue that the claimed thought is not, or ought not to be considered, nonstatutory subject matter. The Supreme Court held as early as 1863 that "ideas" were not patentable.\textsuperscript{120} Recently, it was asserted that, by virtue of their alleged relationship to thought, program-related process patents raised constitutional questions under the first, ninth, and tenth amendments.\textsuperscript{121} The response of the pro-patent community has been a series of efforts to distinguish patentable mental activity from that which is nonpatentable. One variant has been to suggest coverage for all processes, mental or otherwise, as long as they are commercial or industrial in nature.\textsuperscript{122} The following rumination illustrates this line of reasoning:

\begin{itemize}
  \item 114. \textit{See}, \textit{e.g.}, Note, \textit{The Patentability of Computer Programs}, 38 N.Y.U.L. Rev. 891, 909 (1963).
  \item 115. \textit{Prater II}, 415 F.2d at 1399-1400, 162 U.S.P.Q. at 546-47, 2 CLSR at 41.
  \item 116. \textit{See} notes 88-89 \textit{supra} and accompanying text.
  \item 117. Falk, \textit{Mental Steps and the Patent Law—A Rumination}, 8 Pat L. Ann. 203, 212 (1970). This argument was also made by Bell Telephone Laboratories, Inc., in its amicus brief in \textit{Prater II}. \textit{See} 415 F.2d at 1400 n.20, 162 U.S.P.Q. at 547 n.20, 2 CLSR at 42 n.20.
  \item 118. Kayton, \textit{supra} note 73, at B-43 to B-44, \textit{reprinted} in 9 Jurimetrics J. at 138-40.
  \item 119. 415 F.2d at 1395 n.13, 162 U.S.P.Q. at 543 n.13, 2 CLSR at 35 n.13.
  \item 120. Burr v. Duryea, 68 U.S. (1 Wall.) 531, 570 (1863).
  \item 121. Brief for B.E.M.A., \textit{supra} note 54, at 12. This was also raised by the Solicitor General in his petition in \textit{Prater}. \textit{See Prater II}, 415 F.2d at 1400 n.20, 162 U.S.P.Q. at 547 n.20, 2 CLSR at 42 n.20.
  \item 122. McClaskey, \textit{supra} note 112, at 1195.
\end{itemize}
Why is pure mathematics non-statutory? I have found no authority but I think the reason is that historically, mathematics has not been a "useful art" in the constitutional sense because, historically, there has been no immediate correlation between the discovery of a mathematical relationship and the implementation of that relationship in the physical, tangible world of machines.\textsuperscript{123}

Another effort has been to distinguish various qualities of human thought, asking: "Are the steps involving human intervention . . . of the type that require subjective interpretation or are they merely responses that are clearly defined and could, for example, be per-formed [sic] by logic circuitry or apparatus?"\textsuperscript{124} The line can be drawn even more favorably by relegating to the status of nonstatutory only those thought processes that cannot be machine-implemented.\textsuperscript{125}

The second principal response to the "mental steps" objection is to deny that the claim reads on a mental process at all. The evolution of claim-limiting language satisfactory to the C.C.P.A. in this regard is traced below in the discussion of disclosure requirements.\textsuperscript{126} However, mere claim limitations do not meet the contention that it is impossible to draft claims to program inventions that do not read on mental practice. One author seemed to adopt this view in asserting that "[p]atentability cannot depend upon the intelligence represented."\textsuperscript{127} In other words, a program algorithm cannot supply the novelty required by the "new and useful . . . process" language of section 101 because it is itself nonstatutory.\textsuperscript{128} A similar view is reflected in the following quotation: "While the computer operates by physical equivalents of logical functions, the functions themselves are the same procedures which a human being would perform in working the same computation."\textsuperscript{129}

The response to such assertions has been to stress the differences between thought and program processes; specifically, by pointing out that information is physically represented in computers and that machine processes do not, in fact, duplicate human thought processes.\textsuperscript{130}

Patent proponents, attempting to widen the conceptual gap be-

\begin{itemize}
\item \textsuperscript{124} Falk, supra note 117, at 215 (emphasis omitted).
\item \textsuperscript{125} Nimtz, The Patentability of Computer Programs, 1 Rutgers J. Computers & L. 38, 45 (1970).
\item \textsuperscript{126} See notes 213-57 infra and accompanying text.
\item \textsuperscript{127} Galbi, The Unpatentability of Computer Programs, 5 Pat. L. Ann. 147, 171 (1967).
\item \textsuperscript{128} Id. See also, Puckett, supra note 44, at 116.
\item \textsuperscript{129} Brief for Petitioner at 7, Gottschalk v. Benson, 409 U.S. 63, 175 U.S.P.Q. 673, 3 CLSR 256 (1972).
\item \textsuperscript{130} See, e.g., Jacobs, supra note 43, at 374.
\end{itemize}
tween mental and program processes, have also stressed the similarities between software and hardware implementation. The following dicta from *Ex Parte Egan*[^131] is frequently cited on this point:

We agree that the process under consideration is properly analogous to a method of operating a computer, since the charts employed are quite analogous to a preconstructed computer. The method operations in operating a computer are distinct from the method of computation itself. It is perfectly possible to have a patentable process in which apparatus is used in a particular way to get a useful result.[^132]

This passage has been interpreted as taking "for granted that computer programs are patentable,"[^133] but some qualification is necessary. Not only were "programs" not mentioned as such, but *Egan* distinguished the use of the charts from the method of their construction[^134] (which may well have been unpatentable as "mathematical computations"). Thus, the quoted dicta does not address the patentability of a "program" conceived as a method of configuring a "preconstructed computer." In any case, the Patent Office Board of Appeals has demonstrated a different attitude toward programs in recent years, and the primary employment of analogies between hardware and software has been in defense of apparatus, not method, claims.[^135]

The particular uses of the "mental steps" doctrine discussed above do not begin to exhaust its flexibility as a springboard for assertions that program processes are nonstatutory. The doctrine has evolved from a relatively narrow, albeit challenged, preoccupation with human participation in claimed processes, to at least moral support for assertions that claims to totally automatic process steps threaten our "intellectual patrimony"[^136] and seek monopolies on "scientific truths."[^137] The "mental steps" doctrine has been characterized as a "shibboleth,"[^138] and with some justice, having become, in the hands of the Patent Office, a conclusory label for a "mixed bag" of weak objections to program-related processes.[^139]


[^132]: *Id.* at 28.

[^133]: Note, supra note 114, at 894.


[^135]: See notes 235-37 & 255 infra and accompanying text.


[^138]: Falk, supra note 117, at 203.

[^139]: This is not to say that the policy concerns underlying earlier versions of the doctrine were misplaced or that all attacks upon the doctrine have been well-founded.
(2) "Function of a Machine" Doctrine

Explicit statutory authority for "processes" as patentable subject matter first appeared in the Patent Act of 1952.140 While processes had been accorded patent protection prior to 1952 by judicial interpretation of the "useful arts" category, this occurred only after prolonged, evolutional development in the last half of the nineteenth century.141 In the course of that evolution, the Supreme Court, on several occasions, granted patents on apparatus while denying claims to the general operation of the same apparatus. The following dicta in Corning v. Burden142 is frequently cited: "It is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it."143

Although process patents were subsequently upheld in several cases, the language of Corning was echoed in Risdon Locomotive Works v. Medart,144 in which the Court denied coverage for "a process which involved nothing more than the operation of a piece of mechanism, or, in other words, for the function of a machine."145

Soon thereafter, the functional predecessor of the C.C.P.A. declared that "a process, which amounts to no more than the mere function of a machine, is not patentable"146 unless "the process may be performed by hand or by another mechanism than that exhibited, although perhaps not with equal efficacy."147 This doctrine prevailed in the C.C.P.A. until the late 1960's.148

Early writers on program-related patents recognized that claims to processes might be vulnerable to the "function of a machine" objection. It was commonly felt that the disclosure of alternative hardware configurations to carry out the same algorithm could avoid the problem,149 although at least one commentator doubted that such alternatives could be disclosed adequately without a crushing burden of hardware detail.150 The possibility that the doctrine might be avoided by disclosure of alternative pencil-and-paper practice was also raised,151

142. 56 U.S. (15 How.) 252 (1853).
143. Id. at 268.
144. 158 U.S. 68 (1894).
145. Id. at 77.
147. Id.
148. See notes 152-54 infra and accompanying text.
149. See Richards, Recent Developments in Patent Law, in Southwestern Legal Foundation, Patent Procurement and Exploitation 97, 115 (1963); Note, supra note 114, at 907-08.
150. Puckett, supra note 44, at 112.
151. Richards, supra note 149, at 117-18. The author relied on Ex parte Mills, 131
but not pressed in later discussions, since pencil-and-paper practice of computational steps is clearly "mental" activity and directly raises the "mental steps" doctrine.

The 1968 case of In re Tarczy-Hornoch,152 involving claims to an analog pulse-sorting device, terminated the "function of a machine" doctrine. In Tarczy-Hornoch the C.C.P.A. found that the doctrine was supported neither by actual Supreme Court holdings nor by policy considerations.153 Foes of program patents raised the "function of a machine" objection again in Benson, asking the Supreme Court to overturn the Tarczy-Hornoch holding on the ground that it flew in the face of prior Supreme Court rulings.154 The Court made no mention of either Tarczy-Hornoch or the "function of a machine" doctrine in its opinion.

(3) End Use Problems

The "function of a machine" objection rested upon the alleged failure of the applicant to disclose alternative ways of reaching a particular result. A related, but distinguishable, set of problems arose concerning the perception that certain claims are not confined to an appropriate set of end uses. These problems can be separated into those relating to "field of use" limitations and those relating to the qualities of disclosed end uses.

"Field of use" limitations are accomplished by reciting in a claim at least one process step which limits the claim to practice in a particular industrial or technological area.155 Such limitations have been thought by some to be both necessary and adequate to overcome subject matter difficulties,156 although the set of acceptable "field of use" candidates has not been well-defined. Some who otherwise oppose program-related patents suggest that the "field of use" need not extend beyond the data processing industry, arguing that "systems programs"157 or "control techniques"158 are patentable as steps in processes that begin and end with the manipulation of peripheral equipment.

U.S.P.Q. 331 (Pat. Off. Bd. App. 1961), where the specification disclosed an analog device, but the allowed claim was not limited by structural language. In fact, the Patent Office had argued in Mills that the claim failed as an "inherent function of the disclosed apparatus" because, inter alia, "it is not apparent that the recited method could be performed by hand." Id. at 333. Since the "mental steps" issue was not before the Board, the case can only be taken as an uncertain foundation for an inference that the Patent Office might have acquiesced had pencil-and-paper practice been disclosed.

153. Id. at 857, 158 U.S.P.Q. at 142.
154. See, e.g., Brief for IBM, supra note 49, at 24-25.
155. See, e.g., Richards, supra note 149, at 117.
156. Id. at 105, 117; Note, supra note 114, at 903.
The qualitative test for proper "end use" limitations typically relies on the language of *Cochrane v. Deener*,159 which, it is argued, limited patentable processes to those which act to change specified materials to a "different state or thing."160 Processes which include steps of manipulating physical matter subsequent to computational steps avoid the *Cochrane* barrier. The critical issue has been whether internal computer processes are statutory under this test.

The 1966 proposed Patent Office Guidelines characterized such processes as "mathematical" and hence barred by the *Cochrane* doctrine.161 The theme was repeated in the guidelines issued in 1968:

A process or method is directed to patentable subject matter only if it is performed on physical materials and produces some appreciable change in their character or condition; *In re Shao Wen Yuan*, 1951 C.D. 286, 38 C.C.P.A. 967, 89 USPQ 324; *Cochrane v. Deener*, 94 U.S. 780, 1877 C.D. 242. Accordingly, a computer programming process which produces no more than a numerical, statistical or other informational result is not directed to patentable subject matter. Such a process may, however, form a part of a patentable invention if it is combined in an unobvious manner with physical steps of the character above referred to as, for example, in the knitting of a pattern or the shaping of metal.162

Patent proponents have attempted to avoid the application of *Cochrane* by arguing that program-related claims refer to changes in memory device states rather than to numerical manipulation,163 and by asserting that *The Telephone Cases*164 established the equivalence of changes in substances and electromagnetic alterations for subject matter purposes.165 Proponents also claim that the "test" of *Cochrane*,

159. 94 U.S. 780 (1876).
160. That a process may be patentable, irrespective of the particular form of the instrumentalities used, cannot be disputed. If one of the steps of a process be that a certain substance is to be reduced to a powder, it may not be at all material what instrument or machinery is used to effect that object, whether a hammer, a pestle and mortar, or a mill. Either may be pointed out; but if the patent is not confined to that particular tool or machine, the use of the others would be an infringement, the general process being the same. 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.

Id. at 787-88.
161. PROPOSED GUIDELINES, supra note 47, at 865.
163. Note, supra note 114, at 904.
164. 126 U.S. 1 (1887).
165. Kayton, supra note 73, at B-40. See also, McClaskey, supra note 112, at 1155-56.
whatever its original force, was altered by subsequent decisions and that “[a]s long as the process embodies physical materials, agents and effects, and produces a novel and useful result, it is patentable.” The *Prater* case was expected to settle the “acting on materials” issue and was said to have done so, although the statements to that effect in *Prater II* were simply *obiter dicta*. By the time of the *Benson* appeal, however, the Supreme Court was being asked to revive the *Cochrane* doctrine.

(4) "Preemption" Doctrine

In appealing the *Benson* case, the Government argued the irrelevance of the contention of the C.C.P.A. that no one would want to practice the invention by pencil and paper:

> It is surely not proper to grant what would otherwise be an undeserved and therefore objectionable patent monopoly merely because it appears at the time of the grant that it is impossible that anyone will in the future desire to practice the subject matter of the grant.

The Supreme Court stood this argument on its head and struck the claims on the ground that they in fact would preempt other uses of the algorithm lying at the point of novelty.

An attorney active in the program-related patent arena had once declared that “a patent to a . . . program would not cover the mathematics used to develop it; it would merely cover the operation of a machine in accordance with the program.” Other observers, however, had voiced concern that such patents would effectively control the mathematics where computer implementation was the only feasible mode of practice, and the *Benson* court was well briefed on this possibility, with such examples as the Simplex and Monte Carlo techniques. Whether the *Benson* holding would reach attempts to claim

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169. *Obiter dicta* is a legal term defined as “words of a prior opinion entirely unnecessary for the decision of the case.” BLACK’S LAW DICTIONARY 1222 (4th rev. ed. 1968).


techniques of the latter type, however, is one of the many uncertainties generated by the Court’s opinion.  

b. “Machine” Claims

“Machine” or “apparatus” claims to program innovations have been drawn to programmed computers, either in isolation or as components of more extensive systems. The cases reveal eight apparatus claims, four of which were rejected for reasons unrelated to section 101177 and four of which were upheld.178 All were cast in the “means-plus-function” form authorized by the last paragraph of section 112.179 Claim 19 in Bernhart is typical:

A system . . . comprising in combination: electronic digital computer means programmed to respond to applied signals . . .; signal means coupled with said computer means . . .; and planar plotting means coupled with said computer means . . . .180

A contention implicit in such claims is that a programmed computer is, for legal purposes, a different machine from the same computer in an unprogrammed or differently programmed state.181 Opponents of such claims have denied that programming in fact creates a “new” or “different” machine. Claims to a programmed computer have been analogized to claims on a machine with its switches set in a peculiar arrangement and to claims by a gearbox inventor to “forward”

176. See notes 343-54 infra and accompanying text.
179. See note 26 supra.
181. Program patent applications do not claim “programs” as such, which have been characterized elsewhere in machine terms as the “control mechanism of the programmed computer.” Jacobs, supra note 60, at B-77 to B-79. Instead, applications claim the programmed machine. To further strengthen the “machine” image of programs, proponents repeatedly stress the “engineering equivalence” of software and hardware implementations. Explanation of this “engineering equivalence” theory, however, rarely goes beyond the observation that when innovators are confronted with a choice between hardware or software implementations, “the particular approach that is used is essentially an engineering decision. . . .” Id. at B-79.
and "reverse," the judicial sanction of which would be a "contravention of common sense."\textsuperscript{182}

It has also been said that programming does not create a new apparatus because it "is merely another word for operating a computer."\textsuperscript{183} Other objections to machine claims have relied on analogies to phenomena denied protection by the Supreme Court in past cases, such as the mere "packaging" of otherwise unpatentable components,\textsuperscript{184} or particular player-piano rolls in combination with a player-piano.\textsuperscript{185} Such arguments were flatly rejected by the C.C.P.A. in \textit{In re Bernhart}, where the court said: "If a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program."\textsuperscript{186}

The C.C.P.A. has also rejected attempts by the Patent Office to apply process claim doctrines to machine claims. Among these attempts was the contention that such devices were not "machines" because they were "predicated on mental steps" at their point of novelty and hence did not contain structural differences over the prior art.\textsuperscript{187} Also rejected were contentions that claims reciting structural language were readable on human beings\textsuperscript{188} and that patents on program-related apparatus would preempt the underlying algorithm.\textsuperscript{189} Finally, the C.C.P.A. in \textit{In re Johnston}\textsuperscript{190} declared that the control of algorithms by a machine claim, even if possible, was legally irrelevant.\textsuperscript{191}

2. \textit{Anticipation: Section 102}

Section 102 of the Patent Code denies patentability to an invention which was "known or used" in the United States prior to its invention by the patent applicant.\textsuperscript{192} Patent Office "anticipation" objections to computer program-related claims have generally relied on two theories:

(1) That subject matter which is nonstatutory in its own right could not distinguish the invention, and the invention was therefore anticipated because the general-purpose computer

\begin{footnotesize}
\begin{enumerate}
\item[182.] Puckett, \textit{supra} note 44, at 107-08.
\item[183.] Galbi, \textit{supra} note 127, at 165.
\item[185.] Brief for Petitioner, \textit{supra} note 129, at 33 n.32, \textit{referring to} White-Smith Music Publishing Co. v. Apollo Co., 209 U.S. 1 (1908) (a copyright case).
\item[187.] \textit{Id.} at 1398, 163 U.S.P.Q. at 614, 2 CLSR at 363.
\item[188.] \textit{Id.} at 1399, 163 U.S.P.Q. at 615, 2 CLSR at 364-65.
\item[189.] \textit{Id.} at 1399, 163 U.S.P.Q. at 616, 2 CLSR at 365-66.
\item[191.] \textit{Id.} at 771-72, 183 U.S.P.Q. at 177, 4 CLSR at 1502-03.
\item[192.] \textit{See} note 15 \textit{supra}.
\end{enumerate}
\end{footnotesize}
itself was "old;"\textsuperscript{193} and,
\begin{enumerate}[\itemsep=0pt]
\item That apparatus claims were anticipated by such devices as pencils and paper.\textsuperscript{194}
\end{enumerate}

These objections, founded on section 101 theories of the Patent Office, were overturned when the C.C.P.A. rejected the underlying subject matter premise as previously described.\textsuperscript{195}

Anticipation arguments have also been based on the assertion that the digital computer fully anticipates all of its programmed configurations. A representative of a hardware manufacturer once argued that "a program's logic design is contemplated fully in the design of the computer."\textsuperscript{196} Such arguments have been answered by alternative characterizations of an unprogrammed, general-purpose digital computer as a "plugboard"\textsuperscript{197} or "an array of independent space-distributed instrumentalities."\textsuperscript{198} Even the Patent Office was at one time disposed to see an unprogrammed computer as "a 'warehouse' of unrelated parts."\textsuperscript{199} Computers have been described as "incomplete" without programs,\textsuperscript{200} a condition in fact cultivated by their manufacturers: "That a latent functional capacity is enough for anticipation . . . is clearly untenable . . . Indeed, the goal of the hardware organizer is the preservation of the maximum freedom of action for program intervention or organization."\textsuperscript{201}

This dispute finally ended when the C.C.P.A. ruled that a programmed computer was a "new machine."\textsuperscript{202} It is unlikely that the anticipation issue will be seriously urged in the future.

3. Inventor: Sections 101 and 102

Sections 101 and 102 require that the patent application be filed by the inventor of the subject matter of the application.\textsuperscript{203} Some writers

\begin{footnotes}
\item \textsuperscript{193} See, e.g., Prater II, 415 F.2d at 1398-99, 162 U.S.P.Q. at 545-46, 2 CLSR at 38-40.
\item \textsuperscript{194} Id.
\item \textsuperscript{195} See notes 110-16 supra and accompanying text.
\item \textsuperscript{197} Hamlin, supra note 93, at 581.
\item \textsuperscript{198} Eltgroth, Software and the Patent Law, 4 Pat. L. Ann. 1 (1966).
\item \textsuperscript{199} PROPOSED GUIDELINES, supra note 47, at 866. Such a position would seem to support the contentions of patent proponents that introducing a program into a computer creates a different machine. See notes 181-86 supra and accompanying text.
\item \textsuperscript{200} Jacobs, supra note 59, at 10, reprinted in 7 Com. ACM at 584.
\item \textsuperscript{201} Eltgroth, supra note 198, at 4-5.
\item \textsuperscript{202} See note 186 supra and accompanying text.
\end{footnotes}
have visualized potential difficulties in selecting the proper "inventors" of program-related innovations for filing purposes. From one perspective, the programmer might have to be joined by additional persons. One commentator opined that applications containing apparatus claims may have to be signed by hardware designers, and another wondered if the author of the compiler or assembler would have to be included when claims covered object programs. An alternative perspective suggested that the programmer need not sign at all since programming is "automatic" given the algorithm or flowchart.

These issues have received no judicial treatment and it is unlikely that they are grounds for concern. At most, the problem of identifying the set of "inventors" of computer software is no more difficult than that encountered in other areas of technology.

4. Nonobviousness: Section 103

Assuming that an invention is not actually anticipated, to be patentable it must mark such an advance over the relevant prior art that it would not have been obvious to persons of ordinary skill in that art. The Patent Office has attempted to couple section 103 objections to subject matter theories, arguing that nonstatutory subject matter (i.e., algorithms) could not distinguish program-related inventions from the prior art. That effort was frustrated by the C.C.P.A. in

More substantial questions are raised by the conventional application of section 103 to program-related claims. Four claims have been rejected by the C.C.P.A. on the basis of prior art cited by the Patent Office. Other claims appearing obvious, at least at the time of trial, have escaped section 103 challenge, possibly for one or more of the following reasons:

1. The Patent Office preferred for tactical reasons to rest its opposition on theories of more general effect.
2. Obviousness is tested against the art and programmer skill level existing at the filing date, which typically precedes litigation by six or seven years in program-related cases.
3. There does not exist an adequate file of current art, let alone a collection of art historically organized.

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205. Puckett, supra note 44, at 117.
207. See note 17 supra.
210. See notes 474-78 infra and accompanying text.
Some commentators have been confident that a significant number of program-related innovations will be able to pass section 103 muster. 211 Others have expressed strong doubt. 212 The case law to date has not shed much light on the question.

5. Specification: Section 112

Section 112 requires that inventions be adequately disclosed and precisely claimed. 213 In practical application these requirements overlap: elements recited in the claims constitute part of the disclosure, and the adequacy of claim language is measured in light of the specification as a whole. 214 However, the legal doctrines based on section 112 are generally either claim or disclosure-oriented.

The Patent Office initially cast the claim requirements of section 112 in a role ancillary to its subject matter theories: claims reading on nonstatutory phenomena, it was argued, failed to "particularly point out and distinctly claim" the invention. The C.C.P.A. rejected the subject matter objections in Prater II, holding that claims must read only on subject matter which the applicant intends to claim. 215 Since no applicant has been so bold as to lay explicit claim to mental practice, this holding led to a series of terminological exercises in later cases. Possible human implementation was found in "generating physical representations" 216 and in processing "signals." 217 On the other hand, the following expressions were held to limit claims to machine implementation only: "a general purpose digital computer," 218 "bit" and "bit stream," 219 "electrical signals," 220 and "re-entrant shift register," "shifting," "masking," and "storing." 221

All of the litigated apparatus claims to program-related inventions have been cast in the "means-plus-function" form authorized by the last paragraph of section 112. 222 Such claims are potentially vulnerable

211. See, e.g., Jacobs, supra note 46, at 92.
212. Eltgroth, supra note 198, at 7.
213. See note 22 supra.
214. See notes 22-25 & 31 supra and accompanying text.
215. 415 F.2d at 1404, 162 U.S.P.Q. at 550, 2 CLSR at 49.
216. Id. at 1405, 162 U.S.P.Q. at 551, 2 CLSR at 49.
222. See note 26 supra.
to the "multiple recitation" doctrine when disclosed structural elements can be characterized as performing more than one of the claimed functions. Commentators have questioned the availability of the means-plus-function format for this reason. In *In re Knowlton* the Patent Office Board of Appeals held a means-plus-function claim indefinite because the same hardware elements would perform various functions during execution:

There is no more a combination of the two apparatus configurations than there would be a combination, in the usual sense, between a radio transmitter and a radio receiver when the latter has been constructed from various parts taken from the former.

This ruling could not survive the C.C.P.A.'s holding that the claimed "apparatus" was a computer at the instant the program was fully loaded. From that perspective, a more accurate analogy was "a combination transmitter-receiver in which a single element, or a part of the circuitry, plays a different role depending on whether the instrument is being used to transmit or receive."

Disclosure is the other major focus of section 112, which requires that the specification describe the invention in "full, clear, concise, and exact terms;" that it teach its making and usage to "any person skilled in the art;" and that the "best mode contemplated by the inventor of carrying out his invention" be set forth. Adequate disclosure is a critical part of the patent applicant's contribution to society in return for which he receives the power to bring infringement actions. Yet, the applicant's self-interest dictates that he minimize such disclosure and thereby maintain greater control over the information at the core of his invention. Furthermore, circuitous disclosure practices have been encouraged by the automatically negative Patent Office response to explicitly claimed software.

Disclosure requirements for program-related inventions have been only adumbrated by the cases to date. In *In re Brandstadter* it was held that if another user would be put to " . . . unreasonable experimentation and delays for him to come into possession of the ap-

226. Id. at 1363, 178 U.S.P.Q. at 490, 4 CLSR at 807.
227. . . . [W]hen applicant's program is fully loaded into the computer the stored pattern of signals transforms the unprogrammed machine into a new structure. . . .
228. Id. at 1368, 178 U.S.P.Q. at 494, 4 CLSR at 815.
229. Id. (emphasis in original).
paratus that could carry out the invention, a disclosure thus deficient would not be adequate legal consideration for a grant of a patent."\textsuperscript{231}

The content of that test, however, is far from clear, since in \textit{Brandstadter} the applicant failed to give the Patent Office either an estimate of the time required to prepare the program, or even a skeletal flow-chart.\textsuperscript{232}

Affidavits by third parties are admissible to show that the specification, in fact, adequately teaches the invention; but they are only "some evidence" on the question, particularly if not well-larded with factual details of the affiants' experience with the invention.\textsuperscript{233} Extended discussions between the inventor and the affiant can totally vitiate the probative value of such evidence.\textsuperscript{234}

The cases have also provided some indication of the modes of hardware and software disclosure acceptable to the C.C.P.A.

\textit{a. Software Disclosure}

It seems obvious that applications for program-related patents should be required to disclose software. However, early Patent Office resistance to such disclosures induced efforts to achieve program coverage by disclosing only analog implementations and relying on the doctrine of equivalents in later infringement actions. This strategem was apparently in use as early as 1954,\textsuperscript{235} and persisted for some time thereafter,\textsuperscript{236} although increasingly complex algorithms made many inventions too cumbersome for disclosure in this fashion by the mid-1960's.\textsuperscript{237}

There have been numerous objections to this practice. If, in fact, the inventor regards a program-implemented process or device as his true invention, mere analog disclosure would fail the section 112 test enunciated in \textit{Prater II}.\textsuperscript{238} It would also fail to teach the invention to the presumably relevant practitioners—programmers—who are generally not trained to understand and implement analog schematics, and it would certainly not reveal the contemplated "best mode" of carrying out the invention.\textsuperscript{239} Moreover, some believe that the practice may

\begin{itemize}
\item \textsuperscript{231} \textit{Id. at} 1406, 179 U.S.P.Q. at 294, 4 C.L.S.R. at 993, \textit{quoting from In re Ghiron, 442 F.2d 985, 169 U.S.P.Q. 723, 3 C.L.S.R. 70 (C.C.P.A. 1971).}
\item \textsuperscript{232} \textit{Id. at} 1406, 179 U.S.P.Q. at 295, 4 C.L.S.R. at 992-93.
\item \textsuperscript{233} \textit{Id. at} 1406, 176 U.S.P.Q. at 294, 4 C.L.S.R. at 992.
\item \textsuperscript{234} It has been held that "several meetings, each lasting no longer than two hours" were enough to cast doubt on the affidavit. \textit{In re Brown, 477 F.2d 946, 952, 177 U.S.P.Q. 691, 695, 4 C.L.S.R. 56, 63 (C.C.P.A. 1973). See also note 360 infra and accompanying text.}
\item \textsuperscript{235} \textit{See Miller, Software Patents Today, 10 Pat. L. Ann. 151, 152 (1972).}
\item \textsuperscript{236} \textit{See, e.g., Richards, supra note 149, at 108.}
\item \textsuperscript{237} Miller, supra note 235, at 153.
\item \textsuperscript{238} 415 F.2d at 1404-05, 162 U.S.P.Q. at 550-51, 2 C.L.S.R. at 49.
\end{itemize}
constitute "fraud on the Patent Office" and therefore block enforce-
ment of any patent so issued.240

Clearly the most important question regarding mere analog disclo-
sure is whether software implementations would be held to infringe
patents issued on such inventions. Some commentators believe that
software practice would be covered;241 others doubt it.242 However, it
would certainly be anomalous to find infringement by a software im-
plementation which had been defined as unpatentable subject matter in
its own right. Moreover, assuming that apparatus claims (or even proc-
ess claims) to program-related inventions are finally held valid, the
extension of claims covering an analog invention to software would
amplify the control over algorithms which disturbed the Supreme
Court in Gottschalk v. Benson.243

Yet, given that program implementation is revealed, it is not clear
what form of software disclosure is required. Prelitigation commen-
tators generally supposed that mere recitation of formulas would not
suffice.244 Discussions of this issue have primarily concentrated on the
need and advisability of disclosing program listings rather than merely
flowcharts. The case for requiring full program listings has been argued
on the bases of more adequate teaching,245 a consequently diminished
possibility of Patent Office challenge on section 112 grounds,246 and
better protection in infringement actions.247 Listing requirements have
also been urged to prevent foreclosure of new programming areas by
parties carrying new developments only to the flowchart stage and then
filing patent applications with no intention of writing the actual pro-
gram.248

Adequate Legal Protection for Computer Programs, 1968 UTAH L. REV. 369, 375
n.42
240. Banzhaf, (Letter to Editor), 7 DATA PROCESSING MAGAZINE, Jan. 1975, at 13;
Falk, Potential Changes in the Patent Law, in PATENT RESOURCES GROUP, supra
note 45, at 304, 318. In a rather curious exchange of roles in the program patent
debate, Applied Data Research, Inc. brought suit alleging that IBM had comitted
fraud on the Patent Office "by applying for and obtaining patents for computer
systems based on software but disguised as hardware." See Popper, From Hard-
ware to Software: An Adventure Having Some Surprises, id. at 99, 120.
241. See, e.g. Jacobs, supra note 59, at 12, reprinted from 7 COM. ACM at 584;
Note, supra note 114, at 901; Dixon, Patentability in the Computer Domain, 5 PAT.
L. ANN. 187, 188 (1967).
242. See, e.g. Note, supra note 239, at 387-88; Comment, supra note 48, at 478.
244. See, e.g. Kates, Computer Patent Disclosures, 7 COM. ACM 578, 579 (1964);
Seminar A: Patent Procurement, Session One, 4 PAT. L. ANN. 185, 197 (1966)
[hereinafter cited as Session One].
245. Nimtz, supra note 45, at 131.
246. Comment, supra note 57, at 130.
247. Call, The Client's Invention Disclosure, in PATENT RESOURCES GROUP, supra
note 45, at 291, 294.
248. Brothers & Grimaldi, Comment/In re Prater and Patent Reform Proposals: "Debugging" the Patent Office's Administration of Computer Program Applica-
Disclosure of flowcharts has been favored on grounds that they are relatively concise,\textsuperscript{249} are familiar to examiners accustomed to similar representations in other process technologies,\textsuperscript{250} and better reveal the inventive concepts than listings.\textsuperscript{261} In fact, flowchart-only disclosure has been defended by the argument that a listing may "obscure" the invention,\textsuperscript{252} although a more practical reason for not disclosing listings is that to do so would facilitate infringement.

The cases have revealed disclosures ranging from equations only to combinations of equations, flowcharts and listings. The C.C.P.A. has not imposed categorical requirements, preferring to ask in each case whether the disclosure adequately teaches the invention. In \textit{In re Bernhart}, the Board of Appeals approved the disclosure of equations only where implementing the program was considered obvious;\textsuperscript{253} but mere equations were found inadequate in \textit{In re Brown}.\textsuperscript{254} Thus, the only generalization presently possible is that the disclosure of equations, flowcharts and listings is acceptable and safe.

\textit{b. Hardware Disclosure}

The prevailing view has been that detailed hardware disclosure is not required, although some believe that presentation of an alternative analog embodiment of the algorithm might extend the claims and "teach" the Patent Office the alleged "equivalence" of hardware and software implementation.\textsuperscript{255} That these benefits might entail excessive obfuscation and attorney time has also been pointed out.\textsuperscript{256} The reported cases reveal that the C.C.P.A. will settle for generic references to digital computers and components. Although it may be advisable to mention a specific machine upon which the program can run,\textsuperscript{257} there is probably no need to do so.

\begin{thebibliography}{9}
\bibitem{249} Kurtz, \textit{supra} note 167, at 180.
\bibitem{250} \textit{Session One, supra} note 244, at 188.
\bibitem{251} Kates, \textit{supra} note 244, at 579.
\bibitem{252} Jacobs, \textit{supra} note 60, at B-89.
\bibitem{253} As the C.C.P.A. stated:
\begin{quote}
The board recognized that applicants' equations could be readily programmed into the computer by those skilled in programming and held that the disclosure was therefore sufficient.\end{quote}
\bibitem{255} Nimtz, \textit{supra} note 94, at 247.
\bibitem{256} Kates, \textit{supra} note 244, at 579.
\bibitem{257} The Johnston application, for example, mentioned the IBM 1400 series. \textit{See} note 380 \textit{infra} and accompanying text. An IBM 7094 Data Processing System was specifically disclosed in \textit{In re Knowlton}, 481 F.2d 1357, 1367, 178 U.S.P.Q. 486, 493, 4 CLSR 799, 813 (C.C.P.A. 1973).
\end{thebibliography}
D. Judicial Decisions

The preceding section presented a topically organized summary of legal doctrines relevant to patents on program-related inventions. Such a static presentation provides a useful overview of the issues and their interrelationships, but it obscures the fact that legal doctrines evolve from the judicial process. A dynamic perspective is necessary for an understanding of judicial behavior and the policy issues raised. This section, therefore, presents a chronological discussion of the most important program-related patent cases.

1. In re Prater and Wei (Prater I)258

At the time of their invention, the spectroscopic constituent analysis of gas mixtures entailed measurements leading to a system of simultaneous equations. Prater and Wei made the mathematical discovery that the most accurate results could be obtained by choosing for solution the subset of equations with the largest determinant. The number of possible solution subsets was very large—184,756 subsets for a ten-constituent gas mixture.259 The application disclosed, as the "preferred embodiment" of the invention, an analog device for selecting and solving the appropriate subsets.260 It was also disclosed that the invention could be practiced on a digital computer.261

Both process and apparatus claims were drawn.262 The process claim was plainly readable upon mental, or pencil-and-paper, practice. So was the apparatus claim, considered apart from the rest of the specification, if a human being and his pencil-and-paper tools could be characterized as a "system." The Patent Office attack on the application was therefore based on the "mental steps" doctrine, upon which

258. 415 F.2d 1378, 159 U.S.P.Q. 583, 2 CLSR 8 (C.C.P.A. 1968), superseded by, Prater II, 415 F.2d 1393, 162 U.S.P.Q. 541, 2 CLSR 32 (C.C.P.A. 1969), discussed in notes 278-89 infra and accompanying text. 259. Id. at 1379, 159 U.S.P.Q. at 585, 2 CLSR at 10. 260. Id. at 1380, 159 U.S.P.Q. at 585, 2 CLSR at 12. 261. Id. at 1385-86, 159 U.S.P.Q. at 590, 2 CLSR at 19. 262. The critical language in those claims selected as representative by the court was:

17. The method of determining with minimum error from the spectra of spectral analysis the concentration of the components of a mixture... which comprises

   generating physical representations of the magnitudes of the coefficients...
   comparing said physical representations of the magnitudes..., and
   generating physical representations of the concentration...

10. In spectrographic analysis..., the system for selecting from said functions the combination... which comprises means for generating a scalar function... and means for determining that one of said scalar functions... least susceptible to error.

Id. at 1380-81, 159 U.S.P.Q. at 586, 2 CLSR at 12-13.
was erected an edifice of objections under sections 101, 102, 103 and 112.  

Judge Smith, speaking for a unanimous court, upheld both claims. His opinion commenced with a review of the origins and history of the "mental steps" doctrine, which he found to be of doubtful validity. That conclusion can be considered dicta, however, as the process claim was sustained on the basis of three holdings sufficient to the outcome:

1. "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 mental steps."  

2. Cochrane v. Deener cannot be read to require that statutory processes operate only upon materials; the relevant passage was dicta, spoken in the context of expanding, rather than confining, the category of patentable subject matter; and in any event, later Supreme Court cases upheld claims to processes acting on electical phenomena.

3. The heart of an invention cannot be ignored when considering the questions of nonobviousness and anticipation just because it may be unpatentable subject matter when viewed in isolation.

The court then held that the apparatus used to carry out the method of a valid process claim, when it is a "substantial apparatus counterpart" of that process, is also patentable.

In sum, although the opinion did not reject the "mental steps" doctrine outright, it destroyed its utility as a basis for attacking program-related patent applications. Because of that, the Patent Office petitioned for a rehearing of the case. It argued that the court had ignored both important issues and prior judicial holdings and that under the court's holding a patent would "confer upon a patentee the

263. Id. at 1381-82, 159 U.S.P.Q. at 586-87, 2 CLSR at 14-15.  
264. Chief Judge Worley concurred in the outcome but did not join in the opinion because he had not familiarized himself adequately with the issues. Id. at 1390, 159 U.S.P.Q.—a 593-94, 2 CLSR at 26.  
265. Id. at 1385-89, 159 U.S.P.Q. at 590-93, 2 CLSR at 17-25.  
266. Dicta is defined as "opinions of a judge which do not embody the resolution or determination of the court." BLACK'S LAW DICTIONARY 541 (4th rev. ed. 1968).
267. 415 F.2d at 1389, 159 U.S.P.Q. at 593, 2 CLSR at 25.
268. 94 U.S. 780 (1876), discussed in notes 159-70 supra and accompanying text.
269. Quoted in note 160 supra.
270. 415 F.2d at 1387-89, 159 U.S.P.Q. at 591-95, 2 CLSR at 22-25.  
271. Id.
272. Id. at 1389, 159 U.S.P.Q. at 593, 2 CLSR at 25.
right to exclude others from thinking in a certain manner.\textsuperscript{273} The majority approved the petition without comment.\textsuperscript{274} However, Judge Rich, joined by Judge Almond, dissented strenuously in a blistering criticism of the Patent Office's deportment and theories.\textsuperscript{275} The legal effect of the decision to grant a rehearing was to nullify the opinion in \textit{Prater I},\textsuperscript{276} but Judge Smith's reasoning lived on, as later cases revealed.\textsuperscript{277}

\begin{enumerate}
\item \textbf{In re \textit{Prater and Wei} (Prater II)\textsuperscript{278}}

On reargument, the Government added a new contention, namely, that a patent on this invention would control human thought processes and thus run afoul of the first, ninth, and tenth amendments to the Constitution.\textsuperscript{279} Appellants responded, in essence, by repeating Judge Smith's subject matter discussion from his \textit{Prater I} opinion.\textsuperscript{280} The court considered these contentions without comment.

The court characterized the "mental steps" doctrine and the decision in \textit{Cochrane} in the same terms as the preceding opinion,\textsuperscript{281} but on this occasion these comments were merely \textit{obiter dicta},\textsuperscript{282} since the process claims were rejected for failing to comply with section 112.\textsuperscript{283} Specifically, the court held that the process claims were readable upon nonmachine practice, and since the appellants had admitted that they did not intend to cover such practice, they had failed to distinctly claim what they regarded as their invention.\textsuperscript{284}

Upholding the apparatus claim, the court reiterated its holding in \textit{Prater I} that subject matter unpatentable in its own right could distinguish an invention from the prior art.\textsuperscript{285} In addition, it held that means-plus-function claims were to be read in light of the remainder of the specification and that the disclosure of an analog device (and perhaps the possibility of digital computer practice) limited the claims to machine implementation.\textsuperscript{286}

\begin{itemize}
\item 274. \textit{Id.} Judge Smith, the author of the first opinion, had died shortly before the opinion was handed down. \textit{Id.}
\item 276. 5 C.J.S., \textit{Appeal \& Error} § 1446 (1958).
\item 277. \textit{See} notes 306-14 \textit{infra} and accompanying text.
\item 279. \textit{Id.} at 1400 n.20, 162 U.S.P.Q. at 547 n.20, 2 CLSR at 42 n.20.
\item 280. \textit{Id.} at 1400-01, 162 U.S.P.Q. at 547-48, 2 CLSR at 41-43.
\item 281. \textit{Id.} at 1401-04, 162 U.S.P.A. at 548-50, 2 CLSR at 44-47.
\item 282. \textit{See} note 169 supra.
\item 283. 415 F.2d at 1405, 162 U.S.P.Q. at 551, 2 CLSR at 50.
\item 284. \textit{Id.}
\item 285. \textit{Id.}
\item 286. \textit{Id.} at 1406, 162 U.S.P.Q. at 551, 2 CLSR at 50.
\end{itemize}
It was also significantly stated in dicta that:

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 digital computer may be regarded as but a storeroom of parts and/or electrical components. 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 nonobviousness. Based on the present law, we see no other reasonable conclusion.\(^{287}\)

The broad sweep of that dicta was the primary reason that Judge Worley wrote a concurring opinion, rather than joining the majority:

It is questionable whether prior decisions denying patentability of purely mental steps, or the statute, read singly or together, can support a broad rule either sanctioning or prohibiting the patentability of such steps in relation to computer programs. Where the line will be drawn can only be determined on a case by case basis. . . \(^{288}\)

Judge Worley also took the occasion to deplore the possibility that Congress might modify the patent system “that has worked so well.”\(^{289}\)

3. In re Bernhart\(^{290}\)

Bernhart and Fetter invented a way to portray an image of a three-dimensional object on a two-dimensional surface from any spatial perspective. A set of transformation equations constituted much of the novelty and were disclosed along with a digital computer and plotting machine. No software appeared in the specifications.

The Patent Office examiner had attacked the failure to provide actual programs as insufficient disclosure under section 112,\(^{291}\) but was reversed by the Patent Office Board of Appeals, which found the programming obvious given the equations.\(^{292}\) One apparatus claim was drawn in broad terms but was rejected by the Board on the basis of prior art citations by the Patent Office.\(^{293}\) The remaining process and apparatus claims were limited by such language as “programming the computer” and “electronic digital computer means.”

\(^{287}\) Id. at 1403 n.29, 162 U.S.P.Q. at 549-50 n.29, 2 CLSR at 47 n.29 (emphasis in original).

\(^{288}\) Id. at 1406, 162 U.S.P.Q. at 552, 2 CLSR at 51-52 (Worley, J., concurring).

\(^{289}\) Id. at 1407, 162 U.S.P.Q. at 552, 2 CLSR at 52 (Worley, J., concurring).


\(^{291}\) Id. at 1398, 163 U.S.P.Q. at 614, 2 CLSR at 363.

\(^{292}\) Id.

\(^{293}\) Id.
The Government again urged its subject matter objections on the C.C.P.A. It also offered two novel objections to the apparatus claim: (a) that programming did not constitute the requisite structural difference over the prior art; and (b) that the "printed matter" cases blocked patents on nonstatutory subject matter by "indirection."\(^{294}\) The court rejected all objections and upheld both the process and apparatus claims. It again avoided direct rejection of the "mental steps" doctrine,\(^{295}\) holding instead that the requirements of both a "digital computer" and "planar plotting apparatus" in the claim were sufficient to limit the process to machine practice.\(^{296}\)

In answer to the contention, that since the equations themselves are nonstatutory the whole invention is nonstatutory, the court conceded that Congress had intended to exclude mathematical equations from "monopolization by patent"\(^{297}\) but stated that:

To allow the claims in issue here would not prohibit all uses of those equations. . . . [A] member of the public would have to do much more than use the equations to infringe any of these claims. He would have to use them in the physical equipment recited in the claim.\(^{298}\)

The structural difference objection occasioned the formulation of an important characterization:

If a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged . . . . If a new machine has not been invented, certainly a 'new and useful improvement' of the unprogrammed machine has been . . . \(^{299}\)

4. In re Mahony\(^{300}\)

_Mahony_ was the first case to consider claims to a process beginning and ending within a digital computer. The applicant claimed a new method of identifying framing bits in a "receiver of digital information, such as a digital computer" and disclosed digital circuitry in block diagram form as well as an algorithm.\(^{301}\)

The "mental steps" doctrine again constituted the basis of the Patent Office's rejections; and the examiner demonstrated to the court that the algorithm could be practiced by pencil and paper.\(^{302}\) The court

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\(^{294}\) _Id._ at 1398, 163 U.S.P.Q. at 614-15, 2 CLSR at 363-64.

\(^{295}\) _Id._ at 1400, 163 U.S.P.Q. at 616, 2 CLSR at 366.

\(^{296}\) _Id._ at 1401, 163 U.S.P.Q. at 617, 2 CLSR at 364-68.

\(^{297}\) _Id._ at 1399, 163 U.S.P.Q. at 616, 2 CLSR at 365.

\(^{298}\) _Id._ at 1399, 163 U.S.P.Q. at 616, 2 CLSR at 365.

\(^{299}\) _Id._ at 1400, 163 U.S.P.Q. at 616, 2 CLSR at 366.

\(^{300}\) 421 F.2d 742, 164 U.S.P.Q. 572, 2 CLSR 587 (C.C.P.A. 1970).

\(^{301}\) _Id._ at 743-44, 164 U.S.P.Q. at 573-74, 2 CLSR at 587-89.

\(^{302}\) _Id._ at 744, 164 U.S.P.Q. at 574, 2 CLSR at 589-90.
again declined to address the "mental steps" issue and reaffirmed its intention to confine the relevance of mental practice to section 112 scrutiny. The claims were sustained when the court found the recital of "bits" and "bit stream" sufficient to limit the claims to machine practice. The examiner was found to be operating not on a bit stream but on a "character representation" of a bit stream when following the algorithm by hand.

5. In re Musgrave

Musgrave's invention was directed to a method of delineating geological subsurface formations by taking a series of seismograms from geographically separated stations. Musgrave's primary discovery was that the delineation could be improved by applying a hyperbolic function to the family of seismograms produced by a particular arrangement of stations. The possibility that a digital computer could be used to accomplish the corrections was disclosed.

All of the claims were drawn to methods and contained some steps not limited by machine-oriented language. This provided the Patent Office with an opportunity to force consideration of its "mental steps" theories. It also provided Judge Rich, the author of the opinion, an opportunity to reinstate much of Judge Smith's Prater I opinion.

The argument that statutory process steps had to "operate physically upon substances" was again rejected, at least where accompanied by other steps so limited. Judge Rich examined the "mental steps" doctrine and said, "[t]hat law we, like others, have found to be something of a morass." Resort to the "Abrams non-rules" was characterized as "legal error." Judge Rich summarized his findings in a sweeping statement of the law on statutory subject matter:

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."

303. Id. at 745, 164 U.S.P.Q. at 575, 2 CLSR at 591-92.
304. Id. at 746-47, 164 U.S.P.Q. at 575-76, 2 CLSR at 592.
305. Id.
307. Id. at 887, 167 U.S.P.Q. at 284-85, 2 CLSR at 928.
308. Id. at 888, 167 U.S.P.Q. at 285, 2 CLSR at 930.
310. See notes 159-70 supra and accompanying text.
311. Id. at 892-93, 167 U.S.P.Q. at 289, 2 CLSR at 936-37.
312. Id. at 890, 167 U.S.P.Q. at 287, 2 CLSR at 933.
313. Id. at 892, 167 U.S.P.Q. at 289, 2 CLSR at 937.
314. Id. at 893, 167 U.S.P.Q. at 289-90, 2 CLSR at 938.
Judge Baldwin concurred in the outcome but objected to the majority's "major and radical shift in this area of the law" and to their "serious breach with the time-honored judicial practice of resolving important questions of law on a case-by-case basis." He felt that the majority had over-reacted to "this 'fearful' mental steps doctrine" and expressed concern that the new "technological arts" standard would merely substitute one set of uncertainties for another.

For all intents and purposes, the court had come full circle since Prater I. It was not surprising that Judge Rich would reach this position in view of his reaction to a rehearing of that case; but the fact that three other judges joined with him in the Musgrave opinion was an important indication of the court's growing impatience with Patent Office subject matter objections to program-related patents.

6. In re Foster

The discovery presented was a mathematical method for correcting distortion in seismograms, and a digital computer was disclosed as a possible mode of practice. The Patent Office again presented section 101 objections, which the court felt had been answered in Musgrave and Mahony. One process claim was limited only by the word "signals" and was consequently rejected under Prater II's section 112 "intention" test. By contrast, "electrical signals" was held to limit a companion claim to machine practice.

7. In re Benson

Benson and Tabbot invented a new way to convert data from binary coded decimal to pure binary form in a digital computer. The

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316. Id.
317. Id. at 895, 167 U.S.P.Q. at 291, 2 CLSR at 940 (Baldwin, J., concurring).
318. Id. at 896, 167 U.S.P.Q. at 291-92, 2 CLSR at 942 (Baldwin, J., concurring).
320. Caution is necessary in analyzing Patent Office behavior because of the time lag between the development of rejections by the examiners and the Board of Appeals and the hearing of the resulting case by the C.C.P.A. For example, the Patent Office theories considered in In re Bernhart had originally been made before the Prater II decision was handed down. Nevertheless, the oral arguments of the Solicitor General and the failure of the Government to abandon objections before the hearing can be seen as an implied restatement of the theories originally supporting the rejections.
322. Id. at 1014, 169 U.S.P.Q. at 100, 2 CLSR at 998.
323. Id. at 1015-16, 169 U.S.P.Q. at 101-02, 2 CLSR at 1000-01.
324. Id. at 1018, 169 U.S.P.Q. at 102, 2 CLSR at 1001.
specification disclosed a program listing and provided a block diagram description of a computer. Two method claims were at issue.\textsuperscript{326}

Once again, the Patent Office raised subject matter objections to the claims, and once again Judge Rich rejected them.\textsuperscript{327} The claim 8 rejection was rather easily disposed of by finding that the words "reen- trant shift register," "storing," "shifting," and "masking" confined the claim to processes inside a computer.\textsuperscript{328} The Patent Office had apparently become desperate in its objections to such closely limited claims, as the opinion reveals:

The solicitor would have us hold the method is not a "process" within section 101 on the ground that a programmable computer is merely a "tool of the mind" and the method is basically "mental" in character, apparently because the "workstuff" of the method is numbers which are mathematical abstractions. As the Patent Office would say, we do not find the argument persuasive.\textsuperscript{329}

Claim 13 could not be disposed of as easily, since it was readable

\begin{verbatim}
326. 8. The method of converting signals from binary coded decimal form into binary which comprises the steps of
(1) storing the binary coded decimal signals in a reentrant shift register,
(2) shifting the signals to the right by at least three places, until there is a binary "1" in the second position of said register,
(3) masking out said binary "1" in said second position of said register,
(4) adding a binary "1" to the first position of said register,
(5) shifting the signals to the left by two positions,
(6) adding a "1" to said first position, and
(7) shifting the signals to the right by at least three positions in preparation for a succeeding binary "1" in the second position of said register.

13. A data processing method for converting binary coded decimal number representations into binary number representations comprising the steps of
(1) testing each binary digit position beginning with the least significant binary digit position, of the most significant decimal digit representation for a binary "0" or a binary "1";
(2) if a binary "0" is detected, repeating step (1) for the next least significant binary digit position of said most significant decimal digit representation;
(3) if a binary "1" is detected, adding a binary "1" at the (i + 1)th and (i + 3)th least significant binary digit positions of the next lesser significant decimal digit representation, and repeating step (1) for the next least significant binary digit position of said most significant decimal digit representation;
(4) upon exhausting the binary digit positions of said most significant decimal digit representation, repeating steps (1) through (3) for the next lesser significant decimal digit representation as modified by the previous execution of steps (1) through (3); and
(5) repeating steps (1) through (4) until the second least significant decimal digit representation has been so processed.

Id. at 683-84, 169 U.S.P.Q. at 549, 2 C.L.S.R at 1032-33.
328. Id. at 687, 169 U.S.P.Q. at 552, 2 C.L.S.R at 1038-39.
329. Id.
\end{verbatim}
upon nonmachine practice. The court observed that it was improbable that anyone would want to practice the method by hand and that mental practice would not in any case require the exercise of judgment or even the making of a decision: "Realistically, the process of claim 13 has no practical use other than the more effective operation and utilization of a machine known as a digital computer." Computers, as machines, were held to be "in the technological field . . . regardless of the uses to which their users put them," and therefore, processes confined in practical use to "internal computer operations" were also "technological."

Well before Benson, it must have been clear to the Patent Office that its position on program patents was doomed in the C.C.P.A. However, Benson provided the Patent Office an especially suitable opportunity for a petition to the Supreme Court: the entire invention was contained in an algorithm, no field of use limitations existed, permanent changes in substances were absent, and at least one of the claims was readable on human thought processes. Therefore, a petition for certiori was filed and granted, setting the stage for the Supreme Court's first pronouncement on the subject of program-related patents.

8. In re McIlroy

McIlroy claimed a method for retrieving symbolic data from a stored string, and at least one of the process claims was readable upon human practice. The Patent Office again asserted section 101 objections, but the patience of the court had apparently run out. In an opinion occupying little more than one-half page, the court, in effect, sent the Patent Office back to read the opinions in Musgrave and Benson and stated that "machine implementation vs. mental implementation is not a determinative dichotomy in deciding whether a method is statutory under 35 U.S.C. 101." In retrospect, the delivery of that bald statement may have been a serious tactical error, since Benson was soon to go before Supreme Court justices who were particularly sensitive to perceived trammels on thought.
9. In re Waldbaum (Waldbaum I)\textsuperscript{339}

The invention was a method of analyzing data words to determine the number of binary 1's they contained. The claims were limited by such language as “data processor” and “register.”\textsuperscript{340} Patent Office objections based on sections 100(b) and 101 were overruled. The principle point of interest was the C.C.P.A.'s elaboration of the Musgrave “technological arts” test: "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."\textsuperscript{341} Judge Rich filed a concurring opinion, apparently only for the purpose of refining the majority's statement.\textsuperscript{342}

10. Gottschalk v. Benson\textsuperscript{343}

The sole question certified to the Supreme Court in Benson was whether the Benson and Tabbot method was a statutory process.\textsuperscript{344} The numerous briefs filed by the parties and various amici curiae explored most of the subject matter issues that had been raised both in and out of court and asserted a variety of policy arguments. The case was heard by six justices\textsuperscript{346} who unanimously joined in Justice Douglas' opinion, finding the claimed processes to be nonstatutory subject matter.

The opinion has occasioned a large volume of commentary, primarily because the scope of the holding is far from clear.\textsuperscript{347} It is nevertheless

\begin{itemize}
\item \textsuperscript{339} 457 F.2d 997, 173 U.S.P.Q. 430, 3 CLSR 173 (C.C.P.A. 1972).
\item \textsuperscript{340} Id. at 1000, 173 U.S.P.Q. at 432, 3 CLSR at 176.
\item \textsuperscript{341} Id. at 1003, 173 U.S.P.Q. at 434, 3 CLSR at 182.
\item \textsuperscript{342} 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 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 .... Now we have come full circle in pointing out that the intention all along has been to convey the same idea and to occupy whatever ground the Constitution permits with respect to the categories of patentable subject matter named in section 101.
\item \textsuperscript{344} Id. at 64, 175 U.S.P.Q. at 674, 3 CLSR at 257.
\item \textsuperscript{345} See notes 49, 50 & 54 supra and accompanying text.
\item \textsuperscript{346} Justices Stewart, Blackmun, and Powell abstained for unstated reasons.
\item \textsuperscript{347} See, e.g. Bigelow, Infosystems, the Law and Patents, 13 JURIMETRICS J. 129 (1973); Jacobs, Patents for Software Inventions—The Supreme Court's Decision, id. at 132; Duggan, Patents on Programs? The Supreme Court Says No, id. at 135; Freed, Protection of Proprietary Programs in Light of Benson and Tabbot, id. at 139; Note, Patentability of Computer Programs, 27 U. MIAMI L. REV. 494 (1973); Comment, Patent Law—Computer Programs for Processing Data With a Digital Computer Cannot be Patented Under Present United States Laws, 4 LOY. CHI. L.J. 580 (1973); Note, Computer Software: Beyond the Limits of Existing Proprietary Protection Policy, 40 BROOKLYN L. REV. 116 (1973); Are Computer Programs Ever
possible to identify the minimum holding to which the opinion can be confined. It emerges from a consideration of the Benson and Tabbot application in conjunction with the following statement of the Supreme Court’s conclusions:

***What we come down to in a nutshell is the following:

It is conceded that one may not patent an idea. But in practical effect that would be the result if the formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.\(^3\)

At a minimum, therefore, Benson stands for the proposition that processes which are (a) defined by an algorithm with no practical use except in the programmed manipulation of signals in a digital computer, and (b) not limited by further claim language confining the claim to a subset of possible applications, are nonstatutory subject matter.

It is also clear that the Court’s reasoning would have applied squarely to an apparatus claim to a digital computer programmed to practice the algorithm had such a claim been presented. However, apparatus claims were not present and were therefore not covered by the holding, narrowly construed.

Several other features of the case are of interest:

(1) The opinion discussed Cochrane v. Deener\(^4\) at length and stated that “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.”\(^5\) The thrust of this observation was turned aside, however, when the Court later stated: “[w]e do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents.”\(^6\) It is clear in any case that Justice Douglas did not consider the Cochrane test satisfied by state changes in computer components, perhaps because of their ephemerality. Also important was the characterization of Cochrane as “precedent.”\(^7\)

(2) Justice Douglas was plainly preoccupied with programs in general.
(3) The outcome turned on potential economic control of an "idea." It is therefore rather surprising that Justice Douglas, who has been especially preoccupied with first amendment issues, found the subject matter limitation in the intent of Congress rather than in the Constitution.

(4) The generally confusing language of the opinion and particularly the sudden qualifications of categorical statements of doctrine, are persuasive evidence that the remaining members of the court were unwilling to go much beyond the fact pattern of the case. The absence of concurring opinions under such circumstances suggests that the others either considered the issue unimportant or forbiddingly complex. Therefore, Benson may not be a reliable guide to future Supreme Court behavior in program-related patent cases.

11. In re Brown

Brown involved the invention of an all-weather terrestrial navigation system. The applicant disclosed the invention in general block diagrams and furnished mathematical equations. It was also disclosed that an operating "mathematical model" had been constructed, but no programs were provided. Instead, the applicant furnished affidavits asserting that a program had been prepared and that its preparation, given the disclosure, was within the skill level of general practitioners at the time of filing.

The question in the case was the adequacy of the disclosure to teach the invention. The court held that a "mathematical model" was not adequate to teach the actual invention. Of more interest, however, was the holding that the affidavits inadequately demonstrated that the specification could teach the program behind the "mathematical model." They were held to lack sufficient factual content and were unreliable evidence of the skill level of general practitioners because the affiants had discussed the invention at length with the applicant before programming the invention. By disposing of the case on these grounds, the court effectively declined to require actual program disclosure.

353. Id.
354. If these programs are to be patentable, considerable problems are raised which only committees of Congress can manage, for broad powers of investigation are needed, including hearings which canvass the wide variety of views which those operating in this field entertain. The technological problems tendered in the many briefs before use indicate to us that considered action by the Congress is needed.
355. Id. at 73, 175 U.S.P.Q. at 677, 3 CLSR at 263 (footnote omitted).
356. Id. at 950, 177 U.S.P.Q. at 694, 4 CLSR at 62.
357. Id.
358. Id. at 951, 177 U.S.P.Q. at 694, 4 CLSR at 63.
359. Id. at 951, 177 U.S.P.Q. at 695, 4 CLSR at 64.
360. Id. at 951-52, 177 U.S.P.Q. at 695, 4 CLSR at 64. See also note 234 supra.

The invention related to a method of determining the porosity of subsurface geological formations and centered on a mathematical technique for processing the results of physical measurements. Exercise of the mathematical technique constituted the last step in process claims otherwise limited to physical measuring operations. No machine implementation of the mathematical formula was disclosed.\footnote{Id. at 1392-93, 178 U.S.P.Q. at 36-37, 4 CLSR at 66-68.}

Despite the absence of specific references to programming implementation, the case reveals the demoralizing effect that the decision in \textit{Gottschalk v. Benson} had on the C.C.P.A. The majority expressed its rejection of the Christensen claims in the following holding:

Is a method claim in which the point of novelty is a mathematical equation to be solved as the final step of the method, a statutory method? We follow the Supreme Court in concluding that the answer is in the negative.\footnote{Id. at 1394, 178 U.S.P.Q. at 37, 4 CLSR at 70.}

But that was an unnecessarily broad reading of the Benson opinion, which had stressed the fact that the applicant's claims were "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure binary conversion."\footnote{409 U.S. at 69, 175 U.S.P.Q. at 675, 3 CLSR at 259.} The Christensen claims, on the other hand, were limited to the use of the formula in a porosity-determining process and thus could not "preempt" unknown uses of the formula.\footnote{478 F.2d at 1392-93, 178 U.S.P.Q. at 37-38, 4 CLSR at 66-68.} This was to be the broadest reading of Benson by the C.C.P.A.

Judge Rich, who had authored the first Benson opinion,\footnote{441 F.2d 682, 169 U.S.P.Q. 548, 2 CLSR 1030 (C.C.P.A. 1971), rev'd sub nom. Gottschalk v. Benson, 409 U.S. 63, 175 U.S.P.Q. 673, 3 CLSR 256 (1972).} upholding Claim 13 on the very basis on which it was rejected by the Supreme Court, "reluctantly" concurred in the Christensen outcome: "I have no more doubt it is a 'process' within the meaning of § 101 than I had about Benson's process; but on that point I seem to have been reversed."\footnote{478 F.2d at 1395-96, 178 U.S.P.Q. at 38-39, 4 CLSR at 71-73 (Rich, J., concurring).} Although he disagreed with its relevance to section 101, he clearly recognized that the Supreme Court's decision turned on its perception of the "scope" and "breadth" of the Benson process claims.\footnote{481 F.2d 1357, 178 U.S.P.Q. 486, 4 CLSR 799 (C.C.P.A. 1973).}


Knowlton invented a method for digital computer processing of
linked-list files with variable-length records, and claimed it as a "machine" in means-plus-function language. The specification disclosed block diagrams and program listings.\textsuperscript{370}

The Government's position was based solely on citations of prior art and section 112 objections, the Board of Appeals having reversed subject matter objections by the examiner, perhaps on the strength of earlier C.C.P.A. cases.\textsuperscript{371} The C.C.P.A. rejected the "multiple recitation" attack on the claim language.\textsuperscript{372} An effort by the Government to burden program-related apparatus claims with heavy disclosure requirements also suffered defeat.\textsuperscript{373}

The Board of Appeals had acted on the Knowlton case before the decision in Gottschalk v. Benson. The Patent Office thereby lost an excellent opportunity to extend the Benson holding to apparatus claims, since the essential facts in Knowlton seem to fall squarely within the Supreme Court's reasoning.

14. In re Brandstader\textsuperscript{374}

The invention was an apparatus which permitted subscribers of a store-and-forward communications system to retrieve messages from dedicated files. An "alternative" embodiment suggested the replacement of one of the apparatus units disclosed in block diagrams with "stored program routines employed in conjunction with . . . common control unit 30."\textsuperscript{375} No listings or flowcharts were provided.\textsuperscript{376}

The court upheld the Patent Office rejections based on section 112 because the applicant had refused to provide the Patent Office either an appraisal of the effort required to produce the program or a "bare bones flowchart."\textsuperscript{377} Under these circumstances, the Patent Office could reasonably conclude that the average person skilled in the art might be put to "unreasonable experimentation and delays" in coming into possession of the apparatus to carry out the invention.\textsuperscript{378}

15. In re Johnston\textsuperscript{379}

The invention was a computer-implemented, automated, financial accounting system, which periodically processed a transaction file

\textsuperscript{370} Id. at 1358-61, 178 U.S.P.Q. at 487-89, 4 CLSR at 801-04.
\textsuperscript{371} Id. at 1361-65, 178 U.S.P.Q. at 489-92, 4 CLSR at 805-10.
\textsuperscript{372} Id. at 1367-68, 178 U.S.P.Q. at 493-94, 4 CLSR at 813-16.
\textsuperscript{373} Id. at 1367, 178 U.S.P.Q. at 494, 4 CLSR at 814.
\textsuperscript{374} 484 F.2d 1395, 179 U.S.P.Q. 286, 4 CLSR 976 (C.C.P.A. 1973).
\textsuperscript{375} Id. at 1399, 179 U.S.P.Q. at 288, 4 CLSR at 980.
\textsuperscript{376} Id. at 1403, 179 U.S.P.Q. at 292, 4 CLSR at 988.
\textsuperscript{377} Id. at 1407, 179 U.S.P.Q. at 295, 4 CLSR at 994.
\textsuperscript{378} Id.
against individually tailored subfiles. Disclosure was by block diagram and full program listing; and an IBM 1400 series computer was mentioned as a possible element in the system.\textsuperscript{380} One mode of practice mentioned was in the maintenance of bank customer records. The representative apparatus claim read in part:

20. A record-keeping machine system for financial accounts, said system comprising a data processor including a memory . . . , a processor for combining and comparing the coded signals . . . ; input and output devices; and a control system . . . ; said memory including a storage file of a plurality of machine-readable records formed of coded combinatorial signals . . . ; said control system including means for directing the processing of said files . . . ; and means for producing an output record . . . .\textsuperscript{381}

The Board of Appeals, speaking before the decision in Benson, rejected the claims under sections 101, 103 and 112.\textsuperscript{382} The subject matter rejection was made on the ground that the claims failed the Musgrave "technological arts" test\textsuperscript{383} because they sought a "monopoly" on banking activities.\textsuperscript{384} The invention was said to be an obvious variation of either normal bookkeeping practices or of another patent.\textsuperscript{385} The section 112 rejection was made on the basis that the claims were distinguished from prior art only by nonmachine factors, such as account identification and financial relationships.\textsuperscript{386}

The C.C.P.A. refused to sustain the section 112 rejection, saying that the fact that the claims read only on machines was completely dispositive.\textsuperscript{387} Similarly, the section 101 challenge was rejected with the statement that "machine systems" were always within the "technological arts."\textsuperscript{388}

The Patent Office solicitor had argued that Benson controlled the case, but the court said:

As we stated in In re Christensen . . .: "The issue considered by the Supreme Court in Benson was a narrow one, namely, is a formula for converting binary coded decimal numerals into pure binary numerals by a series of mathematical calculations a patentable process? (emphasis added)." Furthermore, the instant claims, in apparatus form, do not claim or encompass a law of nature, a mathematical formula, or an algorithm.\textsuperscript{389}

\textsuperscript{380} Id. at 765-67, 183 U.S.P.Q. at 173-74, 4 CLSR at 1492-94.
\textsuperscript{381} Id. at 767, 183 U.S.P.Q. at 174, 4 CLSR at 1494-95.
\textsuperscript{382} Id. at 768, 183 U.S.P.Q. at 174-75, 4 CLSR at 1496.
\textsuperscript{383} Id. at 769, 183 U.S.P.Q. at 175, 4 CLSR at 1498.
\textsuperscript{384} Id.
\textsuperscript{385} Id. at 769, 183 U.S.P.Q. at 175, 4 CLSR at 1499.
\textsuperscript{386} Id. at 768, 183 U.S.P.Q. at 175, 4 CLSR at 1497.
\textsuperscript{387} Id. at 770, 183 U.S.P.Q. at 176, 4 CLSR at 1500-01.
\textsuperscript{388} Id. at 771, 183 U.S.P.Q. at 176, 4 CLSR at 1501.
\textsuperscript{389} Id. at 771, 183 U.S.P.Q. at 177, 4 CLSR at 1502.
The section 103 rejection was disposed of by reference to several differences between the Johnston invention and the prior art.\textsuperscript{390}

For the first time in the history of program-related patents, there were two dissents to the majority opinion. One was by Judge Markey,\textsuperscript{391} who found the majority's approach to the section 103 question more appropriate to a section 102 anticipation inquiry. In his view, the claimed invention was an obvious modification of existing art.

More fundamental was the dissent of Judge Rich,\textsuperscript{392} who felt that Benson controlled the case. Judge Rich rejected the machine-process distinctions:

\begin{quote}
I am quite familiar with the legal doctrine that a new program makes an old general purpose digital computer into a new and different machine. This court has been through that many times and I am not denying the validity of this principle—which partakes of the nature of a legal fiction when it comes to drafting claims. My problem is that knowing the invention to be a new program, I must decide whether it is patentable in any claimed form in view of Benson.\textsuperscript{393}
\end{quote}

Although confessing confusion as to the meaning of Benson's wording, Judge Rich felt that the spirit of that case denied coverage to programs, however claimed,\textsuperscript{394} and he could find "no realistic distinction" between the instant invention and that in Benson.\textsuperscript{395} Finally, he invited a new consideration of the program patent issue by the Supreme Court.\textsuperscript{396}

The Patent Office apparently felt that the case was strong and petitioned the Supreme Court for certiorari, which was granted.\textsuperscript{397}

\textbf{E. Summary}

One potential cause of legal issue mortality is a court decision. When a court is forced, or chooses, to confront squarely and resolve an issue, the question is settled, at least for a time within that court's jurisdiction. As revealed above,\textsuperscript{398} however, it is not always easy to identify the precise issues addressed by a court or to draw a line between holdings and dicta. Moreover, the same issue settled in one

\textsuperscript{390} Id. at 771-72, 183 U.S.P.Q. at 177, 4 CLSR at 1502-03.
\textsuperscript{391} Id. at 772, 183 U.S.P.Q. at 177, 4 CLSR at 1503 (Markey, J., dissenting).
\textsuperscript{392} Id. at 772-73, 183 U.S.P.Q. at 178, 4 CLSR at 1504 (Rich, J., dissenting).
\textsuperscript{393} Id. at 773, 183 U.S.P.Q. at 178-79, 4 CLSR at 1506 (Rich, J., dissenting).
\textsuperscript{394} Id.
\textsuperscript{395} Id. at 774, 183 U.S.P.Q. at 179, 4 CLSR at 1507 (Rich, J., dissenting).
\textsuperscript{396} Id. at 774, 183 U.S.P.Q. at 179, 4 CLSR at 1508 (Rich, J., dissenting).
\textsuperscript{397} Dann v. Johnston, 421 U.S. 962 (1975). [\textit{Ed. Note:} This article was completed prior to the Supreme Court decision in Dann v. Johnston, 425 U.S. 219, 189 U.S.P.Q. 257, 5 CLSR 1133 (1976). For a discussion of that case and subsequent program-related patent decisions, see the Roberts article and the Case Digest summaries in this issue.]
\textsuperscript{398} See notes 258-397 \textit{supra} and accompanying text.
court may resurface in another jurisdiction. In the program patent context, all of the judicial decisions, except two, have been delivered by the C.C.P.A. That court's doctrines do not bind the multitude of United States district courts, which may re-open the issues during infringement contests. Neither are decisions of the C.C.P.A. binding on other appellate courts, although there, as well as in the district courts, the court's reasoning may be found persuasive. Certainly the demise of an issue cannot be inferred from the apparent acquiescence of the Patent Office in a decision, since the Patent Office may simply be waiting for a case with particularly favorable features for a petition to the Supreme Court (as in Benson and Johnston). Finally, some issues enter a state of "suspended animation" as the focus of the debate shifts elsewhere.

The important issue of patent coverage of software has received no concrete judicial treatment. Therefore, it is unclear what phenomena will eventually be held to infringe patents on computer-related inventions. The questions raised by patents on programs claimed as such have likewise received no direct judicial consideration, but they are still of interest because of possible future congressional action phrased in "program" terms. It is likely that Justice Douglas would have rejected a direct claim to a program had the question been presented in Benson. If it were expected to achieve broad coverage, a claim to a program per se would probably run afoul of Justice Douglas' "nutshell" passage.

The C.C.P.A. has been the sole source of program-related law on sections 102, 103 and 112. Anticipation theories under section 102, peculiar to programs, have been rejected by that court and are unlikely to reemerge. Section 103, however, has received little treatment except for that arising from the Patent Office's assertion of section 103 objections based on the "mental steps" doctrine. Of course, the application of the nonobviousness test is ultimately a matter of judgment in each case, but there are no indications yet of the scope of such general terms as "prior art" in a program context. Apart from the rescue of

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399. 1B MOORE'S FEDERAL PRACTICE ¶ 0.402(1) (2d ed. 1974).
401. See note 399 supra.
402. Id.
403. In Digitronics Corp. v. New York State Racing Ass'n, 187 U.S.P.Q. 602 (E.D.N.Y. 1975), aff'd, 553 F.2d 740 (2d Cir. 1977), the court held that a general purpose computer programmed to do what a patented machine does, does not infringe the machine patent. Id. at 640.
404. See text accompanying note 348 supra.
405. See notes 192-202 supra and accompanying text.
406. See notes 207-12 supra and accompanying text.
means-plus-function claims from the multiple recitation theory, the frequent consideration of section 112 has produced only a set of specific indicators of adequate claim language and disclosure. 407

The center of action in program-related patent litigation has been section 101. By the time of Benson, the C.C.P.A. had removed all significant section 101 obstacles to program-related patents, whether claimed as processes or as apparatus. The “mental steps” doctrine had been effectively eliminated, 408 and the “acting on materials” 409 and “function of a machine” 410 arguments had been rejected. The court had made it quite clear that loosely constructed claims would receive only section 112 scrutiny.

Gottschalk v. Benson produced a substantial perturbation in the law of statutory subject matter, the dimensions and durability of which remain uncertain. Benson clearly did not touch upon the “mental steps” doctrine, but it cannot be inferred that this silence represented a willingness to tolerate a claim that does read upon practical mental implementation. As Judge Rich observed in In re Christensen, the thrust of Benson was to read scope limitations into at least the process category of statutory subject matter. 411 However, contrary to Judge Rich’s section 101 preferences, the Supreme Court has been reading such limitations into the subject matter category throughout the history of the patent system. The “acting on materials” cases, for example, were fundamentally concerned with scope, 412 as were the “function of a machine” opinions. 413 The fact that previous concerns for breadth were cast in language that turned out to be unsatisfactory does not obviate this concern. And Benson at least made the “doctrine” of Cochrane respectable again, 414 following its eclipse in Musgrave. 415

It should also be noted that the majority opinion in In re Johnston 416 is inconsistent with Benson in several respects. Johnston quoted

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407. See notes 213-57 supra and accompanying text.
409. Prater II, 415 F.2d at 1402-03, 162 U.S.P.Q. at 549, 2 CLSR at 46.
411. 478 F.2d 1392, 1395, 178 U.S.P.Q. 35, 38, 4 CLSR 66, 71 (C.C.P.A. 1973)(Rich, J., concurring). This presentation of Christensen’s interpretation of Benson is accurate only insofar as the operative word is “process.” The C.C.P.A. in Christensen plainly saw Benson as reaching beyond “a formula for converting binary coded decimal numerals.” Id. at 1394, 178 U.S.P.Q. at 37, 4 CLSR at 69.
412. See note 409 supra.
413. See note 410 supra.
414. See notes 349-52 supra and accompanying text.
415. 431 F.2d at 893, 167 U.S.P.Q. at 289, 2 CLSR at 937. See also text accompanying notes 310-11 supra.
Waldbaum for the proposition that the “technological arts” define statutory subject matter, but Benson clearly overruled that position. Johnston’s confinement of the Benson holding to its narrowest facts is also unsupportable in the face of even the most conservative reading of the “nutshell” section of the Benson opinion. Finally, as Judge Rich pointed out, claims in apparatus form to the Benson and Tabbot invention would have been interchangeable in effect with the process claims actually presented.

III. THE POLICY DEBATE

The preceding section focused largely on the doctrinal aspects of the program patent issue. Yet, the parties to the debate have not confined themselves to legal argument. Broader policy considerations have frequently been urged in both the secondary literature and the courts. This section collects these scattered policy contentions and presents them according to their contribution to two fundamental issues: (a) whether patent protection for programs should be available; and (b) who should decide that question.

A. Desirability of Patent Protection

Patent proponents typically base their policy arguments upon the purported economic purposes of the patent system and the need for patent support in the software sector. The major economic goals said to be served by program patents are the stimulation of investment in software innovation and the disclosure of innovation with a consequent contribution to other innovation and avoidance of wasteful duplication. Program patents have, in addition, been held out as a stimulant to competition in the entire data processing industry as well as an aid to “orderly” software markets. Needless to say, patent opponents have controverted these arguments at every turn.

Most economic arguments in favor of patents commence with a
recitation of various descriptive statistics and assertions. There is very little disagreement about the fact that the sales volume of the data processing industry has grown substantially over the last decade and a half, or that the percentage share of software sales (and costs) has grown more rapidly than that of hardware. It is also beyond question that the number of programmers at work has grown during this period. In 1965 it was said that "the cost of developing a program is more likely to run into six than five figures," an estimate finding mild support three years later, at least in the case of fully documented and debugged proprietary programs for sale on the open market. On the other hand, there is reason to believe that the average program costs substantially less to develop.

Until recently, it was frequently asserted that there existed a "shortage," or "scarcity" of skilled programmers, a proposition typically offered in further support of patent protection and usually traceable to a 1966 article about the "software gap." Moreover, it was repeatedly contended that the "gap" between the demand for and supply of programmers and their products was growing.

Armed with such information and concepts, the various forces

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426. See, e.g., Bender, supra note 423, at A-16.
427. Id.
428. Id. at A-22, A-23 & n.40.
429. Id.
431. See Pantages, The Problems of Packaged Programs, 14 DATAMATION, Apr. 1968, at 75, where Robert Head, of Software Resources Corp., was quoted as saying that most such programs were offered at $5,000-$25,000, which "ought to be" 1/5 to 1/10 of in-house development cost. If one uses midpoints as means, the mean program cost was approximately $112,000.
432. Total software costs in 1973 were estimated at $10 billion dollars. See Note, Computer Software: Beyond the Limits of Existing Proprietary Protection Policy, 40 BROOKLYN L. REV. 116, 117 (1973). In 1969, it was estimated that 10,000 programs were being written per day. Koller, Computer Software Protection: Report of An Institute Clinic, 13 IDEA 351 (1969-70), reprinted in 3 R. BIGELOW, COMPUTER L. SERV. § 4-1, art. 3, at 1. If a 260-day working year is assumed, these figures imply an approximate average cost per program of something under $10,000.
joined battle on the economics of program-related patents. Proponents described patents as the only possible form of protection for the "inventive concepts" in software. The alarming notion was advanced that failure to supply such protection would "close the door forever on further inventions in the general-purpose computer field."

In what might be seen as the middle position on this issue, one writer noted the absence of current patent protection and stated, "[t]here is no influence on the rate of generation of programs as far as I am able to detect." The particular expression of this position which provoked the most vigorous response, no doubt because of its perceived weaknesses, was that made by the 1966 President's Commission on the Patent System. The Commission, in part, justified its recommendation that programs be denied patent coverage by saying that "the creation of programs has undergone substantial and satisfactory growth in the absence of patent protection." Objectors responded that the statement was obviously speculative:

The computer manufacturers today are having great difficulty supplying the programs necessary to operate their own advanced computers. Who can say how much farther ahead the software industry would be if competition supported by clear patent protection had been the case.

Even more strongly, it was stated that "there is a mountain of evidence that the problems in this area have retarded the growth and application of computers since they were invented," a contention at least partly at odds with another response to the Commission's argument: "It should be noted that the initial development of the program industry took place without the realization on the part of business interests of the full significance of the use of computer programs."

An even more aggressive assault on the economic incentive argument comes from those that contend that program patents would aggravate, rather than alleviate, quality and quantity difficulties prevailing in the absence of such protection. It has been said that patents would be more likely to "stifle" program development than to stimulate it, particularly if the threat of litigation were used to deter challenges to weak patents, and would embroil programmers in mountains of red tape and patent searches before beginning routine programming assignments.
Patent opponents presenting such arguments to the Supreme Court drew comfort from the Department of Justice's assertion that "[i]t is difficult to conceive how the field of programming could have grown faster, or that its past growth has been hampered in any meaningful fashion by a lack of investment funds." 445

Another fundamental economic policy underlying the patent laws is the provision of incentives to disclose and dedicate inventions to the public. Those in favor of program-related patents hold out this alleged benefit, contending that such protection can avoid wasteful duplication of programming resources. 446 Opponents counter such arguments by suggesting that innovators may actually be slower to reveal new ideas in the face of possible future control by other patentees 447 and that resource waste may be aggravated by efforts to "invent around" patented program applications. 448 Predictably, both sides turn to evidence of software community practice for support.

Some companies adopted proprietary attitudes toward software at least sixteen years ago. 449 However, in those days the issue could still be framed in terms of whether developers had a "right" to conceal their products. 450 Patent opponents referred to a "tradition" against program secrecy, based in part on the apparent futility of concealment in the face of mobile programmers who wanted to be known for their work, 451 and in part on the practice of using programs as "a sort of currency." 452 Those favoring patents offered the existence of program exchange bureaus as proof that free exchange required unnatural stimulation, 453 and argued that such bureaus were sponsored by hardware manufacturers in their own self-interest. 454 By 1968, Patent Commissioner Brenner admitted that "today, the only significant free contribution of software to the public comes from the universities and other organizations dedicated to research rather than profit." 455 Four years later it was contended that secrecy practices had been aggravated by the C.C.P.A.'s extension of patents to program-related inventions. 456

446. See, e.g., Note, supra 114, at 892-93; Kurtz, Patents and Data Processing, 6 DATA PROCESSING MAGAZINE, Nov. 1964, at 9, 13; Jacobs, supra note 59, at 7, reprinted from 7 COM. ACM at 583.
447. Puckett, supra note 44, at 125.
448. Note, supra note 53, at 1553.
450. Id.
451. Puckett, supra note 44, at 133.
455. Brenner, supra note 422, at B-1, B-3.
Advocates have also suggested that patents would help promote competition in the data processing industry by encouraging the easy entry of small firms. In the absence of patent protection, claimed one software developer, hardware manufacturers are the only parties who could gain economic benefits from computer-program inventions in view of their "captive market." The response to the competition theory has been that program patents would be of more advantage to large firms in view of their superior research and legal resources. A hardware manufacturer adopted this position, in altered form, by arguing that superior resources could provide an advantage by permitting a company to offer customers indemnity for possible program patent infringement suits. Advocates claim that the integrity of the entire patent system is at stake. Denial of protection, at least by statute, has been characterized as "an awesome precedent," although it is not clear why it would be more awesome than the actions taken by the Supreme Court over the years in other areas of technology. In Benson, the Government took the opposite position, flatly asserting that program patents would tend to undermine the entire patent system.

The denial of patent protection has also been labeled "unfair." According to one software trade association, "[t]he Patent Office is discriminating against inventors who chose a program as the preferred embodiment in favor of a hardware embodiment for the same inventive concepts." Such "equal protection" propositions plainly have no economic content; they are urged by parties who were willing to invest resources in the development of software without patent protection. If there are policy considerations of importance in these propositions, they are probably best expressed in the following statement, which was delivered in another context:

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457. Jacobs, supra note 60, at B-90.
461. Jacobs, supra note 43, at 372-73; see also, Nimtz, supra note 58, at 212.
462. Cases denying patents to new plant varieties led to a congressional enactment, not modifying section 101, but providing special and limited patent protection for plants. 35 U.S.C. §§ 161-64 (1970). Medical techniques, although often denied patent protection since Morton v. New York Eye Infirmary, 17 F. Cas. 879 (C.C.S.D.N.Y. 1862) (No. 9,856) (denying coverage for the process of administering ether as an anesthetic), have received no such succor from Congress.
463. Brief for Petitioner, supra note 129, at 17.
465. ASSOCIATION OF INDEPENDENT SOFTWARE COMPANIES, AISC POSITION PAPER ON LEGAL PROTECTION FOR COMPUTER PROGRAMS (Nov. 21, 1968), reprinted in 3 R. BIGELOW, COMPUTER L. SERV., app. 4-1a, at 1.
I believe that a patent is more than just a simple economic right. . . . There is a human and emotional element to patents which is hard to put on paper. There are fundamental questions of justice, of right, of personal achievement, of glory, and if you will, of glamour, and these must be considered when incentives to inventors are discussed. 466

Probably the most telling argument in opposition to program patents is the claim that the Patent Office is not, and may never be, equipped to cope with the demands that program patent application review would entail. It constituted an important basis for the recommendation of the President's Commission that programs be denied patent coverage, 467 and the Government returned to this theme in its Benson brief:

At present there is no adequate system of classification, searching technique and research files for computer programming. Consequently, it is highly doubtful whether the criteria for examination of patent applications required by Graham v. John Deere Co. . . . can be effectively applied. 468

The issues raised by this objection are usefully separated into those which involve sheer administrative burden and those which involve the methodology of prior art searches. In 1968, Patent Commissioner Brenner expressed concern for the potentially large number and complex nature of the applications and patents which might result from an approval of such applications; and he raised the possibility of "thousands flooding the Patent Office" in the face of an already severe problem of retaining qualified examiners. 469 Patent proponents have responded to this contention by suggesting the use of computers to manage the search operation 470 and the creation of a file of all computer programs now in use to ensure coverage of the prior art. 471 All such administrative objections by the Patent Office have been condemned on the basis of section 131, 472 which sets forth the mandate that a patent shall issue once an invention meets the requirements of patentability. 473

The other problem presented is the difficulty of classifying and comparing programs. This has been dismissed as merely characteristic of any new technology, 474 but the history of efforts to develop appropri-

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467. REPORT, supra note 42, at 13.
468. Brief for Petitioner, supra note 129, at 31.
470. Note, supra note 239, at 385; Kayton, supra note 73, at B-51.
473. Id.; Jacobs, supra note 60, at B-87.
ate methodologies has been discouraging. The American Patent Law Association and the Association for Computing Machinery undertook a classification project in the late 1960's.\textsuperscript{475} After the C.C.P.A.'s decision in \textit{In re Benson},\textsuperscript{476} the Patent Office worked on the same problem with the National Bureau of Standards.\textsuperscript{477} In 1973 it was reported that these projects had come to naught.\textsuperscript{478}

Patent opponents also maintain that patent protection would be of scant interest to most program developers. Patents are costly to secure\textsuperscript{479} and even more so to enforce.\textsuperscript{480} There is also substantial delay between filing and issue, a time period that is presently averaging more than three years in noncomputer cases. Computer applications have taken even longer at times. An application filed on ENIAC on June 26, 1947 was finally issued on February 4, 1964.\textsuperscript{481} The Prater application, which had its first hearing in the C.C.P.A. in 1968, was filed in 1961.\textsuperscript{482} The Benson application was filed in 1963;\textsuperscript{483} and that of Johnston in 1967.\textsuperscript{484}

Of course, a clear holding that all program inventions are patentable would substantially reduce the delay, but prolonged case-by-case determination could make delay an instrument of Patent Office policy. Since an invention is unprotected during Patent Office prosecution, an applicant must either conceal his invention and hope that there will still be a substantial market when the patent finally issues, or market it immediately and hope that users will not be able to economically stop using it when the patent finally issues. There has been a general feeling in the past that the useful life of most software is too short for either approach to be rewarding, although there may be a trend toward more durable products.\textsuperscript{485}

\textsuperscript{475} Koller, \textit{supra} note 432, at 362; \textit{see also} Preston, \textit{Searching in the Programming Arts}, 5 AM. PAT. L.A. Q.J. 30 (1976).


\textsuperscript{477} Brief for Petitioner, \textit{supra} note 129, at 31.

\textsuperscript{478} Duggan, \textit{supra} note 347, at 136.

\textsuperscript{479} Note, \textit{supra} note 239, at 385.

\textsuperscript{480} A 1967 study found costs of litigation in nonprogram cases to range from less than $25,000 to several million dollars. \textit{See} Harris \& Chuppe, \textit{Cost of Enforcement of Industrial Property Rights}, 14 IDEA 77, 81 (Conf. Issue 1970).

\textsuperscript{481} Kurtz, \textit{supra} note 446, at 10. Since the seventeen year patent term does not begin to run until issuance of the patent (35 U.S.C. \textsection 154), there is an incentive for the applicant to engage in delaying tactics if he expects his claims to cover an important and durable technology.

\textsuperscript{482} \textit{Prater II}, 415 F.2d 1393, 1395 n.8, 162 U.S.P.Q. 541, 543 n.8, 2 CLSR 32, 34 n.8 (C.C.P.A. 1969).

\textsuperscript{483} 441 F.2d 682, 169 U.S.P.Q. 548, 2 CLSR 1030 (C.C.P.A. 1971).

\textsuperscript{484} 502 F.2d 765, 183 U.S.P.Q. 172, 4 CLSR 1491 (C.C.P.A. 1974).

\textsuperscript{485} \textit{See} Note, \textit{supra} note 239, at 370, and sources cited therein; Brothers \& Grimaldi, \textit{supra} note 248, at 398-99, \textit{reprinted} in 51 J. PAT. OFF. SOC'Y at 594.
It has also been suggested that patents would be unimportant to most software developers because enforcement would be very difficult. A program can be appropriated and used without visible, identifying traces, or its inventive concept can be adapted and then exploited by a single person acting in secrecy.

Finally, many believe that very few programs could pass the section 103 nonobviousness test. Particularly in the case of applications programs, however costly they are to produce, the programming process is usually straightforward once the formats for data input, output and storage are specified.

Patent protection has also been opposed on the grounds that it is unnecessary in view of the alternative means of protection available. The President's Commission mentioned copyright availability. Most software developers attempting to exploit their products have relied on a combination of trade secret and contract protection. Patent advocates have disputed both the suitability and availability of such alternatives. Some writers, questioning the suitability of all of the present systems of proprietary protection in a program context, have proposed special modifications of the patent system or entirely new forms of protection.

Arguments against patent protection have occasionally included criticism of the patent system in general. Patent advocates have sometimes been inclined to impute an antipatent position to the opponents of program patents. Consequently, something of a debate on the general policy effects of the patent system has arisen in the program context, although the issues are rarely pursued past their assertion. There has been a tendency, for example, for opponents of program patents to refer with apparent opprobrium to the "monopoly" which program patents would confer on their possessors. Writers have also questioned the general relationship between patents and disclosure, and have expressed concern that the real rewards under proprietary protection systems might go to financiers rather than the actual inventors. Program patent supporters have been quick to respond with glowing testimonials to the virtues of the patent system, which, it has been said

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486. Brenner, supra note 422, at B-16, B-17.
487. See, e.g., Eltgroth, supra note 198, at 7.
488. REPORT, supra note 42, at 13.
490. See, e.g., Puckett, supra note 44, at 132; Note, supra note 53, at 1554; Brief for Petitioner, supra note 129, at 15.
491. Puckett, supra note 44, at 133.
492. Note, supra note 432, at 146.
"has helped lead the United States to the scientific and technical leadership of the world."\textsuperscript{493}

Finally, perhaps as an afterthought, an \textit{amicus curiae} brief in the \textit{Benson} case raised the spectre of injury to both the American data processing industry and the balance of payments if patent protection were extended to program-related inventions.\textsuperscript{494} Specifically, the brief suggested that patent protection in the United States might induce the transmission of data abroad for processing in countries without such protection.\textsuperscript{493}

\section*{B. Choice of Forum}

The question of program patentability can be resolved in two distinct decision-making contexts: (1) entirely within the normal patent adjudication process in the Patent Office and the courts; or (2) in Congress, with subsequent elaboration in the adjudicatory process. Two general issues arise in this connection. One concerns the proper forum for the resolution of the patentability question. The other focuses on the type of argumentation that is appropriate in each.

The Report of the President's Commission in 1966,\textsuperscript{496} and the proposed legislation to implement its recommendation that programs be denied patent protection,\textsuperscript{497} provoked a flood of commentary, most of it unfavorable. Although much of the commentary expressed dissatisfaction with the specific contents of both the Report and proposed legislation, the relative merits of Congress and the courts as decision makers were also aired.

A supporter of the proposed legislation justified a preference for congressional resolution by pointing out that "discussion would not need to be encumbered by legalistic discussions of prior cases, as were the Patent Office hearings."\textsuperscript{498} Opponents of the legislation stressed supposed advantages of the judiciary: "The normal, reliable judicial process should be followed, which employs adversary proceedings and real fact situations to clarify the issues."\textsuperscript{499} Another writer preferred a case-by-case treatment because he doubted that a general resolution of subject matter issues was in fact possible.\textsuperscript{500} The withdrawal of proposed section 106 and its progeny in 1968 marked the beginning of a brief hiatus in this aspect of the debate, punctuated by the Patent

\begin{thebibliography}{99}
\bibitem{493} Kurtz, \textit{supra} note 446, at 12.
\bibitem{494} Brief for Burroughs Corp., \textit{supra} note 460, at 19.
\bibitem{495} Id.
\bibitem{496} \textit{REPORT}, \textit{supra} note 42.
\bibitem{497} The prototype of this legislation was proposed in Section 106, S. 1042, 90th Cong., 1st Sess. (1967), \textit{reprinted} in the Appendix in this issue.
\bibitem{498} Galbi, \textit{supra} note 127, at 181.
\bibitem{500} Comment, \textit{supra} note 48, at 487.
\end{thebibliography}
Office's statement that legislative exclusion of program patents was "premature."\(^{501}\)

The string of cases favorable to program-related inventions\(^{502}\) reawakened interest in congressional action, and the briefs to the Supreme Court in *Benson* stressed the forum issue. The Government and its supporters characterized the current law as blocking program patents and urged that any "extension" of patent protection to program-related inventions should be left to Congress.\(^{503}\) The respondents urged that the question should only be addressed in an infringement action "where these and other circumstances can be fully developed in an adversary context."\(^{504}\) The Supreme Court adopted the Government's position, calling for congressional resolution of the patentability issue.\(^{505}\) That decision provoked subsequent unfavorable characterizations of the congressional decision-making process: "Unfortunately, the carfare to 'the Hill' is apt to prove steep because of the traffic jam caused by the large lobbying vehicles sent out by companies and groups with significantly divergent views about just how software should be treated."\(^{506}\)

The other forum-related, issue-appropriate argument was raised by patent supporters in response to the wide-ranging policy considerations urged on the Supreme Court by the Government in *Benson*:

Those arguments . . . invite the Court to explore questions of policy that require the consideration of a wide range of broad economic and technological problems. This is not an appropriate case for the resolution of such questions. The invention here involved is limited both in its nature and in its economic significance. Moreover, the decision of the court below was an appeal from a proceeding in the Patent Office in which the record essentially consists solely of legal assertions and counterassertions by respondents' attorneys and Patent Office examiners.\(^{507}\)

IV. EVALUATION OF THE PROGRAM PATENT DEBATE

It is apparent that one and a half decades of public debate and nine years of judicial consideration have produced substantial verbiage, but little agreement, on the legal and policy issues raised by the prospect of


\(^{502}\) See notes 258-342 *supra* and accompanying text.


\(^{507}\) Brief for Respondent, *supra* note 504, at 5-6. This criticism was echoed in Miller, *supra* note 235, at 155.
program-related patents. There have been judicial decisions, to be sure. However, as already noted, these have been largely directed to the question of subject matter, and their permanence in the face of further judicial review and possible congressional action is uncertain. Section V will resume the discussion of the normative questions where the historical debate leaves off. First, however, the debate itself will be examined for lessons relevant to the policy issues.

A. Legal Discussion

It is difficult to avoid the harsh conclusion that much of what has been said on the program patent issue has been unenlightening and, at times, nonsensical, if one is seeking a rational resolution of the issues. If objections to patents based on the asserted anticipation of program inventions are to be taken seriously, it is difficult to escape the conclusion that the digital computer was anticipated by, if not intended as a parody of, the wonderful machine of Lagado described by Jonathan Swift in *Gulliver's Travels*.

The subject matter debate has descended to this Swiftian level on occasion. One example is provided by the exercises in characterizing programs and algorithms which have often masqueraded as attempts at...
Fortunately, these maneuvers have been partly avoided by the decisions of patent applicants to make claims on programs in combination with computers and other phenomena. More tenacious have been efforts to associate machine operations with human thought processes, efforts which frequently rivaled the anticipation arguments in absurdity. Patent proponents have been on firmer ground on the subject matter issue, but it would be easy to overstate their contribution to a meaningful resolution of this quandary. They have ignored persistent efforts by the Supreme Court to put limits on the scope of patent rights by resorting to subject matter doctrines. Furthermore, it is difficult to believe that the brain-machine distinction so often and so thoroughly urged by patent proponents was not in fact clearly understood from the beginning by just about everyone.

In sum, one side has tended to argue the ridiculous while the other has countered with the obvious. The consequence has been very little contribution to developing reasonable limitations on the scope of program-related patents. Efforts to construct doctrines of limitation appropriate to this subject matter would certainly have been beneficial in moderating the divergence between the C.C.P.A., which has revealed a preference for ignoring limitation policies, and the Supreme Court, which has poorly articulated and defended preemption limitations.

Nor has much light been shed on the reconciliation of program-related patents with the policies underlying nonobviousness and disclosure requirements. These policies have tended to serve in roles ancillary to subject matter attacks on patentability. It is rare to find discussions of these requirements which make any meaningful effort to elaborate on the linkage between fundamental patent policies and proposed or projected outcomes.

B. Policy Discussion

If anything, the policy debate has been even less useful than its
more strictly "legal" counterpart. Frequently encountered, for example, are references to the economic size of the data processing industry and the significance of computer applications to society.\textsuperscript{511} It has also been pointed out repeatedly that patents, even if available for program-related inventions, would be of scant interest to most program developers either because the conditions of patentability would rarely be met or because the present patent system is not well suited to their economic needs.\textsuperscript{512} Such observations are no doubt valid, but commentators who offer them often appear not to realize that they cut both ways on the patentability question without further elaboration.

The critically important, economic issues have received very little quantification. It is not unusual to find the commentary on these issues confined to vague assertions concerning the magnitude and direction of behavioral consequences of one or another outcome. The audience has been told that patents would lead to more program innovations; yet, it has also been informed that less innovation would result. More secrecy has been predicted in the event of no patents. A denial of patentability has been described as fatal to program innovation, on the one hand, while quite the opposite has been asserted due to the purported inhibitory effects of patents.\textsuperscript{513}

References to more specific economic phenomena have been equally lacking in accuracy. A prominent example frequently offered in support of patentability was the "shortage" of programmers in the middle and late 1960's.\textsuperscript{514} Although more recent articles promoting patentability no longer talk about such a "shortage," extended consideration of the shortage issue is warranted by both the frequency of its former reference and the evidence it provides of the tendency to use labels without providing quantitative support.

The word "shortage" can refer to a variety of economic phenomena, and different policy implications attach to each. On the most superficial level, it can be seen as a proxy for "we want more"—a usage which merely puts programmers into the class of all resources termed "economic." Alternatively, an equilibrium interpretation of the word "shortage" might imply that the market for programmers is not at the equilibrium price (i.e., at the intersection of hypothesized demand and supply functions). This would necessarily imply that something is preventing either the employment of some programmers who are already trained and willing to work, or the price of programmers from rising to the equilibrium level. There is no evidence of the former. As for the latter, one commentator has claimed that programmers' salaries may

\begin{footnotes}
\item[511] See notes 426-29 supra and accompanying text.
\item[512] See notes 444-45 & 486-89 supra and accompanying text.
\item[513] See notes 422-95 supra and accompanying text.
\item[514] See notes 433-35 supra and accompanying text.
\end{footnotes}
have been constrained by executive compensation structures. The patent law is surely not an appropriate policy instrument for the correction of that type of market imperfection.

From a static perspective, a "shortage" of programmers might also be defined as the existence of unused capacity of an economic complement—in this case, digital computer capacity. But an understanding of express capacity requires a dynamic, rather than static, perspective. How did it arise? One possible explanation was a time lag in programmer supply; persons encouraged to enter the programming profession by rising salaries have to spend time in training. Another possibility was that the supply of the complement to programmers—digital computers of a particular technological level—exhibited discontinuities due to the economics of manufacture and the stepwise progression of hardware technology. Yet another cause of disequilibrium may have been a failure by hardware buyers to calculate accurately the total cost of purchasing and operating their machines. Nor was idle hardware necessarily nonfunctional. At one time firms displayed their computer installations prominently for the benefit of customers, investors and other visitors.

No doubt many other factors behind the shortage of programmers could be adduced, but these are sufficient to show that the shortage was at all times obviously a temporary phenomenon. In fact, the shortage now appears to be over. Even had the underlying factors been permanent in the absence of social intervention, the general failure of commentators to look behind the "shortage" label obscured the unsuitability of the patent system as a remedial policy instrument.

Of more serious concern is the adequacy in quantity and quality of software itself. Yet, even when discussions have moved beyond insubstantial prophecies of the end of software innovation, economic analysis has tended to stop at the stage of mere declarations, occasionally supported by the recitation of a few anecdotes.

Also unpersuasive have been arguments in favor of patents grounded on appeals to justice and equal protection for innovators of hardware and software. There has been no suggestion that software innovators must divulge their creations. Moreover, there is no apparent reason why the people who invested in software production at a time when patent protection was not clearly available should now be granted such protection merely because hardware innovators have it. If it is

515. Puckett, supra note 44, at 122.
516. The probable impermanence of the programmer "shortage" was pointed out in the mid-1960's in such articles as Sundeen, General Purpose Software, 14 Datamation, Jan. 1968, at 22. These discussions were typically relegated to footnotes in the written debate of program patents on the rare occasions that they were mentioned at all.
assumed that the absence of patent protection reduces the relative returns to software investment, this in itself indicates only that the complaining software producers should invest their capital in hardware innovation instead. It is unlikely that the patent law, which can only be justified on the basis of producing a net social benefit, should be altered in response to individual investment errors.\textsuperscript{517}

Lastly, a reasonable argument can be made that the courts are not the proper forum for an airing of the Patent Office's manpower constraints, although such administrative factors are often weighed in other legal areas. However, the contention that other policy issues, including those concerning the review of prior art, should not be urged on the courts seems untenable.

It is said that cases should be resolved solely in light of the legal issues. But what is the context of legal doctrines except the policies they promote? Adjudication is necessary only because new phenomena present themselves for inclusion in the doctrinal categories defined by statutes and the body of historical case law. If adjudication is to rise above exercises in asserting that the subject matter is now rather like a tree, now rather like a rope, now rather like a tool of the mind, the policies behind the law must be considered. Moreover, the Supreme Court has consistently enunciated patent law doctrines after policy reflection, and clearly feels obliged to do so, as the \textit{John Deere} decision indicates.\textsuperscript{518}

The problem in the program-related patent area is not that policy issues have been argued, but that they have been argued poorly, a situation for which those on both sides of the patent controversy bear equal responsibility.

\textbf{C. Factors Shaping the Debate}

In the final analysis, the behavior of individuals and the institutions they represent is very difficult for an observer to explain with precision. Nevertheless, it is important to examine the program patent debate for possible explanations of its character, both to put in perspec-

\textsuperscript{517} In F. Machlup, \textit{The Production and Distribution of Knowledge in the United States} (1962), the author presented an interesting perspective on the concept of "intellectual property":

Besides the various incentive theories of patent protection there has been a legal and moral theory which claimed that an inventor has, by "natural law," a "property right" in his idea and that a patent is merely a practical way of confirming this property right. This theory, which had its origin in France, was put forth for a political reason: the word "property" aroused favorable sentiments, the word "monopoly" unfavorable ones. Thus, it was dangerous to justify the patent as a monopoly grant, even though it was to serve good purposes.

\textit{Id.} at 167.

tive its shortcomings and to extract possible insights into the patentability issue. In all cases, the observations should be considered hypotheses, consistent with available evidence.

Part of the explanation for the disappointing nature of much of the debate can be traced to the patent laws themselves. The decision of Congress to permit the general judiciary to adjudicate patent issues (with certain jurisdictional modifications) insured that the policies of judicial administration would impinge upon the disposition of patent cases. Above all, it opened the door to reliance upon precedent, including very old precedent, which in general promotes the values of economy, uniformity and reviewability to the exclusion of other more desirable factors.

The real-world "stuff" of the patent law, by contrast, is characterized by flux in both theory and substance. Not only has technology itself undergone dramatic changes since the days of *Cochrane v. Deen-er*, but so too has the conceptual apparatus employed in the development and practice of technology. The same can be said for the other, non-legal cornerstone of patent law—economics—with the additional observation that part of the very "stuff" of economics, the profile of attitudes which characterizes the "economic culture" of American society, has also changed in important respects during the last century. Appreciation of these changes is slow to filter down to those who are not experts in these disciplines.

Further, the pace of general comprehension is progressively retarded by increased specialization, the growing sophistication of tools and vocabulary, and the explosion of written information. The legal profession and the judiciary, laden with the business of daily litigation, have not been particularly alert to the content and significance of these changes.

Finally, the courts have been required to draw somewhat arbitrary lines, on a case-by-case basis, when such issues as nonobviousness and

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519. 94 U.S. 780 (1876). See notes 159-70 *supra* and accompanying text.
520. The most dramatic example is perhaps the collapse of the conceptual line demarcating matter from energy and the consequential revolutionary change in the fundamental "paradigm" of physics, as interpreted in T. Kuhn, *The Structure of Scientific Revolutions* (1962). A host of less dramatic, but more immediate, changes have accompanied each unanticipated development in science and technology, including the emergence of digital computation itself.
521. That these phenomena have threatened the advance of scientific knowledge itself has been presented in the works of Derek John de Solla Price, whose ideas were given serious attention by at least the Soviet government and spawned a distinct discipline labeled the "science of science" (nauka o nauke). *See, e.g., D. Price, Little Science, Big Science* (1963).
522. Intradisciplinary disagreement often compounds the insensitivity of the judiciary to advances in non-legal areas of knowledge, as the history of the "legal insanity" test in the federal courts of appeals attests.
infringement have been presented. Congress has both conditioned and constrained the evolution of the subject matter doctrine by its choice of wording for sections 100(b) and 101, creating doctrines which diverge, at least in verbal formulation, depending upon whether an invention is claimed as a "process" or a "machine." The arbitrariness of this particular distinction has prompted persuasive proposals for a reformulation of section 101 and is graphically illustrated in the program patent area by the practice of applicants of structuring their process claims in apparatus terms. Patent adjudication has thus been cast in a precedential, decision-making mold, using an arbitrary vocabulary, in an effort to cope with the constantly shifting subject matter. This has resulted in massive confusion in the legal discussion of program patents.

As the following passage indicates, a theoretical and empirical understanding of the dynamics of innovation is unsatisfactory when measured by the needs of public decision making:

The plain fact is that economists have neglected the study of technical change at the structural and micro level to the point where we are quite incapable of answering many of the most important questions of our day. . . . Where are the economists even, who are really studying the impact of automation? And the answer is, practically nowhere.524

These economic uncertainties create the opportunity for policy confusion.

The difficulty of resolving the policy issues can be illustrated by a brief discussion of the question of whether the extension of patent coverage to software would, on the whole, stimulate or retard program innovation. Although the motivations to innovate are varied and complex, the patent system is directed to the maximization motive of investors. A wealth-maximizing investor will invest in innovative activity as long as the present value (i.e., the absolute dollar value, discounted at the expected rate of return of his least attractive alternative investment opportunity) of the expected revenue stream from that investment exceeds the present value of all expected expenditures, including the initial investment necessary to produce that revenue stream.525 Concealed in that decision model, however, are a host of

523. See, e.g., Eggert, Uses, New Uses, and Chemical Patents—A Proposal, 51 J. PAT. OFF. Soc'y 768, 785 (1969), where it is suggested that claims be heard for and confined to “how-to-makes” and “how-to-uses” (hyphens added).


525. The theoretical tools for characterizing that decision process are in fact substantially more sophisticated than those described. For example, the behavior of the future costs and revenues, as well as the success of the innovative venture itself, exhibit uncertainty. One approach to the modeling of decisions under uncertainty has the investor constructing subjective probability distributions of the
complex factors defining expected costs and revenues, some of which are related to the prevailing legal systems of proprietary protection.

Given subjective probability functions for the nonlegal factors, the importance of patent availability in the investor's decision can be summarized in three questions:

1. What is the expected net present value of patent protection, measured incrementally, compared with no legal protection of the inventive concepts at all?
2. What is the corresponding incremental value of the best alternative means of legal protection?
3. Is patent protection superior to the best alternative and, if so, by how much?

The answer to the first question is presently quite unclear. Even if one assumes that all program-related inventions are patentable subject matter, the economic return will be affected by such factors as disclosure and nonobviousness requirements, the problems and costs of detecting and prosecuting suspected infringement, and the ultimate judicial resolution of the equivalence question. Moreover, the value to innovators of patent protection is constantly changing because of an erosion process that has been dubbed the "socialization" of the patent system.526

Alternative means of protection include reliance on trade secret law, contractual arrangements and copyright.527 Assuming that these alternatives are in fact available, the relative merits of patent protection are hotly disputed. Such alternatives have been denigrated by commentators arguing in favor of patentability, usually on the grounds that only patents offer protection of inventive concepts and induce uncertain outcomes, of which the expected value, as a measure of central tendency, is only one relevant parameter. The existence of "risk preferences" compels consideration of an additional parameter—the dispersion of the subjective probability distributions. Since it is commonly supposed that investors are generally risk averse, the weight they give future net cash flows is something less than their expected value; the magnitude of the difference varying directly with the variability of the estimated net flows. On the other hand, investors can "hedge" by constructing a portfolio of investment projects so that the outcomes of particularly important future events have offsetting effects across the portfolio with a consequent reduction in activities. To the extent that the decision model is valid, this implies that individual investment decisions cannot be analyzed in isolation from the other activities of a particular investor.


527. The Copyright Office accepts computer programs for registration, but without expressing an opinion as to the legal effects of doing so. See United States Copyright Office, Circular 61 (1976). The availability and utility of copyright protection has received nearly as much attention from commentators as the
public disclosure and marketing.\textsuperscript{528} On the other hand, patents also entail unusually heavy costs and delays, and the expected value is heavily dependent on the prospects of detecting and prosecuting infringements.

Thus the usefulness of patent protection is open to question. Nevertheless, if the existence of other present or potential patentees were ignored, there could be no purely allocative objection to extending patent coverage for, at worst, the level of innovation would remain the same as in the absence of patents.

Complications arise, however, when the model is expanded to admit the existence of other innovators, present or potential, in related areas of technology. The criterion of social choice is now the net effect of patents on the innovative activity of the entire community. The resultant economic uncertainties substantially increase. Any particular investor's calculus must necessarily include the possibility of infringement actions brought by existing patent holders, either with reasonable cause or for a deterrent effect. Additionally, innovators may feel obliged to seek patents on developments which they could more effectively exploit through trade secret or contract, merely to prevent foreclosure by others who might file patent applications on the same invention. These and other counterproductive effects of the patent system are frequently suggested in economics literature, but their ultimate significance cannot be determined at the present level of theoretical and empirical understanding.\textsuperscript{529}


\textsuperscript{529} Among the contributions in this area are Plant, \textit{The Economic Theory Concerning Patents for Inventions}, 1 ECONOMICA (NS) 30 (1934); MACHLUP, \textit{supra} note 517, at 161-76; F. VAUGHAN, \textit{The United States Patent System} (1956); E. MANSFIELD, \textit{The Economics of Technological Change}, 34-36, 207-14 (1968).

A frequently encountered argument, for example, is that patents may be sought on products in order to suppress their exploitation rather than to promote it. Vaughan relies on a Federal Communications Commission report entitled \textit{Investigation of the Telephone Industry in the United States} (H.R. 430, 76th Cong., 1st Sess.) to support the following:

American Telephone, after obtaining thousands of patents upon various alternate methods of accomplishing specific results, used some of them and let others lie dormant. Once a selection was developed, standardized, produced, and installed on a large scale, it acquired subsequent inventions that threatened its position, not to develop and use, but to protect its position and salvage its investment in old equipment. To maintain that only the used inventions were worthwhile assumes an omniscience and disin-
D. Major Participants in The Debate

The state of patent law and the economics of innovation provide fertile soil for confusion. The motivation to cultivate it is suggested by the identity of the parties to the debate. Some of the more prominent proponents of patent availability have been:

(1) Major oil companies. Oil companies began attempts to gain patent protection for software in the early 1950's through broadly drafted claims and the disclosure of analog implementations. The Prater and Wei application, with Mobil Oil Corporation the apparent real party in interest, was filed in 1961 and explicitly disclosed the possibility of digital computer practice. The change in application tactics may have been due to the oblique encouragement of the dicta in Egan and the growing complexity of analog surrogates. Oil companies also may have had interests in the Foster and Musgrave applications filed in 1964 and 1965, respectively.

(2) Bell Telephone Laboratories, Inc. It can be safely said that Bell Labs has been in the vanguard of the forces arguing for patent protection. Of the thirteen cases reviewed above, six appear to have been prosecuted by Bell Labs, as well as its appearing as amicus curiae in Prater. Bell Labs has been among the most daring, repeatedly pushing against the
limits of scope-related concerns by presenting claims drawn to internal computer operations, and testing disclosure requirements by failing to supply actual listings in some instances.\(^\text{537}\)

(3) **Attorneys active in the prosecution of program-related claims.** Morton C. Jacobs, one of the most prolific contributors to the secondary literature,\(^\text{538}\) represented the holder of the "first software patent" to be issued by the Patent Office.\(^\text{539}\) He also filed an *amicus curiae* brief in *Prater* and was counsel for the respondent in *Johnston*. Among other prominent writers in favor of patents has been Richard Kurtz,\(^\text{540}\) counsel for the patent applicants in *Prater, Musgrave,* and *Foster*.

Major patent opponents have included:

(1) **The Patent Office.** Although always seemingly cool to patents on program-related inventions, it has only been since 1968 that the Patent Office has become an adamant opponent. This opposition commenced shortly after the issuance of the "first software patent"\(^\text{541}\) and culminated in the heroic multiplication of objections revealed in the cases previously discussed.

(2) **The President's Commission on the Patent System.** Although entering only a single cryptic appearance in 1966,\(^\text{542}\) the President's Commission apparently stimulated the brief flurry of legislative proposals in the late 1960's\(^\text{543}\) and was quoted by the Supreme Court in *Gottschalk v. Benson*.\(^\text{544}\)

(3) **Hardware Manufacturers.** Occasional entries have been made by several hardware manufacturers and their trade association, the Business Equipment Manufacturers' Association (B.E.M.A.).\(^\text{545}\) However, by far the most indefatigable opponent of patents in this group has been IBM, sponsoring down. *See In re Brandstadter*, 484 F.2d 1395, 1400 n.1, 179 U.S.P.Q. 286, 290 n.1, 4 CLSR 976, 983 n.1 (C.C.P.A. 1973).

\(^{537}\) This tactic failed in *Brandstadter*, id.

\(^{538}\) For a listing of his writings, see the Bibliography in this issue.

\(^{539}\) That this was actually the first to issue is disputed, but it was so reported in *First Patent is Issued for Software; Full Implications Are Not Yet Known*, Computerworld, June 19, 1968, at 1, col. 1. Doubts in the Patent Office about the implications of the patent were quickly manifested by a combination of reticence to accept the patent and a feeble attempt to distinguish the invention. *Patent Office is Ruffled by First Software Patent*, Computerworld, June 26, 1968, at 3, col. 3.

\(^{540}\) For a listing of his writings, see the Bibliography in this issue.

\(^{541}\) *See* note 539 *supra*.

\(^{542}\) *Report, supra* note 42.

\(^{543}\) *See* note 497 *supra*.

\(^{544}\) 409 U.S. at 72, 175 U.S.P.Q. at 677, 3 CLSR at 262.

\(^{545}\) Honeywell filed *amicus curiae* briefs in both *Prater II* and *Benson*. *See* note 50 *supra*. Burroughs and B.E.M.A. also filed *amicus curiae* briefs in *Benson*. *See* notes 54 & 460 *supra*.
articles, proposing alternative legislation, appearing at Patent Office hearings, and filing *amicus curiae* briefs. A significant portion of the arguments advanced by the Patent Office in litigation can be recognized in earlier IBM dissertations.

Although these parties have largely controlled the debate, numerous articles on the subject have also appeared. The topic has stimulated the appearance of many law review notes and comments of widely varying quality. Computer trade publications have also reported and commented on the issues, although sometimes exhibiting profound, if excusable, misunderstandings of patent law.

Finally, a curious feature of the debate has been the relative absence of contributions by academic lawyers, with the exception of Professor Irving Kayton and a few associates at George Washington University. This is particularly surprising since the program issue has forced a review of many principles basic to patent law and will probably not pass without affecting that law in its more general respects.

**E. Motivations of the Parties**

It is interesting, if risky, to consider the possible motives of the participants to the debate, and especially those of Bell Labs, IBM and the Patent Office. These particular parties have tended to control the agenda, and identification of their goals might go far toward answering the question of whether, and to what extent, the entire issue is of general importance.

That Bell Labs and IBM have been acting out of perceived self-interest goes without saying. The scanty public record cannot support an extended refinement of that observation; but, enough is available for the formulation of several hypotheses. It is, for example, possible that Bell Labs' applications, as revealed in the cases, can be taken at face value as efforts to protect software innovation. It is also possible, however, to imagine something like the early ploy of disclosing only an analog implementation, but in reverse, with software disclosure being used to avoid the teaching of intended hardware implementation, hoping that an equivalence will later be found. Such an interpretation is

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547. See, *e.g.* note 49 *supra*.
548. An exhaustive Bibliography on this topic appears in this issue.
549. For example, the Goetz patent prompted the following:

*First Software Patent: Was Program Patented? Or Was It the 'Technique'?*, Computerworld, July 3, 1968, at 4, col. 3. This prospect is beyond the worst nightmares of opponents of program patents.
reinforced by the observation that the high-volume, repetitive applications characteristic of the communications field are particularly well-suited to hardware implementation.

IBM's opposition to program patents, on the other hand, is frequently attributed to a supposed concern that patents would reduce the use of computer hardware by raising the total cost to users and by chilling user-developed innovations. This would supply a motive if IBM believed that a significant number of programs or related inventions could survive the various hurdles of patentability and if it was expected that the net effect would be to reduce data processing activity. A more intriguing hypothesis, however, is suggested by the following account:

At the time of this "invention" by Benson and Tabbot, AT&T was designing its ESS (Electronic Switching System) for both circuit switching and generalized data processing. The Benson and Tabbot patent application directly sprang from the ESS computer software development.

AT&T has consistently utilized its patents to obtain grant-backs from its licensees as a condition to granting a license. A patent license grant-back gives the licensor full access to all future improvements and know-how that the licensee develops as a result of being licensed under the original patent. (While many observers feel that such grant-backs are illegal per se under the antitrust laws, present court decisions have not yet reached that conclusion.)

In addition, AT&T has interpreted its 1956 consent decree as allowing Western Electric to sell to anyone any products which it can legally sell to Bell companies for use in furnishing common carrier communications services; e.g., it could resell the ESS and its components to any prospective purchaser.

On the other hand, IBM has developed its own mini-ESS device, the 2750, which is being marketed only in Europe by its World Trade subsidiary. The 2750 Voice & Data Switching System could have an obvious effect upon AT&T's marketing in the PBX area. PBX (and Centrex) is reputedly one of the most profitable items in Western Electric's inventory. Further, with the Carter-phone Decision, allowing attachment of non-Bell devices (sic) 'foreign attachments'—this market has been particularly vulnerable to an electronics invasion. (The ESS PBX, like the 2750, is both cheaper and technologically superior to the electro-mechanical PBX's presently installed.)

It would indeed be ironic if much of the program-related patent struggle were explicable as maneuvering in a contest for markets between corporate giants. Yet, such an hypothesis would go far toward

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551. It was recently reported that:
After being belted in recent years by a series of adverse rulings from the
explaining the Antitrust Division's intervention. It would also make the absence of the academic legal community understandable, since a position in the debate could all too easily be construed as association with the enterprise on the corresponding side of the issue.

What has motivated the Patent Office position? An adequate explanation would have to be consistent with the prolonged lack of enthusiasm for such patents, the sudden hardening of that position in 1968, and the sustained vigor of the opposition despite changes in Commissioners since 1969. An explanation would also have to take account of the fact that while the Patent Office undoubtedly is obliged to promote the public interest, it has its own set of institutional interests to defend. Given the inadequacy of the public record, it can only be surmised that the probable basis of Patent Office behavior can be found in some combination of the following:

(1) A belief that computer programs pose unprecedented problems in the anticipation and prior art areas and that a solution to these problems is not foreseeably available.\(^{552}\)

(2) A belief that a clear holding of patentability would produce a flood of applications and that regardless of their survival rate, their processing would tax Patent Office resources far beyond Congress’ willingness to provide additional support.\(^{553}\)

(3) A concern that program-related patents could be used to gain economic leverage in areas previously denied patent coverage, coupled with an appreciation of the difficulty of devising a scope-limiting doctrine which could adequately distinguish such cases.

(4) An unwillingness to see the patent system exploited as a tool in the struggle between major economic interests, a position perhaps stiffened by Department of Justice input.

(5) A concern for the integrity of the administrative process engendered by such phenomena as uncooperative and possibly abusive responses by interested parties to Patent Office opinion solicitations\(^{554}\) and the exploitation of possible Patent Office oversights in issuing such patents.

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Federal Communications Commission, Bell has seen its onetime captive business erode as such companies as RCA, International Business Machines, and MCI Telecommunications carved out niches in the market for communications and equipment.

\(552\). See notes 474-78 supra and accompanying text.

\(553\). See note 469 supra and accompanying text. It should be noted, however, that despite the apparent failure of such a “flood” to materialize following \(Prater II\) and \(In re Bernhart\), Patent Office opposition to program-related patents has continued.

\(554\). Events subsequent to the proposal of Guidelines on the program patent issue in 1966 were reported as follows:

While there was no dearth of industry response on October 4, it was all negative. As E.R. Reynolds, assistant commissioner of patents, suggested,
Finally, once it was decided to take an adamant stance, a perceived requirements to defend it without compromise.

V. CONCLUSION

Although an attempt to resolve the program patent question is beyond the scope of this article, it is possible to suggest some factors relevant to future consideration of the issue.

A. Desirability of Program-Related Patents

When delivered in a theoretical vacuum, the declaration that the patent system has "worked well" is no more cogent than the assertion that there is "enough software." While it is true that such macroeconomic assertions can never be put to rigorous test, more theoretical and empirical investigation could substantially refine the understanding of a suitable system for stimulating technological innovation. Perhaps Congress will sponsor such research.

In the absence of a sweeping change, however, the present system reveals a series of authoritative congressional choices on many of the fundamental issues raised by patents. Program-related inventions should be routinely processed through the system unless shown to present novel and significant challenges to fundamental patent policies. As has often been said, programs conceived as either processes occurring within computers or as peculiar arrays of computer component states are not in any respect mental. Applicants seriously interested in claiming only machine phenomena can avoid the imputation of efforts to claim nonmachine implementations by drafting trivial claim limitations. Moreover, subject matter objections that rely on such characterization of programming as "setting switches" and the like are simply insubstantial. What technological innovations, whether viewed as processes or as machines, cannot be characterized as mere rearrangements in time and space of already known phenomena?

Nor is the apparent preemption of an idea or an algorithm a sufficient ground of objection, unless those terms are heavily infused with limiting connotations. All patents preempt such phenomena; otherwise, there could be no infringement by anything other than the original, physical assembly created by the patentee. Such objections have often constituted the stated foundation of attacks on program-related patents. If they were a comprehensive statement of the peculiarities of the
subject matter, the case for patentability would be compelling. The issue is not so readily resolved, however, since program inventions differ from other types of technology in potentionally important respects.

One critical difference is that programs may require no significant investment in physical structures at either the inventive or exploitative stage. Program development may entail the use of computer hardware, and exploitation ultimately requires computer operations. But both the innovator and the user may rent hardware time or impose incremental demands on facilities already devoted in large part to other activities at a trivial incremental cost. Moreover, the final product can be recorded and replicated for marketing purposes or for the innovator's own use at an insignificant cost in materials. Some possible consequences of this difference are:

1. Potential innovators are not limited in number by the burden of investment in expensive research and development facilities. Any person with a modicum of training in programming skills is a potential inventor, and there is an enormous and growing volume of programs. As a result, in comparison with other technological areas, there exists an incomparably larger number of both potential unwitting infringers of program patents and potential innovators, whose efforts might be chilled by either the possibility of infringement actions or the transaction cost of patent searches.

2. Past judicial doctrines limiting the scope of patent coverage have been formulated with the help of further limitations posed by materials costs on both future innovation in related areas and in the exploitation of the invention at hand. Other types of inventions are typically "congealed" at the exploitation stage in tangible, relatively expensive and permanent form, either as actual machines or as installed equipment peculiarly suited to the implementation of processes. Scope-limiting doctrines could therefore be formulated with the thought that later innovative use of the concepts subject to earlier patent could be distinguished by the courts on the basis of easily recognized physical differences, when such distinctions seemed otherwise appropriate. Claims covering programs do not offer this opportunity unless they are confined to particular applications which entail such physical embodiment.

3. The nonobviousness requirements of section 103 are designed to ensure that patents control only technology which does not presently exist and which is not readily available. Application of the test relies upon some minimally acceptable method of putting appropriate prior art before the court. When the population of such art is relatively small, or where the relevant subset can be easily identified, the Patent Office and defendants to infringement actions are adequately reli-
able protectors of the broader public interest. But the candidates for prior art in many areas of program innovation are both numerous and uncollected. Moreover, although application of the nonobviousness test is necessarily an arbitrary judicial exercise at some point, the substantial and permanent physical embodiment of most preprogram innovations has probably assisted the courts in at least two ways. First, numerous complexities have been reduced to visible and more easily comprehensible physical forms. Second, novel physical structures suggest significant empirical experimentation with the properties of incorporated materials and components, and those empirical requirements imply something nondeterminative about such inventions. Many program innovations do not exhibit these characteristics. The most visually comprehensible embodiment may consist of an extremely complex flowchart, and the only experimentation required may consist of the detection and correction of mistakes in logic.

Further differences between program-related inventions and other technologies derive from the sheer number and variety of computer applications. These increase the potential benefits from software innovations, but also expand the scope of potentially unfavorable patent effects.

The variety of program-related inventions revealed in the cases discussed suggests that it may be appropriate to classify these inventions and accord each class different legal treatment. Claims drawn explicitly to physical processes of which digital computation constitutes only one step may raise policy questions that differ from those generated by less confined claims. Inventions which can be practiced without digital computation may differ from those without alternative utility. Among the latter, important distinctions might be made between those confined to computer implementation by heavy volumes of computation and those without even theoretical interest except in computer application.

In the past, the potentially novel policy implications of computer programming have been largely confined to software, a major reason why the long-repeated “engineering equivalence” of hardware and software has not been a particularly persuasive argument for legal equivalence. Technological developments promise to narrow the legally relevant differences, however, and the courts may be confronted with a choice between reviewing the blanket subject matter approval of permanent hardware configurations or being left with totally artificial distinctions between the treatment of hardware and software.

555. A pertinent example is the development of “programmable read-only memory” technology, which permits the automatic and relatively inexpensive embodiment of modest-sized software routines in permanent semiconductor (hardware) form.
In sum, once the existence of the general patent system is assumed, the relevant agenda would seem to consist of (1) identifying the legally significant ways in which computer programs differ from other technologies; (2) classifying the various forms of program-related inventions; (3) establishing whether each form is accompanied by such substantial policy-relevant differences that special treatment is warranted; and (4) formulating appropriate legal doctrines to deal with these differences. If the debate and litigation continue on the basis of denying, on the one hand, the relevance of policy considerations, and asserting, on the other hand, conclusionary economic arguments going to the entire patent system, coupled with wild characterizations, it will be purely accidental if the ultimate outcome is socially desirable.

B. Appropriate Forum for the Program Patent Decision

Congress would seem to be the appropriate forum for permanent resolution of the program patent question. It can call upon the resources needed for a sustained and integrated examination of the issues. It is not confined to piecemeal considerations of issues raised by particular cases, but can take into account the inter-related effects of sections 101, 103 and 112, as well as the various principles that apply during infringement litigation. Not only is Congress not burdened with old case law, but also it can terminate its effect where appropriate. In those cases where special forms of protection may be more suitable than the regular patent system, they can be devised in the context of a review of closely related, but distinguishable, subject matter. Finally, carefully drafted statutory changes could bring a uniformity of treatment that would emerge from the courts, if at all, only after a prolonged course of litigation and appeal. A major danger in the judicial forum is that the courts, confronted with extremely complex legal and economic issues not properly illuminated by the parties, may resort to inadequately considered and sweeping statements of law for the sake of repose.556

556. In opposing the rehearing of the Prater I case, Judge Rich said:

Some have approached this case as though we were obliged to decide a momentous question of public policy: should computer programs be patentable? That is the problem the Patent Office presented to Congress, where the question belongs . . . . But we are not at all concerned with what ought to be. We are not a policy-making body but a court of law. The simple question which has been before us is whether appellants' claimed process and apparatus are patentable under the existing statutes. 415 F.2d at 1393, 160 U.S.P.Q. at 233, 2 CLSR at 31 (Rich, J., dissenting) (emphasis in original). It is a fundamental contention of this article that program-related patents present an extremely difficult problem of applying extant policy, a task with which the courts are charged. Moreover, the section 101 inquiry is not terminated when it is established that the subject matter is a machine or an automatic machine process. In reaching its outcome in Benson, regardless of how narrowly the holding is construed, the Supreme Court necessarily held that much.
The objections raised to a legislative resolution of the question have been largely unconvincing. It is true that Congress can be slow to act, but life in the courts will surely go on much as before in the interim. Lobbyists will indeed appear to urge their special interests, but to the extent that lobbying is undesirable, it is because it implies a special access to the decision-making process by parties who do not necessarily represent the general, public interest.

How representative of the public interest have the parties to program patent litigation been? The only party charged with defending the public interest has been the Patent Office, which as an institutional litigant has had many things to think about in addition to the cases already discussed. And, in general, both the patent bar and the commercial amici curiae have vested interests in certain aspects of the patent system that must be scrutinized before deciding this issue.

The most compelling reason for deferring to congressional action on the program-related patent question is that the general patent system may be subjected to revision in the near future. Under these circumstances, legislation on a particular patent question would be premature, since changes in the general law could also alter the complexion of issues peculiar to program-related patents.

In this connection, an additional observation is appropriate. Shortly after the decision in Benson, the following statement regarding program patent legislation was attributed to an aide to Senator John McClellan, chairman of the Senate Subcommittee on Patents, Trademarks and Copyrights: "We probably need some type of special conference to decide what to do. Not a public hearing, but a conference with interested parties. We held a similar conference in the copyright area that went well."557

In fact, the "interested parties" have been speaking for a decade and a half without substantial progress toward an appropriate resolution of the issue. If Congress perceives that the policy stakes are significant, it should actively engage in analysis of the issues by the academic, legal and computer communities, as well as the economics profession.

In conclusion, it appears that the question of program-related patents will be left to the judiciary for the time being. It is therefore hoped that the courts will become more responsive to, as well as demanding, well-reasoned and empirically supported argumentation directed to the policies which already underlie the patent system.
