Chapter 3

# The Accommodation of Intellectual Property Law to Technological Change

# Contents



Table



Figures

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## FINDINGS

- The application of a uniform system of intellectual property principles, such as that embodied in copyright and patent law, to divergent types of information-based products may no longer be possible. Modern technologies are exaggerating dissimilarities between information products that were once protectable under a single system of law, and are, in some cases, giving rise to new products that strain the applicability of old principles of law. Under these new circumstances, information-based products can be grouped into three large categories—works of art, fact, and function, which are subject to different principles of intellectual property protection.
- The assumption of intellectual property law that intellectual property rights-can be determined and remain stable over time is less and less valid. Copyright law, in particular, assumes that the works it protects have a fixed form, and that ownership can be determined by protecting particular expressions of information. Today, however, computer and communication technologies are changing the nature of information-based products in a fundamental way, making them dynamic, interactive, and functional components of processes. The present system of copyright law, which evolved under the model of print publication, may no longer serve to determine the boundaries of ownership in computer-based methods of creation and dissemination.
- Some of these technological impacts may only appear in the long term, when technologies for creating and disseminating information be ***come*** more widely used. Many of the technologies, such as computer networks and digital editing, are still in the developmental stage, and the intellectual property issues they raise are only just emerging.
- Some of the effects of technology on the adequacy of intellectual property law, however, have already begun to undermine its usefulness as a policy tool, In particular, neither copyright nor patent law has successfully accommodated works of function, such as computer programs. Copyright law may provide either too much or too little protection for them, and patent law, while available for *some* novel processes that utilize computer programs, may be unavailable or too cumbersome to protect many types of computer programs.
- Alternatives to Federal intellectual property protection are available, but these too have their drawbacks. State trade secrets law, although widely used for specially designed products, is ineffective in protecting mass-marketed products. Moreover, it may entail foregoing uniform Federal and international protections, and, in some cases, it may be preempted by Federal law.

## INTRODUCTION: THE LAW'S RACE WITH TECHNOLOGY

Ten years after the general revision of the United States copyright law, new technologies for creating and disseminating information have raised a new set of questions about the law's ability to accommodate technological change. This uncertainty comes from many

quarters: the judiciary, the legal community, academia, and the creators whose work the law is designed to protect. Such doubts are not limited to copyright law; they extend to other areas of intellectual property law where information technologies have also left their mark. *

Although most observers agree that technology is changing the way in which intellectual property law operates, many disagree over just how sweeping these technological changes are, and what ought to be done in response to them. Some suggest that the changes are occurring primarily at the margins of intellectual property law, and can be dealt with incrementally by the courts or through specific amendments to the law.[2] Proponents of this view argue that new technological developments are in many ways like "old wine in new wineskins. Some observers believe that, where problems are specific, they can be dealt with in a specific fashion, without the need to completely rethink or revise intellectual property law.[3] The Semiconductor Chip Protection Act is an example of a measured, specific congressional response to such a problem.

Others, however, believe that recent technological changes are revolutionary, and have fundamental implications for intellectual property law. Typical of this perspective is a statement in a recent report by The President's Commission on Industrial Competitiveness:

> Although the application of our intellectual property rules has been adjusted over time in response to changing commercial practice and evolving technologies, the continuing stream of the new scientific advances calls for rethinking the very concepts derived from earlier centuries on which those rules are based. New concepts of what intellectual property is and how it should be protected–beyond patents, trademarks, trade secrets, and copyrights—may well be needed, as well as sweeping changes in intellectual property laws and the ways they are administered and enforced.[4]

Advocates of this position argue that the concepts employed in intellectual property law–" authorship, " "invention," "writing"—and related notions, are increasingly the obsolete products of a bygone age of print.

Participants in this ongoing debate often confuse the issue of whether intellectual property, as presently conceived, *should* survive with the issue of whether it can survive. This chapter does not attempt to evaluate the first of these questions, but considers the viability of the present system in the light of vast technological change. The question of viability can be separated into two distinct issues: enforcement, which is dealt within chapter 4, and the law, which is the subject of this chapter.

[1] See e.g.: *Gottschalk v. Benson*. **409** U.S. **63,73 (1972):**
> If programs are to be patentable, considerable problems are raised which only commit tees of Congress can manage.

[2] "[I]n the main, it seems to me, the Copyright Act is working pretty well. There are some gaps, some parts of it that don't address current needs, but I don't think it is working all that badly right now. " Testimony of David Lange before the Subcommittee on Courts, Civil Liberties, and the Administration of Justice of the Committee on the Judiciary, House of Representatives, 98th Cong., 1st sess. on Copyright and Technological Change, July 20-21, 1983, p. 73.

[3] "Some specifics of copyright law may change–some may have to change–but the basic principles of copyright . . . will, I think, bear retention. " Jon Baumgarten, "Copyright at the Crossroads, " Billboard, Nov. 12, 1983, p. 1.

[4] *Global Competition: The New Reality*, The President's Commission on Industrial Competitiveness, January **1985;** Appendix D, "A Special Report on the Protection of Intellectual Property Rights, " p. 305.

# PART I: SOME BASIC INTELLECTUAL PROPERTY CONCEPTS

## The Nature of Intellectual Property

Intellectual property can be distinguished from other forms of property in that it is a bundle of rights attached to the intangible form of an intellectual, scientific, or artistic creation. While personal property law determines ownership over *things,* intellectual property law secures ownership in the particular form or expression *embodied in things.* A comparison of two types of property rights in the same item illustrates this distinction:

| *Tangible property* | *intellectual property.* |
|---|---|
| • A Brand X television set | • The circuit design for all Brand X television sets |
| • A photograph named "Trees" | • The pictoral work embodied in all copies of the photograph ''Trees |
| • A phonorecord with "Misty" recorded on it | • The musical composition embodied in all phonorecords with "Misty" on them |
| • A copy of the local telephone hook | • The particular arrangemcnt of names in the literary work known as the local telephone book |
| • A bottle of chemical Z | • A method of manufacturing chemical Z |
| • A microbe containing gene Y | • The process of engineering gene Y |

An intellectual property right is the exclusive prerogative to make tangible objects in particular forms. At its simplest, a copyright is the exclusive right to make copies of particular tangible expressions of information, and a patent is the exclusive right to make, use, or sell a particular application of an idea.

## Intellectual Property Boundaries and Policy Objectives

Any property right, whether tangible or intangible, must have *boundaries.* Property is by definition exclusive; what one owns must be distinguished from what is owned by others. Boundaries of tangible property are relatively easy to establish. A property right in a parcel of real estate, for example, refers to a specific, measurable terrain.

However, because ownership in intellectual property attaches to the intangible characteristics of tangible objects, the boundaries of ownership must be established in terms of those intangible characteristics. For example, to extend a property right to the author of a book on auto mechanics, one must specify which features of the book are subject to the property right: the precise wording of the book; the structure of paragraphs; the style of writing; the organization of topics; the information conveyed to a reader; or the practice of auto mechanics as described by the book. The boundaries of intellectual property are ultimately agreed on by convention, and require that policy makers choose *where* and *why* they are established. In theory, copyright in a book on the Civil War could extend to all books on the Civil War, just as patent rights in a particular thermostat design could extend to all devices that performed similar functions.

In the United States, however, policy makers have set far more limited boundaries for copyrights and patents. As stated in the U.S. Constitution, ownership in writings and inventions is bounded by policies that will "promote the progress of science and useful arts."[5] Marking off boundaries in intellectual property is essentially a policy choice which has major implications for innovation. Boundaries that are 'marked too broadly may impair the ability of individuals to create, innovate, or improve upon the works of others. Boundaries that are set too narrowly, or that fail to protect the most socially valuable aspects of writings or inventions, may diminish the incentive to create or innovate. To promote science and useful arts, policy makers must strike an optimal balance between what belongs to a creator and what belongs to the public domain.

For patents, the boundaries of ownership in an invention encompass only the novel features of that invention. Patent ownership is established by the "claims' made in the patent application and accepted by the Patent and Trademark Office, and patent law requires that the claimed invention be distinct from previous inventions, which are known as the "prior art.

In contrast, copyright protection attaches to a work at the moment of its creation, and the law requires only that the work be original-that is, not a copy of another author's work. Copyright law does not require that an author claim some aspect of a writing as his own, or that a writing be distinguished from the prior art. Because copyright does not have a threshold determination of ownership, the boundaries of ownership in a work are, of ne-

[5] "Article 1, Section 8, clause 8 of the Constitution, authorizing the Congress to establish intellectual property, law, reads:

> Congress shall have Power To promote the Progress of Science and useful Art s, by securing for limited Times to A uthors and I nventors the exclusive Right to their respect ive Writings and I)isco\.eries

The term "Science, as it was used by the authors of the Constitution, was derived from the Latin "scientia, meaning knowledge, *or* to know.

cessity, established by limiting ownership rights to the particular manifestation or expression of information. Copyright does not protect abstract ideas, concepts, systems, and themes.

This assessment is concerned exclusively with the effects of technology on proprietary rights in information-based products and services. Since copyright law has been the traditional system of protecting these works, the boundaries most germane to this chapter are those established by copyright. For this reason, copyright law's method of defining boundaries-the "idea/expression dichotomy" —merits a detailed discussion.

## Idea and Expression—The Boundary Between Mine and Yours

The distinction between idea and expression is one of the most fundamental yet elusive concepts in intellectual property law. Ideas, as such, are neither patentable nor copyrightable. To obtain a patent, the inventor must reduce the principles on which an invention is based to a concrete application. The photoelectric effect is not patentable, although the design for a particular photovoltaic cell may be. Similarly, copyright does not protect "[i]deas, abstract conceptions and similar matters, but rather the "manner of treatment, expression, incidents and details . . . "[6] The distinction *is* crucial, since a monopoly on ideas might impair the very goals that intellectual property law seeks to promote. If, for example, the idea of combining music and drama were protected by copyright, Gilbert and Sullivan's plays might well have been the last musicals produced. Instead, we have available a vast and varied range of musical drama.

Despite its importance, the distinction between an idea and an expression is difficult to draw with certainty. Through the years, courts have developed at least two different theories of what the idea/expression dichotomy means. We will refer to these theories as the "clear distinction" test and the "abstractions" test.

### "Clear Distinction" Test

Copyright scholars generally regard the case of Baker v. Selden[7] as the wellspring of modern thought on the doctrine of idea and expression. This case concerned an alleged infringement of *Selden's Condensed Ledger, or Bookkeeping Simplified,* a book that consisted of a series of blank ledger sheets and an introductory essay explaining their use. The unique feature of Selden's ledger was that, "by a peculiar arrangement of columns and headings, [it] presents the entire operation, of a day, a week or a month, on a single page, or on two pages facing each other in an account book. " In his own account book, the defendant in this case accomplished a result very similar to Selden's, using a different arrangement of columns and headings.

The Supreme Court, although agreeing that the plaintiff book might be copyrighted, nevertheless drew "a clear distinction between the book, as such, and the art that it is intended to illustrate. " "[N]o one, " said the court, "would contend that the copyright of the treatise would give the exclusive right to the art or manufacture described therein. " A *copy*right in books on medicine, art, or mathematics gives the author an exclusive right to print and publish those books, but the systems, ideas, or methods described in them "are the common property of the whole world" and any author has the right to express or explain them in his own way. Moreover, since copyright, unlike patent, requires no novelty, the grant of an exclusive right in the art described in a book, "when no examination of its novelty has ever been officially made, would be a surprise and

[6] *Loew's, Inc. v. Columbia Broadcasting System,* 131 F. Supp. 165 (D.C. Cal. 1955); *aff'd 239* F.2d 532; *aff'd 356* U.S. 43, *reh. den. 356* U.S. 934, The idea/expression dichotomy was codified in the 1976 Copyright Act as follows:

> In no case does copyright protection for an original work of authorship extend to any *idea, procedure, process, system, method of operation, concept, principle, or discovery,* regardless of the form in which it is described, explained, illustrated, or embodied in such work.

17 [J.S.C. § 102(b) (emphasis added). None of these terms are defined, and the legislative commentary on the subject says only that section 102(b) "in no way enlarges or contracts the scope of copyright protection. S.Rep. No, 94-473, *supra* at 54; H.R. Rep. No. 94-1476, *supra* at 57.

[7] 101 U.S. 841 (1880).

a fraud upon the public. . . That is the province of letters patent, not of copyright."[8]

### "Abstractions" Test

Courts have interpreted "idea and expression in other ways. The "clear distinction' test distinguished copyright from patent protection, but did not define the scope of copyright protection. If copyright protects only the literal expression adopted by an author, it allows others to escape claims of infringement by changing the original in only trivial or insignificant ways. The courts have avoided this result by treating idea and expression as a continuum of similarity. Thus, in Nichols v. *Universal Pictures Corp.*,' Judge Learned Hand articulated what is now known as the "abstractions test":

> Upon any work . . . a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. . . . [T]here is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his "ideas, " to which, apart from their expression, his property is never extended. Nobody has ever been able to fix that boundary, and nobody ever can . . . As respects plays, the controversy chiefly centers upon the characters and sequence of incident, these being the substance.

The abstractions test differs subtly from the holding of *Baker v. Selden*, and points to a confusion in the meaning of idea/expression. The abstractions test relies on general similarities between works that are largely a matter of *degree*. If, for example, it was alleged that My Fair *Lady* infringed *Pygmalion*, one would look to the degree of similarity of expression in the two stories—the plot, the characters and their roles, and the dialog. The principle articulated in *Baker v. Selden*, however, concerns the kind of protection afforded a writing, drawing a line at the the manner of expression, and extending to neither the underlying concepts or information expressed, nor to the activities or techniques described. These two analyses—the "abstractions' test and the 'clear distinction" test—are often combined into the term "idea/expression, but they are essentially different, Although both limit the boundaries of copyright, each sets that limit in a different way. As we shall see in Part Two of this chapter, neither of these two fundamental copyright principles is particularly applicable to computer processable information.

### Some Related Concepts

A number of closely related, but distinct copyright principles can be derived from the idea/expression dichotomy (see figure 3-I). For example, in order to be copyrighted, a work must be *original*, which simply means that it cannot have the same expression as another work. The boundaries of a given original expression also include the right to build upon it by creating a *derivative work*.[11] A given copyright is infringed when there is *substantial similarity* of expression between the original and another work. The notion of a copyrighted *work* emphasizes that the boundary of a given expression is intangible, and is distinct from the actual physical object–the copy–in which it is embodied. [12] The work is the subject of intellectual property ownership; the copy is ordinarily the private property of the purchaser.

'Id. pp 842-44, The ruling in *Baker* is more subtle than it appears at first glance. The work in question was of an explanatory, functional sort (see discussion below under works of function), Unlike purely artistic or factual works (see discussion below under works of art and works of fact). the accounting book explained a method or procedure, which thus raised the specter of patent-like protection not present in the case of art or fact. For artistic works in particular, *"expression " is not limited to the literal expression of a work. "else* a plagiarist would escape by immaterial variations.'' *Nichols v. Universal Pictures Corp.*, 45 F.2d 119 (2d Cir. 1930).

'45 F.2d 119, 121 (2d Cir. 1930), *cert. denied*, 282 U. S. 902 (1931).

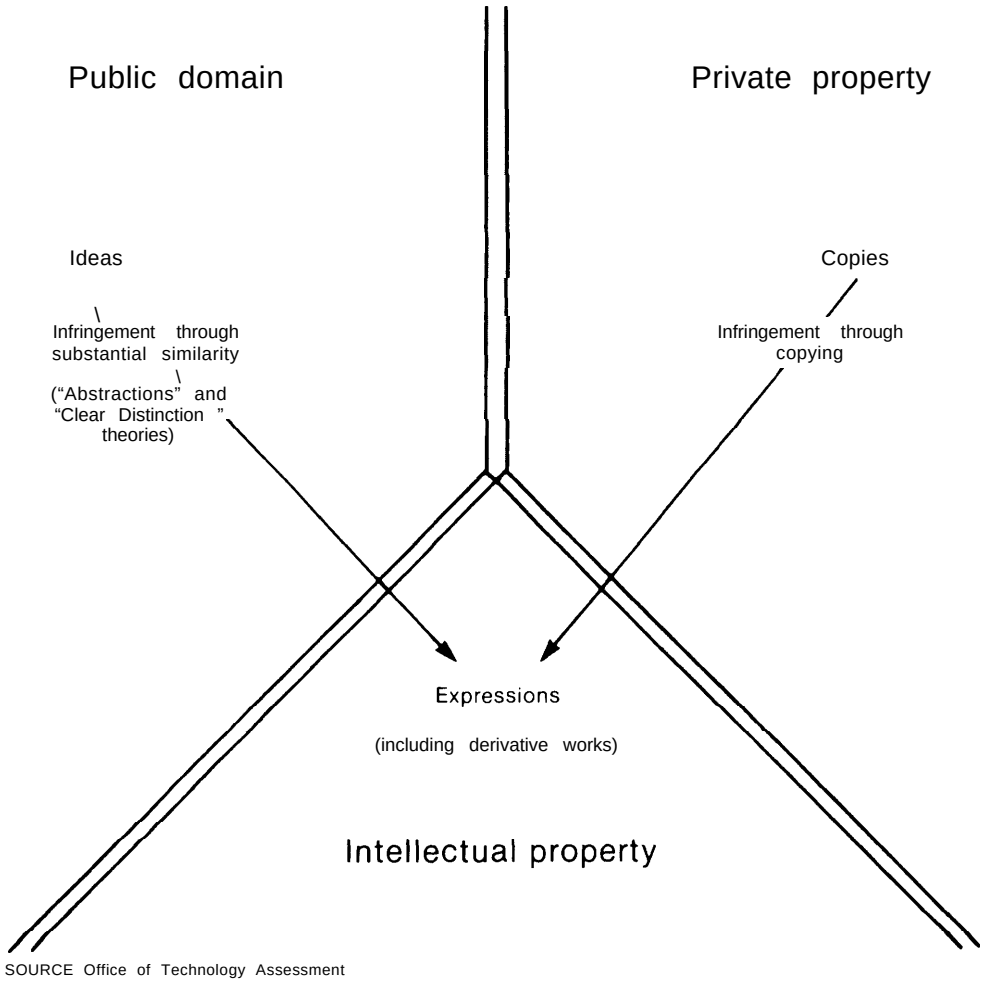
*'However,* an identical, but independently created work, is not an infringement, The "originality necessary to support a copyright merely calls for independent creation, not novelty, 1 *Nimmer on Copyright*, Y2,01 [A](1982). originality)_ is. however. subject to a *de minimus* standard, and works entirely lacking in creativity or substance cannot be copyrighted. Simple phrases, such as ''apply hook to wall, ' for example, may not meet this standard.

'derivative work is defined in section 101 of the act as:

> . . a work based upon one or more preexist ing works, such as a translation, musical arrangement, drama tization, fictionaliza- tion, mot ion picture version, sound recording. art reproduction, abridgment, condensation. or any other form in which a work may be recast, transformed, or adapted.

'Section 202 of the act says that "[ownership of a copyright, or of any of the exclusive rights under a copyright, is distinct from ownership of any material object in which the work is embodied, The material object, or copy, is usually the private property of its purchaser. 17 U.S.C, §109.

**Figure 3-l.— Property Rights in Information**

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# PART II: THE IMPACT OF TECHNOLOGY ON THREE VARIETIES OF INFORMATION-BASED PRODUCTS

The variety of intellectual and artistic works protected by copyright law in the United States has grown steadily since Congress enacted the first copyright statute in 1790.[13] As technology introduced new and unprecedented forms of expression into the commercial, artistic, and scholarly worlds, copyright law has taken each into its protective system of rights. Although the forms of expression, media, and economics of creation, distribution, and use varied widely among new types of works, copyright law absorbed each new type of creation with very little change to its underlying concepts, distinguishing only slightly between the types of works that it protects.

## An Open-Ended Protection Scheme

Copyright protects a vast range of works, many of which bear little similarity to each other. Through the years, copyright has come to protect virtually all artifacts of communication: piggy banks and doctoral theses, tele-

[13] Ch. *15*, §1, 1 Stat. 12

vision programs and restaurant menus, ash trays and news documentaries, bread wrappers and sound effects recordings, artistic photographs and tablecloth designs, road maps and stock market reports, toilet paper designs and movies, computer programs and greeting cards. Prior to the Copyright Act of 1976, a work had to fall under a category of work defined by statute to be copyrightable. Thus, each time technology created a new form of expression—photography, for example—Congress had to amend the copyright law.

The drafters of the Copyright Act of 1976 sought to avoid the need for constant amendment by making the subject matter of copyright open ended and "technology neutral."[14] Instead of listing types of works, the act defines the attributes a work must possess to be protected:

> Copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.[15]

The act, therefore, treats all information-based products and services the same for purposes of copyrightability. By making the criteria of copyrightability nonspecific and purely formal, the act gives the necessary and sufficient conditions of statutory protection applicable to any conceivable work, regardless of the technologies involved in its creation, distribution, or use.

Since a work can be fixed in any tangible medium "now known or later developed, " all works fixed after 1978 are automatically copyrighted, without the earlier requirement that they be published or disseminated;[16] and, with some exceptions, all works are protected under the same basic bundle of rights. "

Given the broad and pliable language of the act, with its emphasis on technological accommodation, the question is how technology can affect its continuing viability. The answer to this lies in the very broadness of the concept of "works of authorship, " and in the legacy of copyright principles carried forward in the 1976 Act. The 1976 Copyright Act assumes that, by making "works of authorship' a comprehensive category, the copyright system could successfully assimilate unforeseeable technologically based works. However, as illustrated below, because it continues to use concepts fashioned over the previous 200 years, the new copyright law is, like its predecessors, encountering some familiar problems now placed in relief by modern technology.

The central problem of copyright law's continued accommodation to new technologies lies in the indiscriminate application of the doctrine of idea and expression to three fundamentally different categories of works: works of art, works of fact, and works of function. Unless the law recognizes the inherent differences among these types of works, technology may make the boundaries of intellectual property ownership difficult or impossible to establish, and less relevant to the policy goals the law seeks to further.

## Three Categories of Works

Although the copyright law adopts a uniform approach to protected works, not all types of information-based products are the same, nor can they be treated as if they were. A list of stock and bond prices, for example, differs from the musical score of a motion picture, and both of these are distinct from a computer program. In the case of stock prices, the value is in the information itself—the number of shares traded and the daily fluctuation in prices. The value of a musical score, in contrast, lies in the

"'Authors are continually finding new ways of expressing themselves, but it is impossible to foresee the forms that these new expressive methods will take. The bill does not intend either to freeze the scope of copyrightable subject matter at the present stage of communication technology or to allow unlimited expansion into areas completely outside the present congressional intent. Section 102 implies neither that that subject matter is unlimited nor that new forms of expression within that general area of subject matter would necessarily be unprotected. H. R. Rep. No. 94-1476.

[15] 17 U.S.C. §102(a),

[16] 17 U.S.C. § 302(a).

'-17 U.S.C. §106. All works are subject to reproduction. derivation, and dissemination rights; some are subject to performance eights: others to display rights.

way it sounds to an audience—the appeal of its melody, rhythm, and harmony. And computer programs are valued for what they do–their effectiveness at performing a given task in a computer.

This analysis has identified three types of copyrightable works: *works of art, works of fact,* and *works of function.* Figure 3-2 shows one way of conceptualizing this trichotomy, and gives examples of the types of information-based products and services that might fall into each category. Although dividing lines between each categories are not absolutely distinct, major differences between the categories do exist. It is these differences that pose problems for the uniform application of copyright principles to all three categories.

### Works of Art and Interactive Technologies

The phrase *works of art,* **as** used in this discussion, denotes works that are created for their own intrinsic value-whether that value is primarily aesthetic, entertaining, or educational in nature. This definition implies no appraisal of qualitative or artistic merit; labels for soup cans and recordings of symphonies are both works of art. Although it is impossible to fix firm boundaries on what constitutes a work of art, this category includes such traditionally copyrightable items as fiction, paintings and other graphic works, sculpture, music, drama, film, and choreography. Other works, such as sculpture used as bases for lamps[19] or film documentaries[20] also fall within this category, but contain factual or functional elements as well.

Traditionally, works of art have been amenable to an analysis of idea and expression under the "abstractions test, " since very often the intrinsic value of the work depends heavily on the particular expression adopted. The intrinsic value of Duchamp's 'Nude Descending a Staircase, for example, lies in the overall style and manner of execution, the use of lines and solids, and the colors chosen. It is these values that copyright protects when protection is limited to the painting's expression.

Furthermore, works of art have always had a fixity and completeness to them. Although their creation involved preliminary steps such as drafting, sketching, and revision, they did not change in appearance or structure, and retained a distinct and perpetual identity. Particular works were distinguishable from one another because the expression was complete and final once the work was fixed. Moreover, the fixation of a work in a tangible copy allowed its preservation over time.

It is this static, individuated, and localizable quality of works of art that allows copyright law to speak in terms of *the* work[21] created by an author or authors[22] belonging to him from *the* moment of creation,[23] subject to the laws of *the* country in which the work was created.[24] As we have seen in chapter 2, printing made copyright both possible and necessary, since it permitted the existence of many identical copies of a work and so shifted the primary economic value in writings from the ownership of a particular manuscript to the ownership of a right to make copies of that manuscript, while it simultaneously created markets for unauthorized copies. The very notion of a particular "expression" as the product of a particular author was to a large degree enabled by the invention of the printing press. Evidence for the proprietary boundaries of a work relied on the existence of a single, unchanging artifact-the book, the painting, the sculpture.

This model of the static work of art may no longer apply to works involving certain new technologies. In particular, digital computing and communication technologies pose both

[18] "Copyright does not concern itself with the qualitative aspects of a work. See: *Bleistein v. Donaldson Lithographic Co., 188* U.S. 239 (1903).

[19] As in the case of *Mazer v. Stein, 347* U.S. 201 (1954), where a statuette used as the base of a lamp, was found copyrightable insofar as its utilitarian aspects could be separated from its aesthetic aspects.

[20] Such as the documentary of the Hindenberg disaster in *Heeling v. Universal City Studios, Inc., 618* F.2d 972 (2nd Cir.), *cert. denied, 449* U.S. 841 (1980),

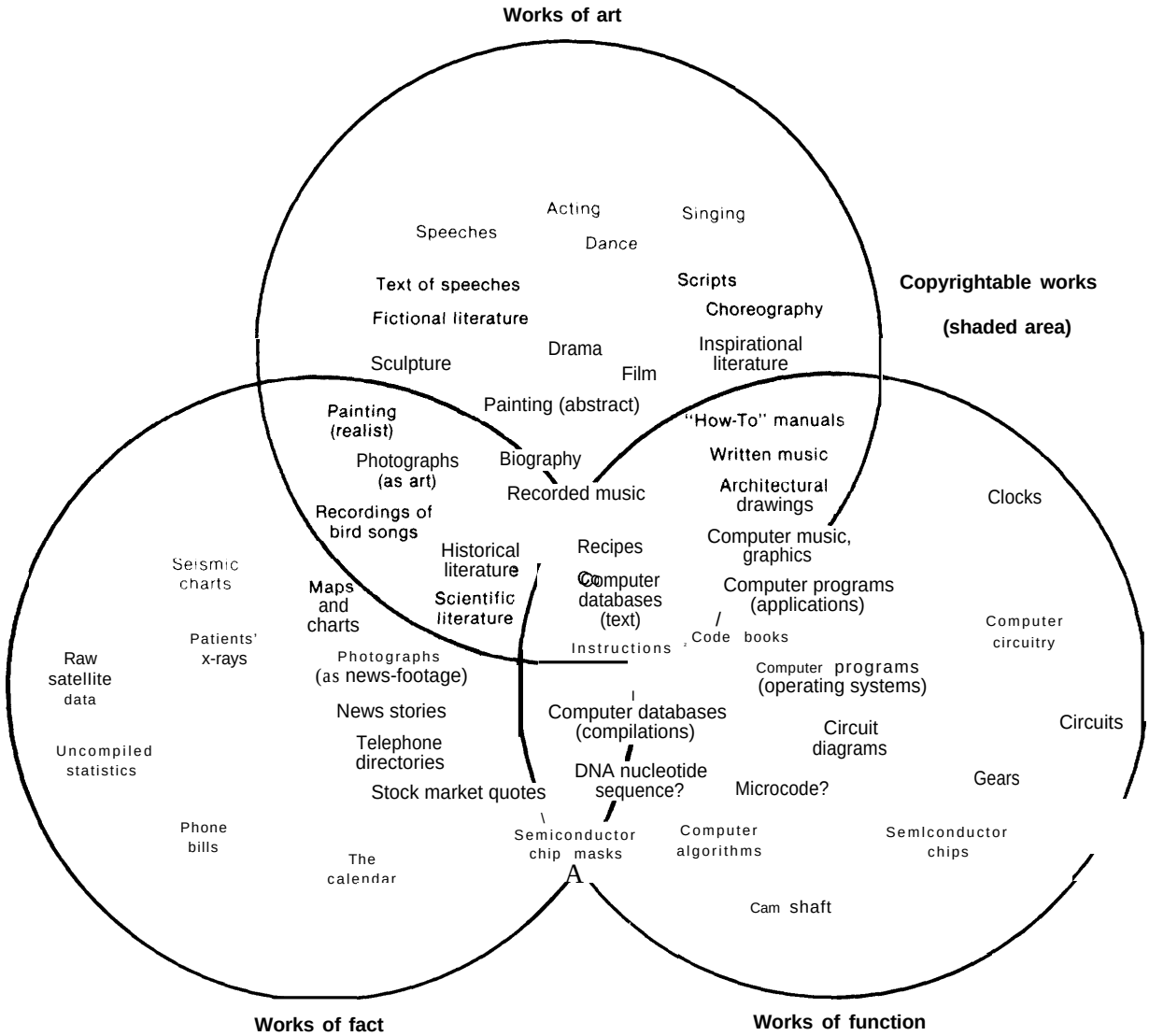
[21] 17 U.S.C. §20.

[22] 17 U.S.C. §20.

[23] 17 U.S.C. §30.

[24] 17 U. S. C., ch. 6, infra.

**Figure 3-2.— Types of Information-Based Products**




SOURCE Office of Technology Assessment

conceptual and legal problems for copyright law in this regard. If print technologies" permitted stasis, electronic technologies permit a new dynamism that makes proprietary boundaries for many works of art indistinct, elusive, and subject to constant change. Although opinions vary widely on the viability and commercial deployment of such things as electronic publishing, on-line conferencing and editing, and interactive computing, these technologies have reasonably clear implications for the principles of ownership:

> In short, the process of computer communication produces multitudinous versions of texts, which are partially authored by people and partly automatic. The receivers may be individuals, or they maybe other machines that never print the words in visible form but use the information to produce something else again. So some of the text that is used exists

"" Print technologies"' is used here in a very broad sense, and would include not only the methods of printing books and magazines, but photographs, records, and motion pictures as well.

> electronically but is never apparent; some is flashed briefly on a screen; and some is printed out in hard copy, What starts out as one text varies and changes by degrees to a new one. Totally new concepts will have to be invented to compensate creative work in this environment. The print-based notion of copyright simply will not work.[26]

Some have suggested that, for art and scholarship, the new technology has created an environment more like that of the Middle Ages than of the post-Gutenberg era, resembling the oral tradition rather than the print culture. The ramifications of such a change can be explored by considering two particular embodiments of information technology as they apply to works of art: computer networks and interactive computing.

Computer Networks. The advent of computer networks may mean the loss of the identifiable boundaries of works on which copyright has relied to distinguish yours' from "mine. In this fluid environment, works of art may lose the singular thing-like quality that made copyright protection possible. The extent of the problem is hard to estimate given our limited understanding of the full impact of electronic networks on the creative environment.

A computer network is a collection of computers, called hosts, that communicate with each other. The host computers may be microcomputers, commonly used in homes and businesses, or they may be larger mini-, mainframe, or supercomputers. With connections between hosts ranging from local area networks to satellite-mediated long-haul networks, data in the form of text, voice, and, in principle, video, can be stored, modified, and exchanged by anyone anywhere on the planet.[27]

Computer networks offer a variety of advantages over centralized computing. They permit *remote processing*, which allows any host in the network to use computer programs stored on another host in the network. Users in such a network can gain remote access to supercomputers to do advanced graphics, chip design (and remote fabrication), or scientific or economic computer simulation. Networks also allow users to access remote databases. Finally, *communications*, such as computer conferencing, allow collaboration among users of the network. [28]

The capacities of computer networks for on-line creation and worldwide collaboration will demand rethinking several key aspects of copyright law.[29] First, concepts dealing with the *creation* of a work will have to take into account several novel features of networks. A network, for example, allows an author to collaborate with others in ways that are different from the past. Collaboration may occur in a very haphazard and informal fashion, and each contributor may be anonymous and his contributions unrecorded. Some may be independent authors, while others may be creating works for hire.[30] Imagine, for example, a network "magazine" in which the readers are also contributors, receiving and perhaps modifying a different version of the text or graphics in the magazine. Under these circumstances, who has a right to claim ownership of a work if it becomes commercially valuable? To which of the multitude of different versions of the work did *this* person contribute? What share of the contribution was his? What rights does this person possess to insure the integrity of his work?

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[26] Ithiel de Sola Pool, *Technologies of Freedom* (Cambridge, MA: Belknap Press, 1983), p. 215.

[27] For a detailed description of computer networks, see: Andrew S. Tannenbaum, *Computer Networks* (Englewood Cliffs, NJ: Prentice-Hall, 1981).

[28] "The experience of the ARPANET, which is being reconfirmed in CSNET and other networks, is that collaboration, often envisioned as the least of the three (applications), is in fact the most important." Peter Denning, "The Science of Computing: Computer Networks," *American Scientist, vol. 73*, 1985, pp. 127-129.

[29] Many of the difficulties alluded to here apply with equal force to works of fact and works of function, discussed below. This analysis of the impact of networks and interactive programs on works of art is therefore cumulative. It is confined to works of art for the sake of clarity.

[30] Some textbooks have already been written (although not published) "on-line." See, for example, C. Mead and L. Conway, *Introduction to VLSI Systems* (Reading, MA: Addison-Wesley, 1980), which was written over the ARPANET.

Although copyright law allows for the possibility of collaborative and anonymous works,[31] the application of copyright law to on-line creation may become forced and arcane. Questions will arise, in this regard, over what "the' copyrightable work is. If, for example, a picture, a musical composition, or a story is being constantly embellished, and separate versions are being culled from an original and reworked over time, issues of ownership and identification of the work become exceedingly intricate. As with on-line computer databases (described below), the perpetual creation and modification of works of art raises questions about when copyright protection begins and ends.[32] The deposit and registration of frequently changing works is likewise complicated.[33]

Networks also pose immense practical difficulties for administering the copyright system. Once in a host computer, a work can be easily and quickly transferred to any other host in the network. Even if the work is confined to one "closed network, [34] it can be entered into other networks by a given host, at which point control over the work is lost. [35] Copyrighted works, such as photographs, that exist in a closed database library, which is itself part of a network, may be downloaded onto one host in the network and transferred to another network, where they may be excerpted or modified by others with access to the network." If such "sharing" occurred in simple exponential fashion at 15 minute intervals, it would take approximately 8 hours to blanket the entire world's population with copies. "

The problems of administering copyright for on-line works also occur internationally, but with an added twist. Under U.S. law, copyright protection of published works hinges upon the nationality of the author or the location of first publication.[38] But satellite data transmissions and submarine optical fiber links may muddle the concept of a work's "national origin, " and international collaborative efforts and the simultaneous existence of numerous versions of a work worldwide will preclude its easy identification with a particular nation. Thus, publication and location many no longer be workable criteria when numerous versions of a work are simultaneously appearing throughout the world .39

Interactive Computing. Interactive computing refers to any creative process in which a preliminary or final version of a work is the result of interactions between a person and a programmed machine. The proportion of the work that is the product of the machine, and the proportion that is the product of a human may vary. In many cases, as with word processing programs, the machine contributes little to the creation of a work; it is ' 'transparent' to the writer's creativity. But with some programs, such as those that summarize (abstract) written articles, the processing done by the computer could constitute "an original work of authorship' if it were done by a human being.[40] Indeed, the machine itself is at once a series of processes, concepts and syn-

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"17 U.S.C. §§§ 101,201, and 101, Joint works require that the authors intend that their contributions be merged inseparably into one work, but collective works are separate and independent elements of the whole (like the individual stories which comprise an anthology). In the case of joint works, the intention of the authors may have to be inferred or constructed by a court.

'17 (J, S.C.§§102,302.

See page 77 of this chapter for a discussion of the application administrative formalities for works of fact,

'Closed networks usually have proprietary access equipment, which permit only those with the right equipment to access the information in the network. LEXIS, the legal database network, and airline reservation systems are examples of closed networks. Solomon, "I ntellectual Property and New Computer-based Media, " OTA contract report, Aug. 1, 1984.

Of course, these activities may be illegal under copyright law, but lacking an "audit trail, " and an awareness of the "leak" on the part of the copyright holder, the possibility of enforcement is practically nonexistent, See ch. 4 on enforcement.

"Questions concerning modification and derivation are perhaps the most perplexing of all. How, for example, can property rights attach to works which are intended to be modifiable components of an interactive process? This question will be dealt with presently under " Interactive Technologies. "

$^{32}2^{32}$ is approximately 4.29 billion.

"In general, a work is protected under (J. S. law if: 1 ) one or more of its authors is a national or domiciliary of the United States or any nation which is a member of a copyright treaty to which the United States is a party, or if 2) the work is first published in the United States or in a country which is party to the Universal Copyright Convention. 17 U.S.C. § 104.

"'Publication is the distribution of copies to the public, 17 U.S.C.§ 101; is transmission of digitized information to thousands of host computers a "distribution of copies?'

4 Originality is the *sina qua non* of copyrightability, but refers only to the fact that a work is not a copy of another.

theses of human intelligence-so mixed that it is difficult, if not impossible, to separate its parts from the whole." Interactive computing takes many forms, and cuts across many disciplines. Some examples of interactive computing are:

- Interactive fiction is a computer-mediated form of storytelling/writing that permits the user of a program to "co-author" a story by making choices about details of the plot as the story unfolds on the computer.
- Computer-aided design (CAD) is a technology that is widely used in science and engineering. Using CAD systems, engineers may design new products, invent new processes, or even create other software programs that are based on interactions between their own experience and expertise with a CAD system. A program called SYNGEN, for example, suggests potentially useful chemical reactions based on chemical reaction-mechanism theory. Using SYNGEN, some completely new reactions are "invented" that may prove important enough to be further developed in the laboratory. 'z
- Interactive computer graphics permits a creator to use another's images as the "grist" for computer-assisted manipulation in the production of further works. Creators using this technology cannot only generate images of nature that have never existed in reality; they can also take images from existing photographs or films, "map" them into a computer memory, and bring them back to life in totally new settings, with new movement and dialog.
- Computer-processed music permits the processing, editing, and resynthesis of sometimes costly preexisting works in the production of new works. Music can be sampled and manipulated in a process known as digital editing, and the notes and even the work itself can be rearranged and manipulated to create entirely new works.

The interactive capability of computers poses unique problems for the category of works of art. The problem is in determining where the programmer's expression ends and where the user's contribution to the final form of the expression begins. This problem stems from the fact that computers often mediate between programmer and user, and intermingle the creative efforts of both. Indeed, the program itself may contribute substantially to a creator's final artwork, and in ways that could be considered an autonomous or creative activity if done by a human being.[43] Because the programmer's, the user's, and even the computer's expressions are intermingled in the process of creation, separating rights in the products of interaction with a program from those in the program itself will become increasingly difficult. Consequently, many interactive computer-based applications may generate entirely new questions of ownership and originality.[44] Figure 3-3, which describes a hypothetical interactive program called "MINSTREL," illustrates the difficulties that can arise in sorting out the contributions of the various parties to interactively produced works.

The problems of interactive computing and machine-generated works were considered by the National Commission on New Technological Uses (hereafter CONTU) in its 1976 Re-

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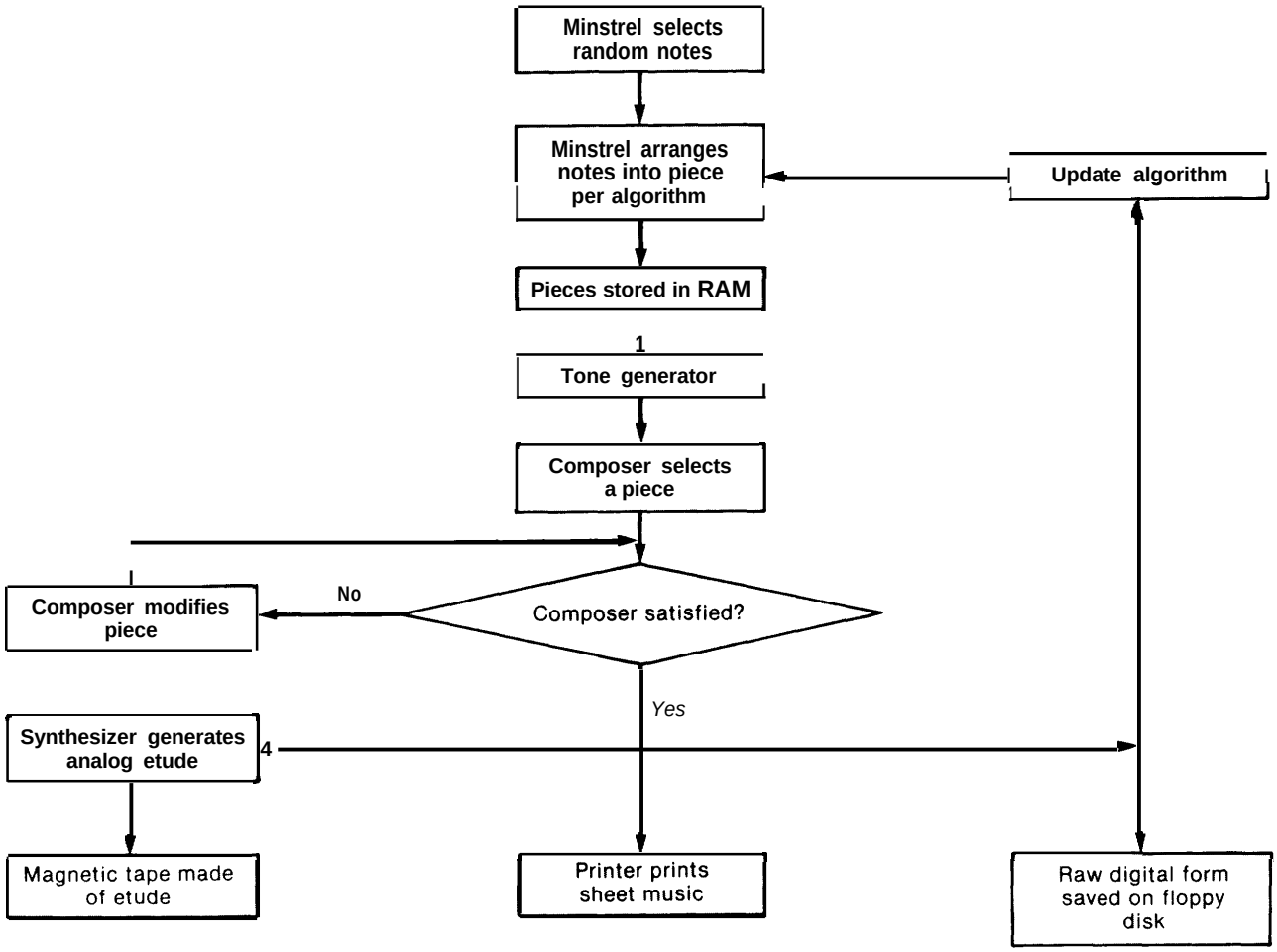
"Richard Solomon, "Intellectual Property and the New Computer-Based Media, OTA contractor report, Aug. 1, 1985, p. 2.

"James Hendrickson, "Synthesizing Chemicals by Computer, " *Technology Review,* April 1984, pp. 24-27: see also R.K. Lindsay, et al., *Applications of Artificial Intelligence for Organic Chemistry: The DENDRAL Project (New* York: McGraw-Hill, 1980). In this example, similar questions might be raised of patent law: who is the "inventor? "-the programmer, the operator, or the machine'?

"Computer programs may modify themselves based on an interaction with the environment, and then alter the environment itself. Programs now exist, for example, that permit a computer to "learn," in some sense, from its environment. A number of rules for producing a given result are compared with an environment; generalizations are formed as a result of the comparison; and these generalizations are then incorporated into the rules of production. See "Learning" in *Proceedings of the National Conference on Artificial Intelligence* (Los Altos, CA: American Association for Artificial Intelligence, 1983), and Sleeman & Brown (cd.), *intelligent Tutoring Systems* (London: Academic Press, 1982), Part IV "Self-Improving Teaching Systems. "

"There are disputes today, for example, over ownership in the output of programs that automatically route signals through gate-arrays, and in code that is compiled by a proprietary compiler program. Conversation with Richard Stern, Nov. 11, 1985.

**Figure 3-3.— Flowchart for the "Minstrel" Program**




SOURCE: Office of Technology Assessment

**Interactive Works: The Case of the "Minstrel" Program**

A Composer uses a software program. named "Minstrel" which was written and developed by a Programmer One of the results of this program, Etudes *for Unaccompanied Computer,* a collection of thematic musical pieces, is the subject of a lawsuit between Programmer and Corn poser

The Programmer had made no license or sale agreements with the Composer for either the use or the purchase of "Minstrel. " He expected to receive no remuneration fort he Composer's use of the program or for the computer time Indeed. the Programmer had given permission to the Composer to use " Minstrel " and the computer simply "to see what It could do "

The software program "Minstrel" randomly selects "notes" from the standard twelve tone scale These notes are represented as variables in the program On the basis of rules embodied in a music composing algorithm developed by the Programmer, these notes are combined into melodies and chords, and processed into pleasing harmonic, rhythmic, and thematic structures A number of pieces are thus created and stored in Random Access Memory (RAM) The Composer then selects one of the pieces on the basis of his own aesthetic tastes and modifies the selected piece to make improvements These modifications are then incorporated into the original "Minstrel" algorithm. This process is reiterated so that the program in effect "learns'" from the composer's judgment

Etudes for *Unaccompanied Computer* was recorded in the following media: 1 ) the final object code (digital) version was downloaded from RAM onto a floppy disk; 2) a final audio (anal`ogue) version was prepared using a commercially available music synthesizer and recorded on magnetic tape; 3) a sheet music version was printed using a special printer designed by the Programmer

When the Composer left the Programmer's laboratory, he took with him the floppy disk, the magnetic tape. and the paper upon which the sheet music to *Etudes* was printed—all of which were his personal property. The Composer licensed the audio recording to the Record Company, and the sheet music to a Publishing House. This raises some questions:

1, Who is the author of the "Minstrel" Program after it has been modified by Composer?
2. Who is the author of '<Etudes?" The Composer? The Programmer? The "Minstrel" program?
3. Does the Composer's use of "Minstrel" infringe the Programmer's right to make derivative works from ''Minstrel?"
4 Is "Etudes" a work derivative of "Minstrel?"

port." The commission found that "there is no reasonable basis for considering that a com-

"CONTU was created by the act of Dec. 31, 1974; Public Law No. 93-53, tit. II; 88 Stat. 1973. See, generally, The Final *Report of the National Commission on New Technological Uses of Copyrighted Works* (Washington, DC: Library of Congress, 1979), The Final Report was issued July 31, 1978.

puter in any way contributes authorship to a work produced through its use. The commission said:

> The computer, like a camera or a typewriter, is an inert instrument, capable of functioning only when activated either directly or indirectly by a human. When so activated it is capable of doing only what it is directed to do in a way that it is directed to perform .... The obvious answer is that the author is one who employs the computer.[46]

It is misleading, however, to think of programs as inert tools of creation, in the sense that cameras, typewriters, or any other tools of creation are inert. Moreover, CONTU's comparison of a computer to other instruments of creation begs the question of whether interactive computing employs the computer as co-creator, rather than as an instrument of creation. It is still an open question whether the programmed computer is unlike other tools of creation. Authorities in the field of artificial intelligence (AI), although disagreeing on AI nature and purpose, do agree that its aim is to produce a pattern of output that would be considered intelligent if it were displayed by a human being.[47] One must ask, therefore, whether machines or interactions with machines might produce a pattern of output that would be considered creative or original if done by a human being. If machines are in any sense co-creators, the rights of programmers and users of programs may not be easily determined within the present copyright system.

If the questions raised by interactive computing are not settled in the legislature, the judicial system will be called on to resolve them. Thus far, there have been few court decisions on the matter of interactive computer programs, and those that exist have been resolved on extremely narrow grounds. Most of the relevant cases have concerned video games, which employ computer programs (usually recorded in Read Only Memory, or ROM) to generate video images and sounds that respond in a limited way to the game player. The case law has, for the most part, been built on litigation involving traditional audiovisual works.[48] In the only case dealing with interactivity, the defendant asserted that, because the player interacted with the game, he was a coauthor of the video work.[49] The court rejected this argument, saying that a substantial proportion of the work was repetitive and not subject to player control. However, as computer programs increasingly permit the user wider choice in structuring input and output, the analogies between interactive computer programs and traditional works will begin to break down. Courts will then be left with little guidance, and even less expertise, to solve these highly complex conceptual and technological issues. But the decisions they render will, in effect, be policy decisions affecting many aspects of the creative environment.

The courts may not have to react immediately to the difficulties of interactive computing. Creation through interactive computing is new, and is still the domain of pioneering artists with access to the necessary computing power and memory .50 However, as interactive techniques become cheaper and more widely available, either the legislature or the courts will have to confront some questions that will be very difficult to resolve under the present system. These include:

- *Does* copyright in a program (for example, an interactive graphics program) entitle the copyright owner to the output of these programs? If so, under what circumstances? If that output was unforeseen by the programmer? When the user inputs the data? When the work is "predominately" the result of the machine program, presuming that authorship in outputs might be measured?

[46] CONTU Final Report, p. 44.

[47] Howard Gardner, *The Mind New Science–A History of the Cognitive Revolution (New* York: Basic Books, 1985), ch. 6. Depending on whom one talks to, AI may have in part already achieved its objectives.

[48] See, e.g., *Midway Manufacturing Co. v. Arctic International, Inc.*, CCH Copyright Law Reporter ¶25,526 (7th Cir. 1983); *Stern Electronics, Inc. v. Kaufman, 669* F.2d 852 (2d Cir. 1982); *Midway Manufacturing Co. v. Omni Video Games, Inc., 668* F.2d 70 (1st Cir. 1981). Courts have held video game programs embedded in ROM copyrightable, and video game manufacturers have often copyrighted the audiovisual portion of the game separately. *Atari, Inc. v. North American Philips Consumer Electronics Corp., 672* F.2d 607 (7th Cir. 1982).

[49] *Williams Electronics, Inc. v. Arctic International, Inc., 685* F.2d 870 {3rd Cir. 1982).

[50] See ch. 5 for a discussion of the impact of interactive computing on the works of artists.

- *Ought* protection of the program to extend to its output? Where, for public policy purposes, ought expression in a program leave off? What are the appropriate boundaries necessary to insure that both programs and their creative interactions are given incentive?
- How are legal distinctions to be applied to this new-creative environment? Does expression include all of the ways in which a program may literally express itself? Does the user's interaction result in the production of a derivative work, and to whom does the derivative work belong?[51] What of originality in works that are predominately automated? Who is the author?

Providing answers to these questions will become more urgent as creative activities continue to fuse with machine intelligence. One effect of computer-mediated works of art on copyright may be the blurring of the distinction between the copyrighted work and its product. It may no longer be possible to ascertain the ownership of a particular expression. Both the creators and users of a program may have some claim to its output. Similarly, the line between the creator and the user of a work of art may be less clear, and distinctions may have to be made between the *creation, use,* and *appropriation* of an expression.

### Works of Fact and Computer Databases

The category *works of fact,* as used here, encompasses any work whose value lies in the accurate representation of reality. As with works of art, works of fact is an amorphous category, and may include biographies and dramatized or fictionalized accounts of events, which are also works of art. Maps, nautical charts, news programs, documentaries, and scientific and scholarly literature are examples of works of fact. Compilations, such as telephone directories, stock market quotations, statistical tables, and bibliographies, may also fall into this category.

Works of fact have long been copyrightable, but copyright protection in works of fact is limited to the way in which facts are expressed. It does not extend to the underlying information or facts expressed. In a map, for example, protection is limited to the details, colors, and symbols chosen by the author, and does not extend to the terrain that is represented by the map. In a statistical table, copyright protects the arrangement and labeling of columns and variables, but not the numbers or statistical values represented. In a news story, copyright protects the wording and the way in which the information is expressed and presented, but does not protect the information about events that are the subject of the news story.

Works of fact have always caused problems for copyright law because, unlike works of art, their economic value is often in the underlying information, rather than in the manner in which that information is expressed. Copyright, therefore, does not necessarily protect the value of a work of fact. This discrepancy will likely be exaggerated by information technologies, because computers can easily manipulate the expression of a work of fact, and communication systems can quickly transfer the work.

The problems with copyright protection for works of fact stem from two otherwise complementary concerns of copyright: the provision of *incentives* to stimulate the production and dissemination of original works, and the policy goal of *sharing information and ideas* and making them widely available.

Works of fact often take much time and effort to produce, and some economic incentive is necessary to encourage their production. Tabulating price data, covering news stories, and drafting maps, for example, require independent research and investigation. If an author knows that a competitor may reproduce his work with impunity at little or no cost, he may have less incentive to create the work in the first place. Recognizing that the ostensibly copyrightable component of such works of fact–the wording, selection, arrangement, and presentation of information—is of little bene-

[51] A derivative work is a work "based upon one or more preexisting works." 17 U.S.C. §§102, 106.

fit to a proprietor whose competitors can easily change the appearance of facts and information, some courts have sought to expand copyright protection well beyond the particular form that the work takes:

> . . . the test is whether the one charged with infringement has made an independent production, or made a substantial and unfair use of the complainant's work.[52]

Despite the judiciary's tendency to expand copyright protection in works of fact to "unfair" appropriation by competitors, copyright in these works is still severely limited: the information or data within the work is not copyrightable.[53] Given the imperative that copyright should "promote broad public availability"[54] of the ideas and information latent in any expression, the protection of information is anathema to copyright philosophy. Early in this century, the Supreme Court recognized the inadequacies of copyright protection for works of fact, and sought to get around them by constructing a "quasi-property right" in news stories to address an underlying wrongdoing.[55]

There is a tension, therefore, in copyright protection for works of fact. The tension is between incentives and the public access to information," and this tension is likely to be heightened by modern information and communication technology. A good example is computer database technology.

Computer Database Technology.–A computer database is a compilation of stored computer-readable information. A database vendor frequently sells both the data and the *means* of accessing, searching, and assembling that data through use of a computer program. Computerized database technology has a number of characteristics that set it apart from traditional methods of compiling information. These characteristics have to do with the way that information is stored, input, searched, and distributed:

- *Storage:* The storage medium may take many forms: punch card, magnetic tape, hard or floppy disk, microelectronic components within the computer, and the laser-read optical disk. Electronic storage media greatly concentrate the amount of information that can be stored in one location. One 5-inch optical disk, for example, is capable of storing over 10,000 pages of printed information.[57] The information may be stored in any fashion: serially, chronologically, or as a hierarchy of information types. The type of information stored may be print, audio, or still or motion audiovideo. Anything that can be represented digitally can be stored and ac-

"Toskvig v. *Bruce Pub. Co.*, 181F.2d 664 (7th Cir. 1950) a case that concerned a compilation, which is a work formed by the collection and assembling of preexisting materials, or data that is selected, coordinated, or arranged in an original way, 17 U.S.C. § 101, and are particularly vulnerable to this problem. See also: *Leon v. Pacific Telephone & Telegraph Co., 91* F.2d 484 (9th Cir.1937), *Triangle Publications v. New England Newspaper Publishing Co.*, 46 F, Supp. 198 (I). Mass. 1942), and *Quinto v. Legal Times of Washington, Inc., 506* F.Supp 554 (D. D.C. 198 1). As one court has said, if "protection (for compilations) is limited solely to the form of expression, the economic incentives underlying the copyright law are largely swept away. *National Business Lists, Inc. v. Dun & Bradstreet, Inc., 552* F. Supp. 99 (N. D, 111. 1982). Parenthesis added.

"'This statement is truer of compilations of data, such as airline schedules or telephone numbers, but also extends to compilations in which the compiled material is itself copyrightable, as in the case of NEXIS, a computerized database of news stories. In the latter, both the format of the compilation and the compiled material is protectable by copyright. However, in no case does copyright extend to the information conveyed by either the compilation or the material compiled.

"*Fox Film Corp. v. Doyal, 286* U.S. 123 (1967).

"*International New Service v. The Associated Press, 248* U.S. 215 (1918), in which the Court said that "the news element— the information respecting current events contained in the literary production—is not the creation of the writer, but is a report of matters that ordinarily are *publici juris*; it is the history of the day. " Id. at 234. This case was based on the Copyright Act of 1909, and was implicitly overruled by the Copyright Act of 1976. The difficulties that the court faced, however, remain. A recent Supreme Court decision, *Harper & Row v. Nation Enterprises, No. 83-1632,* May 20, 1985, *also* dealt with the appropriation of a work of fact, but since the defendant copied some of the plaintiff's work verbatim, the court did not have to reach the issue of idea and expression.

"'The tension is most acute in the case of factual compilations which document information compiled by the government, or information that is already in the public domain, since proprietary rights in the information would have the public pay twice for the same data. see, e.g., *Dow Jones & Co., Inc. v. Board of Trade, 546* F. Supp. 113 (S. D.N. Y 1982).

' 'The optical disk, which is presently in use in some computer systems and in home stereo systems, is also capable of storing, in digital form, roughly two hours of music or audiovisual material, or thousands of still pictures, The Library of Congress' current project utilizes all of these capabilities. At present, commercially available optical disks are strictly for playback, but "write/erase' versions will be available shortly.

cessed by computer.[58] The types of works stored on present-day databases include full text literary and legal works, bibliographic information, scientific, financial, legal, criminal, demographic, and defense information. However, since a computer is indifferent to the nature of the information stored, computer programs are also accessible as "data' on a database.[59]

- *Input:* Information may be *input* into a database in a number of ways: it may be typed in by a person at a computer terminal; it may be fed in automatically from a sensing device, such as a heat sensor or a pressure gauge; it may be read in from a typed or written document by an optical character reader; systems are coming into use that accept input from the human voice.
- *Search:* Information is accessed in a database by the use of a computer program, through which users can instruct the computer to search for keywords or categories (fields) of information such as article titles or authors' names. Artificial-intelligence-based programs are becoming available that allow searches in natural languages, such as English, based on the syntax or semantics of a query. Telecommunications links allow users to search for information stored in computers in many different locations throughout the world.
- *Distribution:* Once accessed, the information is typically fed to a user's terminal and may be copied on a local storage device, such as a magnetic disk. This information may be processed in the user's computer such that it may no longer resemble the "original' information. And it may, in turn, be searched by, distributed to, and processed *in* other *computers.*

These unique characteristics of computer database technology may severely curtail the usefulness of copyright protection for works of fact that are distributed on-line, since copyright protection extends to only the work's expression. This expression may be easily and systematically changed by a person with access to the database and the ability to 'download' and copy information from it with all evidence of copying erased.'" Once the information is modified, the user may no longer be liable for infringement, since the information, as such, is not protected. The downloading and the subsequent rearrangement of the information may be entirely legal, especially if the downloading onto disk is permitted under contract. Since information that is *rearranged* and copied by hand may be legally appropriated,[61] the same rearrangement might easily be done by the computer in real time as it is being received.[62]

Even if copying onto disk were illegal and did infringe the owner's reproduction, publication, or display rights, the copyright owner could not possibly monitor and enforce all such uses.[63] Given the relatively low cost of down-

'Information theory implies that anything seen, heard, smelled, or felt can be represented, encoded, and replicated by a series of 0s and 1s, although putting theory into practice has required over 40 years and billions of dollars. Solomon, op. cit.. p. 14. Even smells maybe represented digitally. "Robot Noses, " *Business Week,* May 13, 1985, **p.** 57.

'Indeed, the definition of "database' can get quite confusing. For example, a current trend in the design of computer chip manufacturing for very large scale integration (VLSI) is through the use of a "design' database that, when guided by various algorithms, can integrate database components in the design of a chip. Thus, to say that databases store information is to simplify the dynamic uses to which this information may automatically be applied.

[60]A computer must, in some fashion, download the information in order to use it. The downloading may not be into permanent disk storage, but memories within the computer all possess some degree of permanence. Indeed, the information must be stored in some way in order for a user to access it. Information that is accessible for only transient durations is very often of little use, since the information must in some way be surveyed, compared, and selected. At least one industry representative cautions that: "(copyright is) a rock-bottom starting point. . . If nothing else, the copyright enables the negotiation of contracts providing for anticipated, and remunerated downloading. " Letter from David Peyton to OTA, Information Industry Association, Aug. 8, 1985. Copyright, in this view, may be necessary, but not sufficient for the protection of databases.

"The status of hand copying under copyright law is uncertain. See Chapter 7: New Technologies and the Intellectual Property Bargain. For works of fact, such as demographic tables or phone listings, the *rearrangement* of the information is not an infringement—otherwise, copyright would step beyond *expression* and protect *information.*

'It might be argued that, in order to transform the *information,* the computer must first *copy* into RAM before proceeding with the transformation. This is a strained application of law, since the copy in RAM may be too ephemeral to constitute a' 'fixation, or it may be an "essential step' under section 117 to an otherwise legal procedure.

' 'See ch. 4 on enforcement.

loading, and the continuing expansion of computer storage capabilities, a user might easily compete with his provider, and secure copyright in his "new" database. Although many database services prohibit such activities by contract, these contracts, as a practical matter, may be unenforceable. The copyright holder may find it extremely cumbersome, if not impossible, to detect and prove infringement, unless the contract itself provides for monitoring.

Beyond these questions about the scope of copyright in works of fact, computer databases also raise a number of separate, but related policy questions. The first is whether databases generated by computers, such as Landsat Earth resources data, can and should receive copyright protection. A second is whether copyright should extend to all contributors to a database. Finally, there is the question of how to best administer copyright in works on a computer database.

The question of computer authorship has to do with a legal requirement that the item to be copyrighted be an 'original work of authorship. "[64] Although "originality' requires only that the work not be a copy of another work, questions still exist over whether information that is automatically written or compiled by a computer is a "work of authorship' within the meaning of the law." As discussed at the beginning of this section, in the absence of the creative activity normally associated with writing a novel or composing a song, copyright in works of fact often serves to protect the labor or diligence of a researcher or compiler of facts. However, machines are increasingly replacing human labor involving the recognition, organization, and compilation of facts and information. Electronic compilers and assemblers, for example, have taken over the process of compiling computer code from high-level languages to machine-readable form. Work is also under way on natural language processing systems, which may enable computer systems to "understand' documents within a database, and then produce written abstracts of the document in response to queries from a database user. Similar research is being conducted on machine-generated translations of documents from one language to another." When the element of human labor involved in the processing of information is replaced by automation, the incentive of copyright protection may become entirely disconnected from the authorship that it seeks to inspire. Information that is automatically generated by a computer is "authored, if at all, by a program that is indifferent to legal incentives."

If copyright is to be granted to machine-produced works, it would signal a new role for copyright, and a departure from its traditional role as an incentive for authors. This raises the issue of whether copyright, in addition to providing incentives for authorship, skill, or diligence, should also serve as a method of protecting a return on capital investment in an information-conversion business. In the information age, copyright may increasingly be called upon to serve as an economic regulatory device that establishes proprietary rights in the products of automated processes. Accompanying such sweeping policy changes would be changes in the law. Congress would have to consider whether computer input, processing, and output are legally sufficient to constitute an original work of authorship.

Works of fact stored in computer databases also pose the question of who should receive copyright protection for the individual contributions to the database. Many databases consist of thousands of short records or entries on a particular subject, which are typically produced by many contributors. Very often, none of these contributors can copyright their

[64] 17 U.S.C. § 102(a).

[65] For example, oil production, electricity usage, or credit information may be automatically measured and compiled as transactions occur. Even in cases of full text databases, the element of authorship may consist of little more than entering information at a keyboard, or using an optical character reader to scan the material and enter it into the computer.

[66] U.S. Congress, Office of Technology Assessment, *Information Technology R&D: Critical Trends* and Issues, OTA-CIT-268 (Washington, DC: U.S. Government Printing Office, February 1985).

[67] The issue of whether the author of a program can claim copyright in the output of the program is discussed in the previous section on works of art.

contributions, because the individual contributions are often "de minimus" –that is, so lacking in quantity or originality as to make them uncopyrightable, or containing expression that admits of so little variation as to merge with the idea. An individual bibliographic citation, for example, typically contains the name of an author, the name of a book or article, the time and place of publication, and other facts. This citation is probably not copyrightable, since the author of the citation contributed insufficient original expression to constitute authorship or originality. The database itself, however, is a copyrightable compilation or collective work,[68] and the proprietor or the database owner would own the copyright. Yet, the database owner might not be the one who exercised the skill, industry, and diligence that copyright in works of fact is meant to protect. Instead, countless field agents or government employees perform the labor of researching and assembling the information, and they do not receive copyright. As with machine-produced works, the incentive of copyright in databases is disconnected from the authorship it seeks to promote." Copyright in many computer databases may increasingly play a role as security for investments, rather than simply providing an incentive for authorship.

Finally, there is a question of how copyright in computer databases that are continuously modified should be administered. Copyright law requires that the copyright owner comply with a number of administrative formalities. In general, the copyright owner must deposit two copies of any published work bearing notice of copyright protection in the Copyright Office within 3 months of publication.[70] The copyright deposit is required in order to acquire copies "for the use and disposition of the Library of Congress."[71] Indeed, much of the Library of Congress' collection is a product of many years of copyright deposits.

Databases, like any other work, may be deposited for the Library's use and disposition. 'Many databases, however, are "dynamic"-they-are constantly updated, expanded, and modified, so that the "work' is never in a fixed or final form. Dynamic databases, therefore, raise a question of whether and how copies are to be deposited with the Copyright Office, and whether the objectives of the deposit requirements can be met.

To get around the difficulties of depositing dynamic databases, industry representatives from the American Association of Publishers and the Information Industry Association have proposed "group registration" and the deposit of "identifying materials' of dynamic databases, which would represent portions or samples of the copyrighted database.[72] Although the industry proposal may prove workable for administrative purposes, questions remain *over* whether the objectives of the deposit requirement will be met. If, in the future, more and more information is stored in computer databases, and is subject to perpetual modification, policy makers may need to reexamine the rationale for deposit in light of the needs of the Library of Congress and the burdens on copyright owners.

[68] 17 U.S.C.§§ 103, 101.

[69] "This issue was central to a controversy surrounding the or-dine Computer Library Center's (OCLC's) bibliographic database. The contributors to the OCLC database are member libraries, some of whom objected to what they saw as an undeserved windfall for the OCLC database proprietor. In a letter from one of the member libraries to the Copyright Office, a question was asked "whether it is legally or morally legitimate to copyright a database comprising records where both the intellectual content, the physical record creation, and the input of a great bulk of the records are funded with taxpayer's dollars. *Copyright Notices,* vol. *32,* May 1984.

[70] 17 U.S.C.§407. Failure to deposit these copies may result in a fine of the copyright owner. The Register of Copyrights may exempt categories of materials from deposit requirements, or modify deposit requirements. Only the first and last 25 pages of "identifying material' of computer programs, for example, need be deposited. **37 CFR** §202.20.

[71] **17** U.S.C.§407, Notes of the Committee on the Judiciary, H.R. No. 94-1476. The fundamental criteria governing exceptions to the deposit requirements are the needs and wants of the Library, balanced against the hardship of deposit on the copyright owner.

[72] 50 *Federal Register, 24240* (June 10, 1985). While such a solution is perhaps plausible for databases which rely on a more or less constant and overarching "selection and arrangement' of information (see discussion below), it is less plausible for works of art. The protectable expression in many works of fact is often the format or arrangement of data—the formal "receptacle" into which new content can be added. In works of art, however, the protectable expression is the content itself–the way the picture looks or the way that the story reads. When the protectable expression is itself in flux and exists in many different versions in many different places, it may not do to register the creation in the categorical way envisioned the proposals of the AAP and the 11A,

## Works of Function and Computer Programs

The category "works of function, " as used in this discussion, denotes those works that use information to describe or implement a process, procedure or algorithm.[73] They may be physical objects which embody procedural information, such as cams or cogs in a machine, thermostatic controls, or punch cards for a loom. In general, physically embodied works of function *implement* a procedure, process, or algorithm directly by being incorporated into the intrinsic design of the mechanism.[74] However, not all works of function are physical embodiments of information. They maybe written works, such as recipes or instruction manuals, which merely *describe* a procedure or algorithm that must be implemented by a human being.

Modern technology has created a new class of functional works. They are hybrids of those works of function that physically implement processes and those that describe processes. Computer programs are hybrid functional works insofar as they employ words and symbols to implement and control a process. Although understandable by humans, computer programs also initiate and control processes or procedures by operating electronic switches in a computer. These switches may, in turn, control other machines or devices.[75]

Important differences exist between works of function and works of art and fact. Unlike works of art, works of function are seldom valued for their intrinsic or aesthetic qualities. A recipe, for example, is useless without the necessary ingredients and utensils. Similarly, a step-by-step instruction manual for a nonexistent machine, or a computer program without a computer has no value. Works of function also differ from works of fact. The value of a work of fact lies in its accurate representation of reality-maps and news stories, for example, are reports about *what is.* Works of function, in contrast, are descriptions of *what can be* if a given procedure is followed.

Although copyright protection is available for works of function, it is subject to a very important limitation: Copyright does not protect the functional aspect of functional works.[76] Copyright in a recipe, for example, does not grant the copyright holder rights in the procedure described in the recipe. Others are free to bake the cake, and infringe no copyright in doing so. The functional aspects of a recipe are separated from its descriptive aspects, which alone are protectable.

For computer programs, the difficulty is protecting their descriptive aspect—the symbols used in the program-without at the same time protecting their functional aspect–what the symbols do in a computer. Because programs possess both a symbolic and functional nature, copyright may either protect too little if the copyrightable expression is limited to the literal program code, or too much if the copyrightable expression extends beyond the program code.

Computer Programs.[77] On the basis of the recommendations of the CONTU Commission, and without legislative debate, Congress determined that computer programs could be copyrighted as "literary works" under Section

[73] The *Dictionary of New Information Technology (New* York: Vintage Books, 1982) defines an *algorithm* as "a procedure, or rule, for the solution of a problem in a finite number of steps.

"For example, a cam in a machine is a physical embodiment of the logical operation: "if there is a 3600 turn, push rod X. It implements this procedure directly when the camshaft is turned 360 . Similarly, a thermostat physically embodies the logical operation "if the temperature rises above 70°, turn off switch Z." [n each case, the design of the object embodies information to a surrounding physical system.

[75] Recombinant DNA may also be thought of as a hybrid functional work; encoded genetic information can be used to control the production of proteins in a living, physical organism. This section focuses principally on computer programs as functional works, and considers recombinant DNA only briefly, and by way of contrast with computer software. One reason for this is that, while both are arguably works of function, they raise separate social, economic, and ethical issues which are beyond the scope of this report.

[76] This is the law under *Baker v. Seldon,* which was discussed above.

[77] The words "program" and "software" are often used interchangeably, but software has, in recent years, broadened to include the supporting materials which accompany the sale of computer programs, and even the the content of technologically based communications (e.g., prerecorded videocassettes are often referred to as software). This chapter adopts the terminology of the Copyright Act, and speaks in terms of computer *programs,* which are sets of "statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result. " 17 U.S.C. § 101.

102 of the 1976 Copyright Act. [78] Although the issue of whether computer programs could or should be either copyrighted or patented was the subject of considerable legal controversy, it is now dormant.

In the nearly 10 years since CONTU's recommendations, the types of litigation over computer software have evolved through what one lawyer has called 'two generations."[79] The first generation concerned the issue of *whether* computer soft ware is or should be protectable by copyright. Except for certain details, the courts have resolved these questions in favor of copyright protection for programs.

The second generation of computer program litigation, still in progress, concerns *what kind* and *how much* protection will be afforded. The questions emerging during this generation point to strains within the conceptual fabric of copyright, which have existed ever since its inception. This chapter will focus on the issues likely to arise in this second generation litigation.

The 1980 amendment to Section 101 of the Copyright Act defines a computer program as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."[80] The courts have interpreted this definition in a very comprehensive fashion:

> Any Medium: The set of statements or instructions can be embedded in any medium, from paper to magnetic tape to disks to Read-Only Memory (ROM) silicon chips.[81]
>
> Any Form: The program may be "source code, i.e., the form in which a programmer writes the program in a particular language (such as BASIC or PASCAL or FORTRAN); or "object code, " which is the source code translated into a form directly processed by the computer. " Any program, whether used to govern the internal operations of a computer or used to interact with the user, may be considered copyrightable.[83]
>
> Any Computer: The term "computer" is quite broad, encompassing everything from fast, specially designed Cray supercomputers, which may be constructed out of thousands of integrated circuits, to a single microprocessor chip.

Computers are commonly described in terms of hardware, which is the physical machine components, and software, the term for computer programs. In modern computer design, however, hardware and software functions are largely interchangeable. The allocation of func-

"1980 Computer Software Copyright Act; Dec. 12, 1980; Public Law No, 96-517, § 10; 94 Stat. 3028. The amendment affected only §§101 and 117 of the code, which, respectively, concerned the definition of "computer program and "Limitations on Exclusive Rights.

'Jon Baumgarten, "('copyright and Computer Software: Databases and Chip Technology, " an unpublished bibliography, 1985.

"'Title 17 § 101, as amended Public Law 96-517, §10(a), Dec. 12, 1980, 94 Stat, 3028. Note that "computer software' is used differently than "computer program" here and elsewhere in the literature; the former includes such ancillary material as written instruction manuals, books, and supporting documentation.

"See *Apple Computer Inc.}, Franklin Computer Corp., 714* F.2d 1240 (3d Cir.1983), cert. dismissed per stipulation, 104 S. Ct. 690; and *Apple Computer, Inc. v. Formula International, Inc., 724* F.2d 521 (9th Cir.1984). By implication, copyright would also extend to programs in Programmable-ROMs (PROMS) and Erasable-Programmable ROMs (E; PROMS).

"'This '(breakdown" is usually accomplished automatically! by the computer through the use of an "interpreter," "compiler, or ''assembler' (which is itself a program). Any computer program in a given language may be used as the source code for an object code in another language. ''1 High level'' languages, such as ''1.1 SP, in their machine code form, may serve as the object code for a source code written in another language, such as FORTRAN. The FORTRAN" program can in turn function in the presence of a "PL 1" interpreter as the source code for source code written in the language PI. 1. In this fashion, programs may be layered upon programs. Object code and source code are merely relational terms, designating which language the programmer may be working in, and which language the machine operates in, Indeed, the so-called *hardware* in a given machine may itself be configured in LISP (or any other) ''*software* language; the hardware software distinction is not absolutely distinct.

"''Microcode," also know as ''firmware, is the most primitive level of programming, and embodies the sequence of paths that a given electrical signal is to follow between the arithmetic and logic units of the computer. Its function is to replace a "hard-wired control system that '' mediate[s] the transfer of information between the central processor, the main memory units, and the various input and output devices. David Patterson, " Microprogramming, *Scientific American,* vol.248, March 1983, p. 50. The copyrightability of microcode remains unestablished, but it seems in principle no less "a set of statements or instructions' than any other form of program, although it is not usually changed, or even seen, once it is embedded in a microprocessor. Microcode has been held patentable, *in re Bradley,* 600 F.2d 807 (C. C.P.A.1979), *aff'd,* by an equally divided court, *sub nom. Diamond v. Diehr,* 450 U.S. 381 ( 19811, and a case is pending on the issue of its copy. rightability, *NEC v. Intel,* Civ. Action No. 84-20799, A motion for summary judgment in the N EC case has been denied, and is scheduled for trial in April 1986.

tions between them is the result of design decisions that balance such factors as the speed, cost, and flexibility required in the final product. The symbols in any computer program, therefore, are ultimately substitutes for hard wiring. This interchangeability between software (symbols) and hardware (circuitry) make programs a paradoxical sort of "writing, since they are symbols expressed as components of machines.

Like other copyrightable works, programs symbolize information to human beings, and can be read and understood by programmers. The CONTU Report stressed that programs, like other copyrightable works, communicate to those who can read them.[84] Because computer programs are symbolic, they appear to be at least as eligible for copyright as sound recordings, which require a record player to be understood by human beings.[85] But, computer programs unlike previous "literary works, are both writings in the traditional sense and tools for accomplishing particular results. All traditional forms of writings are inert and purely representational. Books, movies, musical compositions, paintings, or statuary do nothing that a user does not do with them. They simply convey information or entertain a reader, viewer, or listener. But, as one expert in artificial intelligence says:

> [t]here is a qualitative difference between the computer as a medium of expression and clay or paper. Like the genetic apparatus of a living cell, the computer can read, write and follow its own markings to levels of self-interpretation whose intellectual limits are still not understood.[86]

Computer programs also differ not only from works of art and fact, but also from traditional works of function such as cams, thermostats, instruction manuals, code books, or recipes. These traditional works either describe a process to a person, who then intervenes to lend the words or phrases their utility, or they implement a process without describing it. Computer programs, as hybrid functional works, describe and implement processes. They cause physical changes to occur in a machine, and can interact with other programs or with an environment. A recipe encoded in a program language cannot only tell a programmer how to bake a cake, it can "tell' the computer, too. With the appropriate robotic apparatus, the recipe can *cause* the cake to be baked.

The hybrid character of computer programs raises some very difficult problems for the law of copyright, and has prompted commentators to point to inconsistencies in copyright protection for programs:

> No one would ever advise you that the copyright on a schematic diagram of a diode matrix would extend to the diode matrix, yet that is exactly what is being done by extending copyright on 1s and 0s to a diode matrix which it represents. Thus the same diode matrix could be covered by copyright on one form of work and not the other. This is obviously wrong. [87]

These inconsistencies grow out of the basic copyright distinction between unprotectable ideas and protectable expressions, and they are symptoms of a very fundamental problem with copyright protection for computer programs. The problem is whether copyright protection can be limited to the "expression" of a computer program, without also protecting the "idea, procedure, process, system, method of operation, concept, principle, or discovery. '[88] Although both CONTU and Congress made

[84] *CONTU Final Report,* p. 21.

[85] To accommodate the way in which technology mediates information between human beings, a provision in the Copyright Act says that all original works of authorship are copyrightable so long as they can be perceived, reproduced, or communicated, "either directly or indirectly with the aid of a machine or device. " 17 U.S.C. §102(a),

[86] Alan Kay, "Computer Software, " *Scientific American* vol. 251 September 1984, p. 53.

[87] Letter to OTA from Manny D. Pokotilow, Esq., Cesar, Rivise, Bernstein & Cohen, Ltd., Philadelphia, PA, Aug. 5, 1985. See also: Richard Stem, "The Case of the Purloined Object Code: Can It Be Solved?" *BYTE,* September 1982; and Pam Samuelson, "CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form, " 1984 *Duke Law Journal,* 663 (1984).

[88] The quoted language is from 17 U.S.C. §102(b). The "idea/expression dichotomy codified therein is a broader formulation than "ideas," per se. It comprehends the distinction made in Baker v. *Selden* between the expression and the "art expressed, rather than just the abstract manner of presentation.

clear that "the expression adopted by the programmer is the copyrightable element in a computer program, and that the actual processes or methods embodied in the program are not within the scope of the copyright law,"[89] the question still remains. What is the expression in a computer program?

Part of the problem is that the scope of the expression of a computer program can vary widely, depending on how the word *expression* is interpreted. As figure 3-4 illustrates, computer programs can be described in many ways, ranging from those descriptions that focus on the precise code used to those that generally describe the procedure or algorithm to be implemented by the program. The boundaries of copyright protection in programs will depend on what is considered an expression and what is considered an idea.%' Opinions vary on where the protectable expression should stop and where unprotectable ideas begin, One author believes that 'the expression in the software *does not consist of the exact written source code,* but the specific logic and design of the program."[91] others take an opposing view, and argue that copyright protection in a computer program, "is *limited to the literal code* and does not extend to the structure or other nonliteral elements of the computer program."[92]

Regardless of how legal scholars resolve the issue of idea and expression, the Federal courts, in interpreting copyright law, will eventually face a dilemma; either: 1) the copyrightable expression in a computer program will be limited to the strict line-by-line program code, in which case the unscrupulous might easily escape liability for infringement by simply varying the code in a trivial way, or 2) the copyrightable expression will be extended to the logic, design, structure, performance or even the output of the computer program, in which case one has copyrighted a "procedure, process, system, or method of operation, " The cases that have been decided thus far indicate that the courts are adopting the latter alternative, and have extended the meaning of expression in computer programs to include the processes that the programs implement. One opinion, for example, suggests that a program that achieves results similar to other programs, or even to other works of function—such as a commodities trading manual— will constitute an appropriation of a copyrighted expression. " The court in this case emphasized a similarity in "overall structure' between one work and the other. In another case, a court found that 44 out of 186,000 lines of code constituted substantial similarity of expression.[94] Yet another court ruled that "the protectable expression in a computer program is the manner in which the program operates, controls, and regulates the computer in receiving, assembling, calculating, retaining, correlating, and producing useful information either on a screen, print-out, or by audio communication."[95]

In theory, none of these rulings is permitted under traditional copyright principles. This is not because the courts have misinterpreted copyright law, but because copyright law cannot be successfully applied to computer programs. Unlike artistic or factual works, which

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"{ Rep. No. 94-473 , 94th Cong., 1st sess.1975, p. 54; and H R Rep No 94-1476, 94th Cong., 2d sess.1976, p. 57 (emphasis added). I n keeping with this notion, the circuit court in *Apple Computer, Inc. v Franklin Computer Corp.,* 714 F.2d 1240 (3d Cir. 1983), said t hat "Apple does not seek to copyright the met hod which instructs the computer to perform its operating functions hut only t he instructions themselves."

'See ['art I of t his chapter for a discussion of idea and expression as t he determinant of the boundaries of intellectual property ownership.

Duncan I Davidson, " ['protecting Computer Software: A Comprehensive Analysis," *Jurimetrics Journal,* summer 1983. p 367

'I Defendant's Memorandum in Support of Their Motion for New Trial and or to Alter Judgment, *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.,* Civil Action No. 83-4583 (E. D. Pa 1 985), p. 8; reported in 225 (1, S. P.Q.156 (E.D. Pa. 1985).

*Williams v. Arndt,* F. Supp. (D Mass., 1985), No. 83-3397. In this case, the plaintiff's work was a step-by-step method for trading in various commodities. The defendant, without authorization, translated the plaintiff work into a computer program that achieved similar results, and was found guilty of infringement.

*SAS Institute v.* S&H *Computer Systems, Inc.,* F. Supp. (M.D. Term. 1985), No. 82-3669. The court in this case also had before it evidence of actual copying by the defendant s–a fact which made the conclusion of infringement easier to draw.

*'Whelan Associates, Inc. v. Jaslow Dental Laboratory)', Inc.,* 225 USPQ 156 (E.D. Pa. 1985), hut see: *Q-Co. Industries. inc. v. Hoffman,* F. Supp. , No. 85 Civ. 4653 RWS (S. D. N.)'. 1985)

**Figure 3-4.—Computer Programs - "What Is Protected?"**

Each of items (a) through (g) represents a different, but equivalent expression of a procedure for computing an average. Each of these expressions could act as a program for computing an average, depending on the sophistication of the computer operating system handling the information.

If copyright protection in one of these expressions is broadened to include any or all of the equivalent expressions, then copyright protection has been extended to ideas or processes, and assumed patent-like status without stringent patent requirements (such as novelty and nonobviousness).

If copyright protection in one of these expressions is limited only to that expression, then copyright protection is almost useless, because it allows others to escape infringement by insignificant variation of the expression.

The scope of patent protection in programs is also hard to ascertain. The distinction between mathematical formulae, algorithms, and computer programs, is not clear. In theory, one cannot patent mathematical formulae or laws of nature, but how is this distinction between discoveries and inventions to be drawn in the context of computer programs?

Intellectual property protection for such fundamental procedures as computing an average is problematic. Proprietary rights in the "building blocks" of computer science may impede, rather than further, its progress. If rights are to be granted in functional works such as programs, at least one question is: what is so basic as to constitute a "staple" item in the trade?

As computers become more sophisticated in their ability to process natural language (conversational English, for **example), the** line between what counts as a protectable program and what constitutes user input will begin to blur. As this illustration shows, "program" and "algorithm" have no fixed meanings.

(a)

To compute an average, sum the numbers in the set to be averaged, and divide by the number of items in the set

(b)

$$X = \frac{\sum_{i=1}^{n} X}{n}$$

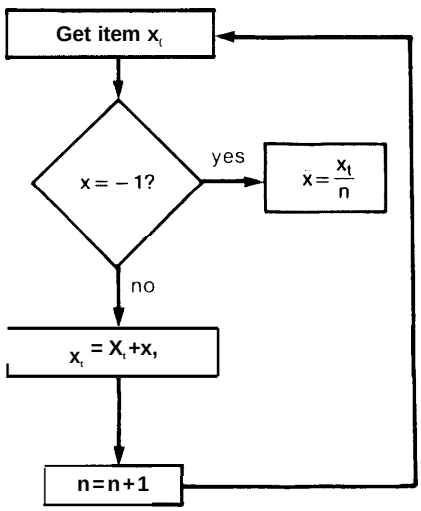
(c)

```
Get a data item
   add item to total
   increment index
   if no more items, continue:
      else go to get
divide total by index
```

(d)

```
10 data 10, 12, 17, 22, 6, – 1
20 read X,
30 If x = – 1 goto 70
40  let X_t = X_t+X,
50 n = n + 1
70 average= X_tn
80 print average
```

(e)




(f)

Call average

10, 12, 17, 22, 8

(9)

01100100110101010
10010011011001110
01110101001100100
110100110, ., .

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are subject to the "abstractions test between idea and expression, copyright in computer software is an either/or choice. Either one protects the words or variables as they are literally represented by the programmer, or one is forced to interpret those words or variables in terms of the procedure they implement in a computer system; thus protecting a procedure, process, or method of operation. 'G The "clear distinction" made in *Baker v. Selden,* "between the book, as such, and the art it is intended to illustrate, collapses in a computer program, because the program embodies both "the book" and "the art. " one cannot arrive at a "clear distinction" between idea and expression in a computer program by using traditional copyright analyses.

Policy Implications, The practical import of appropriate protection for computer programs lies in the public policy objectives of the copyright system itself. For computer program proprietors and creators, as well as to the domestic and international economies, it is important that computer programs be adequately protected.[97] If courts construe copyright protection in computer programs narrowly, creators and proprietors may well find unprotected the very thing that distinguishes their product from others–its logic and design. Equally important, if only the precise code is considered expression, copyright protection will be of limited use, since this expression can be easily changed by competitors.

If, on the other hand, courts continue to interpret the expression in computer programs as broadly as they have in recent cases, developers of computer programs may also be adversely affected, If copyright in computer programs is held to extend to the "useful knowledge' '–the method of achieving certain results—embodied in the program structure or algorithms, copyright may block software innovators by precluding the creation of programs that differ in detail, but implement and perhaps improve on copyrighted programs.'" The patent system was designed to have this effect, but it is inappropriate for the copyright system, which was neither doctrinally nor administratively designed to protect functional information. Overly broad copyright protection would give the owner patent-like protection over processes for a much longer duration than patent law provides, and do so with no examination for the program's novelty or nonobviousness, as is required by patent law. Moreover, patent law requires that an invention bean advance over the 'prior art, requiring an inventor to examine previously patented claims before gaining patent protection. For this reason, the Patent and Trademark Office keeps records of all patents that have been issued. But the Copyright Office does not keep records of "prior art, '[99] which leaves no way of predetermining whether a program that performs similar functions *or* obtains similar results will infringe a previously copyrighted program.

Copyright law does not distinguish between the types of computer programs it protects, which may exacerbate some of the difficulties described above. The type of computer program that is copyrighted may significantly af-

. . . —

"Consider the distinction logicians make between ''object language and'' met a 1 angu age (or language about the object language) in the context of t he following statements:

Bake the cake
Execute '' Bake the cake''

The former is the object language; the latter is the meta language. This distinction collapses in computer programs, since propositions can be ' 'recursive''; i.e., they can serve as both object and meta statements. '' Bake the cake, ' depending on the con te x t of use within the running of a computer program. may either be information to be displayed to the user, or a subroutine instructing the computer to bake the cake.

''A major, if not the chief means of inventing today is being done in a non-engineering liberal arts mode which is alien to the historical patent-copyright paradigm, From a speech given by John Lautsch, ''Why Be Concerned About Proprietary Protection of Software'?' American Bar Association Conference. Washington, DC, July 1985.

"AS Justice Bradley commented in *Baker v. Selden*: "The very object of publishing a book on science or the useful arts is to communicate to the world the useful knowledge it contains. But that object would be frustrated if the knowledge could not be used without incurring the guilt of piracy of the book. 101 U. S. 841 at 103 (1880).

"Deposit of programs in the Copyright office is required if the program is published with notice. 17 U.S. C. §407. However, only the first and last 25 pages of a program need be deposited, and these need only be sufficient to identify the program in question. 37 CFR $202.20 (c)(viii(A). These pages need not disclose any of the workings of the program,

feet the market power a copyright owner can possess.[100] For example, both operating systems and applications programs are generically computer programs, but crucial distinctions exist between the two. Operating systems govern the internal operation of a computer, and allow it to communicate with a range of applications programs (e.g., spreadsheets, graphics, and word processing programs). The operating system will, therefore, determine which applications programs can run on a particular computer. Thus, copyright on an operating system may be a far more powerful right than a copyright on an applications package, and may govern the market for applications packages. Indeed, this desire to make one's applications program marketable may have been at the heart of the *Apple v. Franklin* **case,** since it was unlikely that the 15,000 applications programs written for Apple's operative system would be rewritten to run on the Franklin Computer's machines. ""

Reverse Engineering. The trend of interpreting expression broadly in copyright for computer programs may also pose problems for reverse engineering. Reverse engineering refers to the unauthorized, although not necessarily illegal, reproduction of programs in their object or source code form for the purpose of teaching, analyzing, or evaluating the concepts, techniques, or ideas embodied in the program. [102] This process promotes innovation by allowing programmers to build on the works of others in the creation of new works. It also eliminates the need for redundant research and development. Reverse engineering allows abstract knowledge and techniques to be passed on, while prohibiting the wholesale appropriation and sale of another's work.

Computer programs create unique concerns about reverse engineering because, unlike other copyrightable works, their expression is not disclosed when they are published. '03 While a journalist can learn his craft without copying, by reading the others' published works, a programmer cannot. He *must* copy the program from its original storage medium–probably by decompiling it into source code form–in order to read and learn from the works of his predecessors. This copying may give rise to copyright liability, even though it may in no way interfere with the market value of the copied software.[104] The copy that is made in the course of reverse engineering may have relatively little financial value. It may bear little, if any, resemblance to the work that is allegedly infringed, and may even be destroyed after use. Instead of examining the work, the court looks to the "paper trail" left by the defendant in the research and development process. The infringement often occurs in the process of copying a program to create a new one. However, courts have used this initial copying as the basis for finding that the final work produced by a defendant was an infringement, even though it resembled the copied program only slightly.[105] This creates uncertainty whether any copying, even that for reverse engineering, is legal.

As it exists, copyright law offers two conceivable ways of dealing with the problem of reverse engineering. One possibility, Section 117 of the Copyright Act, permits copying of software as an "essential step" in the utilization of a computer program for "archival pur-

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""For a thorough discussion of copyright and market power, see ch. 6.

"" Allan Schmid, "Intellectual Property Rights in Biotechnology and Computer Technology, " to be published in *Zeitschrift fur die gesamte Staatswissenschaft, 1985.* One writer argues, however, that this problem has been contradicted by the facts. Duncan Davidson, "Software and the Wealth of Nations, " to be published in *Computer Law and Practice,* **1985.**

[102] The language used in this definition is adapted from the Semiconductor Chip Protection Act, 17 U.S.C. §906.

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[103] For a discussion of the disclosure issues surrounding computer programs, see Pamela Samuelson, "CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form, 1984 Duke Law Journal 665.

[104] Pamela Samuelson, "The Demise of the Right To Reverse Engineer Computer Programs: Is It Appropriate?" unpublished draft, Sept. 25, 1984.

[105] Indeed, the emphasis on the *conduct* of the defendant, as opposed to an assessment of the similarity in *content* between works can be seen in several recent cases: e.g., *SAS Institute, Inc. v. S&H Computer Systems, Inc. (1985* M.D. Term.), No. 82-3669, *Whelan Associates, Inc. v. Jaslow Dental Laboratory, 225* U.S.P.Q. 156 (E. D. Pa. 1985), and *Hubco Data Products Corp. v. Management Assistance, Inc., 219* U.S.P.Q. 450 (D. Idaho 1983).

poses. "[106] This provision does not explicitly address the issue of reverse engineering. CONTU, which wrote section 117, interpreted ' 'essential step" narrowly, to include only the copying done by a computer in the process of loading a program into the machine. Likewise, the courts have followed this interpretation. [107] A broader interpretation of "essential step" might permit reverse engineering. But because such a broad interpretation of section 117 may also conflict with the copyright owner's exclusive right to prepare derivative works,[108] it seems to be a slim reed on which to facilitate reverse engineering.

Alternatively, the doctrine of fair use may provide for reverse engineering, because it permits copying for scholarship or research. [109] Fair use, however, evolved in the context of print technology, and so several of its features make it an uncertain device, at best. Two of the criteria used in determining the fairness of a use are: ( 1 ) the purpose and character of the use, including whether the use is of a commercial nature; and 2) the amount and substantiality of the work as a whole. [110] Because reverse engineering is often performed for inherently commercial reasons, the "purpose and character criterion could weigh against a finding of fair use. Furthermore, programs must often be copied in their entirety to understand their workings, or to study the relevant portions of code. The fair use factors concerning "amount and substantiality' not only deal with the number of copies of a work made, but also with the portion of a work that is copied. Hence, the fair use doctrine may not allow reverse engineering. However, because there has been no court decision on the matter of reverse engineering, it is impossible to say definitively whether fair use will allow it.

### Computer Program and Patent Law

Given the problems of applying copyright protection to computer programs, patent protection may be a more viable alternative than fair use. Among other things, patent law protects new and useful processes,[111] and computer programs, as works of function, use information in a process. Many patents have been issued for computer programs.

Patent protection, however, also poses problems. Some are *theoretical;* not all programs that need protection will be eligible for patent protection. Some *are practical,* and have to do with how suitable the patent system is to the commercial environment of program engineering.

Programs and Patent Theory. Since 1966, the issue of program patentability has been juggled among the Patent Office, the Court of Customs and Patent Appeals (now the Court of Appeals for the Federal Circuit), and the Supreme Court.[112] Computer programs have proven to be as problematic an "invention' for patent law as they have been a "writing" for copyright law.[113] For, the same characteristics that make programs acceptable subject matter under the copyright scheme cause problems under the patent scheme. Whereas copyright has problems with the functional nature of programs, patent law has difficulties with symbolic nature of programs. They represent processes that have heretofore been mental, such

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'"The relevant part of section 117 reads:

> it is not an Infringement for the owner of a copy of a computer program to make a copy or adaptation of that computer program provided (1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner.

[104] *See, e.g.: Midway Manufacturing Co v. Strohon,* 564 F.Supp. 741 (N. I). Ill. 1984).

[105] 17 U.S.C. § 106.

[106] The doctrine of fair use is codified in Section 107 of the Copyright Act, and is discussed in ch. 7 of this report.

[107] 17 U. SC. §107, sections 1 and 3

[111] 'Section 101 of Title 35 (Patents) states that whoever invents or discovers any new and useful ( 1 ) process, (2) machine, (3) manufacture, or (4) composition of matter, or any new or useful improvement thereof, may obtain a patent on his invention or discovery.

[112] See Duncan Davidson's " Protecting Computer Software: A Comprehensive Analysis, in 1983 *Arizona State Law Journal* 611, 634-650.

[113] 'One writer has suggested that "[m]uch as the distinction is breaking down in copyright because of technological changes blurring the distinction between a product and its idea, so too— especially in the area of computer software— is the dichotomy losing its meaning in patent law. " James Beniger, *Information Technologies and Commodities in the Development of Intellectual Proper. \': Changing Rights and Practices,* OTA contract report, April 1985, p. 58.

as balancing a checkbook or searching for a word in a text.

Strictly speaking, computer programs are not in and of themselves patentable. At present:

> . . . [patent protection] is available for computer programs that are intrinsically tied to a device which physically and automatically applies the results of the computer program. . . . The invention is not in the program: It is merely implemented by the program (and) is actually a new method of doing something.

Patentability is determined by whether the program implements a physical process that is itself the subject of invention, and meets the criteria for patentable processes.[115] For example, a method of typesetting,[116] of timing the curing of rubber,[117] of searching for oil,[118] or of storing and manipulating telephone signals and records in a database [119] are patented inventions that include computer programs as components of the invention. Programs that are the only novel component of an otherwise unpatentable process, [120] or that merely implement an algorithm or a scientific or mathematical truth,[121] are *not patentable.*[122] This is the case for a great many computerized industrial processes, and the majority of programs written for personal computers.

The courts' reluctance to uphold patent protection on programs in isolation from physical processes points to a very fundamental problem with patent protection for programs. Programs are expressions of algorithms, which are rules or procedures for achieving particular results. Algorithms, like mathematical formulae and laws of nature, are not patentable, Yet, the algorithms expressed in programs can also be configured in a computer in hard-wired form.

This equivalence between algorithms in hardware and those in software raises an issue concerning the patent 'doctrine of equivalents." The doctrine states that a patent protects equivalent configurations, even though they may neither be disclosed nor actually claimed, unless the equivalent configuration performs the function in a substantially different way.[123] If, therefore, a program can be described in terms of the functioning of digital logic circuitry in the computer hardware, rather than in terms of algorithms embodied in software, patents might be issued on machines which if they were software, would be denied.[124]

The Practical Limitations of Patent. There are administrative and practical problems connected with seeking patent protection for computer programs. Many observers consider time and expense to be the greatest drawback. A claim may be pending for 2 to 3 years and cost an inventor upwards of $10,000 to prosecute. [125] Many innovators may find the time and expense involved in obtaining patents for computer programs prohibitive, depending on the rate at which software designs become obsolete, and the amount of financial resources available to a given software innovator. Even

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[115] John C. Lautsch, *American Standard Handbook of Software Business Law* (Reston, VA: Reston Publishing, 1985), p. 65.

[116] "That is, useful, novel, and nonobvious (35 U.S.C. §§101, 103). Similarly, machines, methods of manufacture, and compositions of matter that employ programs and that meet the statutory criteria for patentability are also patentable.

[117] *In re Freeman,* 573 F.2d 1237 (CCPA 1978).

[118] *Diamond v. Diehr,* 450 U.S. 175 (1981).

[119] *In re Taner,* 681 F.2d 787 (CCPA 1982).

[120] Patent No. 4,479,196—Hyperedge Entity-Relationship Data Base Systems (1 984), for example.

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

[122] *Gottschalk v. Benson, 409* U.S. *63* (1972). The Supreme Court ruled that a program for the conversion of binary coded decimals into pure binary numerals could not be patented, since "the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself. " 409 U.S. at 71 72 (1972).

[123] This statement is based on the caselaw that has so far developed. one observer, however, has pointed out that "[p]atents are now being granted every week with claims covering a series of steps which can be executed completely on a computer and, it appears, without any last-step output, that is, to turn a crank, light a light, eject a part, and so forth. Whether court (sic) will uphold such claims in infringement proceedings remains to be seen. " Letter to OTA from Robert Shaw, The Patent, Trademark, and Copyright Research Foundation, Franklin Pierce Law Center, Oct. 11, 1985. Many patents have been issued for "pure" programs (e.g., "SWIFT-TECH"™ is a patented computerized database search algorithm that runs on mainframe, mini, or microcomputers. U.S. Pat. No. 4,270, 182).

[124] Duncan Davidson, "Protecting Computer Software: A Comprehensive Analysis, " 1983 *Arizona State Law Journal 611,* 643, citing 4 D. Chism, *Patents,* §18.04 *(1982)*

[125] Ibid.

[126] "'Larry Kahaner, "Patent Reform, Pending, " *Across the Board,* September 1984, p. 36; and conversations with Richard Stern (see note 44) and Robert Shaw (see note 122). See ch. 9 on institutional issues.

after a patent is successfully obtained, it is often found invalid when challenged in court,[126] making the value of a patent to investors highly uncertain. The scope of patent claims in programs, too, is uncertain, because of their symbolic nature. The actual code written by a programmer is seldom the subject of patent claims. Instead, what is claimed is the process that the code implements, and the program is incidental to this process. The scope of the patent claim may, therefore, be difficult to delineate precisely, because it does not refer to a specific embodiment or tangible item.

### Computer Programs and Trade Secrets

A trade secret is a form of intellectual property that covers any confidential formula, pattern, device, or compilation of information used in a business, which gives that business an opportunity to obtain an advantage over competitors who do not know or use the secret.]" Trade secret law is a viable method of protecting computer programs, and in some cases, seems better suited to programs than either patent or copyright. Indeed, software developers rely on it heavily for protecting against the unauthorized disclosure of competitively valuable information.

Trade secret law differs substantially from both patent and copyright law. The law of each State, rather than Federal law, defines what a trade secret is, and what rights the holder of a trade secret has. Unlike copyright, trade secret protection can extend to the ideas, algorithms, and procedures embodied in a program, as well as to the expression adopted by the programmer. Unlike patent, a trade secret generally requires no compliance with formalities, no waiting time to acquire, and no proof of novelty or nonobviousness. Perhaps most important, trade secret is not encumbered with the problems of fitting computer programs into subject matter schemes of patent and copyright.[128] In trade secret cases, a court is freer to focus on the effects of disclosure on a plaintiff's business, and the contractual or tortious misdeeds of a defendant, rather than on strict standards of infringement.[129]

Trade secret protection, however, has drawbacks from both a public policy and a proprietary point of view. As a matter of public policy, an overreliance on trade secret protection may hinder technological growth in the computer industry by "locking up" information that can benefit whole sectors of the industry. Unlike the patent and copyright systems, trade secret does not further the goals of disclosure and publication. Quite the reverse: trade secret protection is lost by unrestricted or unprotected disclosure of the secret.[130] Trade secrets are often enforced through contracts between employers and employees that restrict the employees' rights to enter into competitive ventures or to subsequently become employed by competitor companies. Although intended to protect employers from unscrupulous employees, abuses of these noncompetition agree-

[126] Estimates of holdings of invalidity range from 50 percent (see Davidson, op. cit. ) to 70 percent (Richard Stern, "ROM's in Search of a Remedy: Can They Find It? 1 Computer Law Reporter 4, 1982).

[127] Restatement *of Torts*, §757, comment B

[128] ""Rather than the uniqueness, novelty, or originality of the program, a court ruling upon a trade secrets case will look to the unique value of the program to a company's competitive advantage, the company's investment in the program design, or the ' 'unique logic and coherence' of the program. See, e.g.: *Corn-Share, Inc. v. Computer Complex, Inc.*, 338 F, Supp. 1229 (E, D. Mich. 1971) and *Computer Print Systems, Inc. v. Lewis*, *422* A.2d 148 (Pa, Super. 1980), but see: Structural *Dynamics Research Corp. v. Engineering Mechanics Research Corp., 318* N. W.2d 691 (Minn.1982) ("Mere variations in general processes known in the field which embody no superior advances are not protected.")

[129] "The same can be said of many other State law forms of intellectual property protection. Theories such as tortious interference with contract, interference with prospective advantage, misappropriation, and unfair competition law all focus on the conduct of defendants, rather than on the subject matter of the item that is allegedly infringed.

[130] ""The factors that go into an assessment of whether certain information is one's trade secret include:

1. the extent to which the information is known outside of his business;
2. the extent to which it is known by employees and others involved in his business;
3. the extend of measures taken by him to guard the secrecy of the information;
4. the value of the information to him and to his competitors;
5. the amount of effort or money expended by him in developing the information; and
6. the ease or difficult' with which the information could be properly acquired or duplicated by others.

*Restatement of Torts, §757,* comment B.

ments may also hinder technological advance by acting as a barrier to employee established startup companies.[131]

Trade secret protection is of limited usefulness to many types of software developers and vendors. Programs that are mass marketed are not suitable candidates for trade secret protection, since the trade secret status of the software is lost through disclosure, and disclosure is often the natural consequence of mass marketing. To avoid this problem, some vendors have licensed, rather than sold, their programs, and required the licensees to keep the program secret .-Depending on the number of licensees, however, these schemes may be neither legally nor practically enforceable.[132] The software vendor also faces a number of other problems with trade secret protection, including a lack of uniformity in trade secret laws from State to State, and difficulties in attempting to obtain concurrent protection through patent or copyright law.[133]

"''These (noncompetition) suits hit the startups at their most vulnerable stage, when every available dollar and minute has to be poured into the nascent company. The suits have become so common as to kindle suspicions that some established companies are using the courts more to suppress competition than to right legitimate wrongs. " "In High-Tech Industry, New Firms Often Get Fast Trip to Courtroom, " Wall *Street Journal,* Aug. 14, 1984.

'-Davidson, "Protecting Computer Software, " op. cit.

"Secrecy may be lost through copyright registration and deposit, or through a Freedom of Information Act request upon the Copyright office, The Copyright Office has promulgated ''secure deposit" regulations with respect to deposit of the Multistate Bar Exam, 37 CFR $203.40, and see *National Conference of Bar* Examiners *v. Multistate* Legal *Studies,* 692 F.2d 478 (7th Cir.1982), and the Freedom of Information Act has a trade secret exemption, 5 U.S.C. $552( b)(4), but neither of these provisions has been construed with respect to computer programs. Section 301 of the Copyright Act preempts State law that provides ''equivalent protection. Despite the fact that the Supreme Court has found that patent law does not preempt State trade secrets law, *Kewanee Oil Co. v. Bicron Corp.,* 416 U.S. 470 (1974), the situation is not entirely clear with respect to preemption of State trade secrets law by Federal copyright law. See e.g., *Videotronics, Inc. v. Bend Electronics, 564* F. Supp. 1471 (D. Nev. 1983),

# PART III: IMPLICATIONS FOR POLICY

The application of a uniform system of intellectual property principles, such as that embodied in copyright and patent law, to divergent types of information-based products may no longer be possible. Modern technologies are exaggerating dissimilarities between information products that were once protectable under a single system of law, and are, in some cases, giving rise to new products that strain the application of old legal principles.

There may be no one simple solution to the problem of accommodating intellectual property law to technological change. Being different in kind, many of the problems require different types of solutions. Determining the proper form of protection for computer programs, for example, is largely a question of which aspects of programs the law should protect; whereas determining ownership in works distributed on-line is one of finding a feasible administrative mechanism.

Problems also require different degrees of change. Copyrighting dynamic databases, for example, may call for relatively minor changes in copyright registration and deposit regulations, but the difficulties that computer and communication technologies pose for protecting works of fact may necessitate sweeping changes in the type of protection that the law currently offers.

The timeframe in which problems are likely to arise also hinders attempts to construct one comprehensive solution. Protecting computer programs is a problem that requires immediate attention, but other issues, such as interactive authorship, may not significantly affect the intellectual property system until early in the next century.

Given the complexities of formulating appropriate intellectual property law, it is convenient to organize Congress' policy options accord-

ing to the type of action that might be taken. A choice of one option does not necessarily exclude others, and the policy maker may choose to exercise several options at once, or in sequence over time. These options, and their strengths and drawbacks, are described below.

### Option #l: Rely on the Marketplace

Marketplace options accommodate technological change with little or no government intervention. Under this kind of option, private entrepreneurs, acting individually or as groups, address problems that exist in intellectual property law. Solutions to particular problems will often take the form of "technological fixes" or private contractual agreements. For example, "identifiers" electronically embedded in some works may help to solve some of the problems of integrity and identity associated with works of art that are produced and distributed on-line, and technological methods of monitoring use, although expensive, are available for some database distributors of works of fact. And, where current legal protection is inadequate for works of function, proprietors might try to supplement intellectual property protection through the use of site licensing or "shrink wrap" licensing.[134]

The marketplace approach to resolving intellectual property issues is favored by a majority of the public, 54 percent of whom feel that business should have the primary responsibility for solving problems associated with intellectual property. (See table 3-l.) In response to a survey conducted for OTA by Yankelovich, Skelly & White, Inc., the public responded in the following way when asked "Thinking about this issue of intellectual or creative property, who would you say should have primary responsibility for solving any problems created by new technologies (like computers or videocassette recorders)?" Manufacturers of computer hardware and many established software developers, fearing that legislative efforts to adapt intellectual property law may create more uncertainty than it resolves, would also prefer that Congress pursue marketplace options. In some cases, private industry has already taken a marketplace initiative by seeking to establish technical standards,[135] or by protecting their products through contractual agreements with their customers. However, not all representatives of the information industry believe that the marketplace alone can provide adequate protection for their products. Database vendors, in particular, are uncertain about marketing their services without adequate and appropriate legal mechanisms.

**Table 3-1 .—Who Should be Responsible for Solving Intellectual Property Problems?**

| | Total | Familiar with issues | Not familiar with issues |
|---|---|---|---|
| Business in the Information and entertainment industries | 54% | 54% | 53% |
| The government | 34 | 33 | 35 |
| Both | 8 | 11 | 7 |
| Neither | 1 | 1 | 1 |
| Don't Know | 3 | 1 | 4 |

SOURCE Yankelovich, Skelly White, Inc. *Public Perceptions of the Intellectual Propertyi Rights Issue* contract prepared for OTA February 1985

The marketplace option has several advantages over others. The marketplace is more likely to be able to respond rapidly and flexibly to rapid innovation. Contracts between computer program sellers and buyers are likely to address the specific needs of each party, and can be tailored to take unique features of the technology into account. Technological means of protecting information or monitoring use avoid costly enforcement and litigation. And, marketplace solutions can evolve as rapidly as the technology.

Marketplace solutions do not solve all of the problems that vendors of information products face, nor do they necessarily further the public interest. Unlike intellectual property law, contracts do not ordinarily bind those not

[134]Shrink wrap licenses, so called because they purport to bind the purchasers of mass market software to a license agreement rather than an outright sale, are of unproven effectiveness and legality. See ch. 6, pp. 183-184 for further discussion of shrink-wrap licenses.

[135]The Association of Data Processing Service Organizations (ADAPSO) has recently proposed a standard method of copy-protecting computer software, and the proposal has met with some resistance from both software vendors and users.

party to the agreement. This means that, lacking adequate intellectual property protection, a creator or purveyor of information is often without legal recourse against third parties.

Technology-based protections may also be unworkable. Not only are they susceptible to the diligent "hacker,' they may also be impracticable to market or difficult to standardize. Moreover, by protecting works that are publicly disseminated, copyright encourages dissemination. In lieu of copyright protection, information providers may be inclined to "lock up' access to information that they previously had incentive to keep open. This would not serve the public interest.

### Option #2: Judicial Accommodation

Judical accommodation is an option that allows the Federal court system to treat intellectual property problems on a case-by-case basis, by fitting existing law to the particular facts before the court. By interpreting the law in specific circumstances, courts develop rules that eventually have broader application. Many judicially developed doctrines, such as fair use and the idea/expression dichotomy, were later codified by the legislature.

The individuals having the strongest opinions about judicial accommodation are attorneys. Those attorneys who view existing intellectual property law as adequate to deal with technological issues also feel that the judicial forum is the most appropriate method of dealing with technological advance. The great virtue of the judicial process, according to this perspective, is its ability to adapt the broad outlines and fundamental principles of statutory law to circumstances that are unforeseeable at the time law was written into statute. They also stress that many uncertainties, such as whether computer programs are copyrightable, have already been resolved by the courts, and that a foundation therefore exists for further judicial development.

A growing minority of attorneys, many of whom come from a background of engineering and patent law, strongly disagree. They argue that not only are existing methods of legal protection inadequate, but so too are judges' abilities to comprehend the subtleties of the technology and the long-range impact of their decisions. Given uncertainties in applying the law to new technologies, they often counsel their clients to proceed conservatively in order to avoid lawsuits. The clients, in turn, may forego potentially profitable avenues of research or application. Often, there is no way of knowing how the law will apply to them until they are haled into court–a prospect that many wish to avoid.

The legal profession's opinions on judicial accommodation reveal many of the strengths and weaknesses of this option. Judicial accommodation may be advantageous in some cases, where statutory law can be construed by the courts so as to avoid the need for legislative solutions. The judiciary may, for instance, be able to clarify the meaning of the fair use and idea/expression doctrines in the context of computer software. The courts' role is to adapt general law to specific circumstances and, given the idiosyncrasies of the situations that may arise, the flexibility of judicial accommodation gives it many advantages over attempting to anticipate future problems through legislation. In many cases, alternative causes of action—such as trade secrets, misappropriation, and unfair competition law—may also fill the gaps left in copyright or patent law because of the effects of technology.

Nevertheless, the courts, which are generalists par excellence, may be ill-equipped to deal with many of the highly technical and multifaceted problems raised by some of the technologies. Moreover, as this chapter suggests, many of the problems in intellectual property law are fundamental, and may not lend themselves to resolution through a case-by-case application of the law. In order to obtain results that seem to them just, courts have recently begun to render decisions that are, in essence, policy choices.

In light of the Supreme Court's consistent signals to Congress that the judiciary should not serve as a policymaking forum for patent and copyright law, resort to the courts to re-

solve many of these technological issues may be tantamount to a delegation of Congress' policymaking authority. Even if the judiciary acts with restraint with respect to policymaking, the application of obsolete law to novel circumstances may end up skewing the policy objectives that the statute seeks to promote.

### Option #3: Amendment

Amendment is an option that allows Congress to modify portions of existing law in order to accommodate changes in the way the law operates brought about by technology. In 1980, for example, the copyright law was amended to include computer programs, and in 1985, it was amended to deal with the rental of sound recordings. A bill presently before Congress would amend the copyright law to include the ornamental designs of utilitarian items, such as semiconductor chip masks.[136]

Industries and organizations that rely on, or are affected by copyright protection, generally favor amendment, where necessary, as an option for accommodating technology. Among these groups are the recording and motion picture industries, the library and educational associations, the software and computer industries, and a variety of authors', publishers', and artists organizations. Each of these groups tends to have specific and unique concerns that are often best addressed by amendment. These organizations view amendment as the best option for a number of reasons: marketplace options may not be viable for achieving many results, such as proposed royalties on blank tapes; [137] litigation may produce results that are unfavorable, as with *Sony Inc. v. Universal* studios,[138] or not sufficiently comprehensive for the group's particular ends; and the groups' interests are seldom broad enough to favor more comprehensive legislative options, such as revision or *sui generis* legislation.

Amendment to patentor copyright law may bean appropriate solution to some of the problems posed by technology, especially those amenable to relative}' isolated legislative treatment. For example, the problems of deposit and registration for dynamic computer databases, the difficulties involved with thousands of contributors to a single database, and the issue of the scope of protection for computer programs may be soluable through amendments to appropriate sections of the Copyright Act. Accommodation by amendment offers the advantage of relative timeliness in the face of technological change. Next to judicially fashioned responses, amendment is perhaps most flexible in meeting the rapid pace of technological change. Amendment also offers the advantage of fitting specific technological accommodation within a larger precedential context, thus reducing uncertainties about whether existing legal principles would apply to new provisions.

However, insofar as problems affect the entire intellectual property system, accommodation by amendment may be but a temporary solution. If, for example, computer databases and net works become a principal means of storing and distributing information, copyright law, both in principle and in practice, may fail to protect what needs protection—algorithms and information. Amendment may fail to address the fundamental difficulties posed by technological advance, since the problems lie at the conceptual core, rather than at the periphery, of existing law. The failure of copyright law to account for the trifold nature of information—works of art, fact, and function—is an example of a fundamental problem that technology is exacerbating.

### Option #4: Sui *Generis* Legislation

*Sui generis* is a latin phrase used to describe any law that is "of its own kind or class. *Sui generis* intellectual property law is legislation that stands apart from existing patent, copyright, trademark, or unfair competition law. The Semiconductor Chip Protection Act is an example of *sui generis* law designed to protect the architecture of semiconductor chips.'" The *sui generis* option has also been suggested for computer programs.

"H. *R.* 1900, also known as "The Design Protection Act of 1985." Introduced by Represent ative Moorehead.
S. 31 and 1{. R. 1030
[138]*Sony Corp. v. Universal City Studios*, 464 *(1. S.* 417 ( 1981).

"The Semiconductor Chip Protection Act comprises Chapter 9 of Title 17, U. S. Code.

The identity of the parties likely to favor or oppose *sui generis* legislation will depend on what the legislation seeks to protect, and on how it proposes to protect it. In the case of the Semiconductor Chip Protection Act, for example, the semiconductor industry generally favored protecting chips through an amendment to the existing copyright system, rather than *sui generis* law, because of the greater certainty that amendment offered. Other groups, such as the publishing and computer software business, favored the *sui generis* option because of possible adverse effects that amendment of the copyright law would have had on protection of other types of copyrightable works. In general, groups whose products *sui generis* law is likely to affect prefer protection under existing copyright or patent schemes because of the lag time involved in writing a whole new system of protection, and because of the uncertain way that courts will interpret the new law.

The *sui generis* option offers the advantage of accommodating intellectual property law to the gradual introduction of new technologies. Even with rapid technological change, many of the traditional, print-based, methods of creation and distribution will continue to form a great part of the commerce in the information industry, and traditional concepts developed for print culture may still work quite well. As new forms of expression grow up alongside of existing ones, Congress may want to consider parallel forms of intellectual property protection. Indeed, the Semiconductor Chip Protection Act is a good example of this parallel, *sui generis* approach. *Sui generis* legislation can be specifically tailored to the idiosyncrasies of the technologies and their markets, without damaging the fabric of existing law. Where doubt exists over the applicability of the intellectual property clause of the U.S. Constitution, alternative constitutional authority can be found in the commerce clause.

A *sui generis* law for computer programs and other works of function might be desirable for many of the above reasons, Like the Semiconductor Chip Protection Act, a *sui generis* law for programs and other works of function could build in a balance between proprietary and public interests, by granting appropriate proprietary rights in those aspects of the work that are valuable, by allowing for reverse engineering, and perhaps by limiting the term and scope of protection to reflect actual markets for functional works.

Works of fact might also be protected under a *sui generis* scheme that recognizes the importance of protecting information *per se*, while at the same time balancing such protections against the rights and needs of the public to that information. Compulsory license arrangements and alternative remedies, such as the imposition of "reasonable" royalties for certain types of infringement, might also be tailored to the specifics of the interests at stake.

*Sui generis* schemes of protection are not, however, a panacea. They are costly in terms of the political investment necessary for their creation. They may also require the creation of new administrative agencies, with appropriate expertise. Lacking a history of judicial precedent, uncertainties will also exist as to the meaning of terms and the applicability of the law to specific circumstances. Furthermore, *sui generis* laws may cause great difficulties for international legal, economic, and political arrangements. Computer programs, for example, have only recently been incorporated into the the body of many of the developed nations' copyright law, and only after many years of contention.

### Option #5: Revision

Revision would entail rewriting all or a substantial part of the Copyright Act of 1976 to conform to the policy goals that Congress seeks to further in a new technological context. A revision might retain the basic legal principles already developed in law, as the revision of 1976 did, or it might adopt wholly new principles.

Although many observers have commented from time to time on the obsolescence of copyright law, and although some have even envisioned the broad outlines of a future intellec-

tual property law,[140] OTA found few advocates of a general revision of copyright law. Indeed, most parties with whom OTA spoke indicated that they believed the Copyright Act of 1976 is adequate for the foreseeable future.

Nevertheless, Congress will have to give consideration to the general revision of the copyright laws in the course of the next decade. In addition to substantial and worsening enforcement problems,[141] copyright law is becoming irrelevant to new technologies and more removed from the policy objectives for which it was designed. Hence, many of the same pressures exerted by technology on the Copyright Act of 1909, which required the 1976 revision, have already begun to undermine the Copyright Act of 1976. Congress should therefore begin now to gather the information necessary for the eventual revision of the copyright law.

This chapter suggests a framework for an eventual revision of the copyright law. The revision might be modeled on the trichotomy developed in this chapter for works of art, fact, and function; and it could specify rules for the protection of each. Under this system, works of art, whose value is closely tied to expression, might be protected in a traditional copyright fashion. Protection for works of fact, whose value lies in the accurate representation of reality, might be tailored to reflect this value, while at the same time assuring adequate public access to socially and politically important information. Works of function, which rely on algorithms as their source of value, might be protected along lines of patent law, with some threshold requirements of advance over prior art and disclosure.

The copyright proprietor could register his work under one of these three categories, comply with the relevant formalities of each, and receive a type of protection more closely suited to the value and social function of the work. Traditional limitations on rights, such as fair use, could be adapted to fit the particular nature of the type of work in question: for works of art, fair use might resemble its present form; fair use in works of fact might be limited according to the social utility of permitting nonproprietors to copy or publish the work;[142] and for works of function, fair use might be shaped to meet the particular requirements of reverse engineering. Durational provisions could also be designed to reflect the economic "lifetime" of the particular type of information product,

Such a proposal, of course, has many drawbacks. The 1976 revision of the copyright law was a major political effort, requiring over 25 years of study and legislative bargaining. Like *sui generis* laws, a revision that departed substantially from the existing copyright framework might cause substantial domestic and international uncertainty. In addition, a revision would have to address concerns over enforcement, which would exist regardless of how carefully protection is tailored to subject matter.

### Option #6: Alternatives to Copyright and Patent

Congress may also wish to consider alternative options that dispense with tradition-bound ideas of intellectual property, One scheme would be essentially *distributive* in nature, Under the distributive approach, the law might limit itself to prohibiting only the unauthorized duplication of works for a period of time. Issues concerning the cumbersome and increasingly obsolete definitions of intellectual property, such as what constitutes the appropriation of an idea versus an expression, what constitutes a derivative work, a performance, display, and so on, would be jettisoned in fa-

[140] See, e g Michael Pendleton, "Intellectual Property, Information-Based Society, and a New International Economic Order—The Policy Options?" 2 *European intellectual Property Review* 310 1985); Harlan Cleveland, "King Canute and the Information Resource," *Technology Review*, January 1984, pp. 12-1 5; Gary Klueck, "The Coming Jurisprudence of the Information Age, "21 *San Diego Law Review* 1077-111 1 ( 19811, R. Grant Hammond, "Quantum Physics, Econometric Models, and Property Rights to Information, " 27 *McGill Law Journal* 47 ( 19X1): Ithiel de Sola Pool, *Technologies of Freedom* (Cambridge, MA: Belknap University Press, 19X:\l, especially pp 212-217.

[141] See ch. 4

[142] "In *Harper & Row v. Nation Enterprises s*, Supreme Court No. 83-1632 (1985), for example, the Supreme Court decided that the First Amendment interests asserted by *Nation Magazine* were essentially spurious, since Time Magazine would have shortly provided the public with the Gerald Ford's memoirs anyway. In essence, the court was passing on the balance that a works of fact provision would strike between access and remuneration.

vor of a law which looked to a desired outcome. The outcome might be specified in terms of recovery of fixed costs associated with the production and distribution of, and value added to, a particular work, plus rents limited to a certain rate of return. After rate of return objectives were met, the work would enter the public domain. The distributive scheme has the virtues of simplicity and adaptability, making it resistant to technological obsolescence.

Although it departs substantially from existing law, the distributive approach is not without precedent. The regulation of public utilities is conducted in a very similar fashion. Moreover, many aspects of current copyright law, such as royalties on cable television transmissions, are already moving in the direction of a distributive approach. Bills presently before Congress, which would impose a‘ ‘compulsory license” on the sale of blank tapes and recording equipment, are also essentially distributive in nature.[143]

The distributive approach would require information about information markets that is presently unavailable (see ch. 6 on the Operation of Information Markets). Moreover, the distributive approach might be politically untenable, since it would essentially impose a ceiling on returns for a creative work. The administrative mechanism necessary to make the distributive scheme work, although presaged in some ways by the Copyright Royalty Tribunal, is nonexistent and would have to be carefully constructed by Congress.

Another alternative approach to the present system of copyright might be called the *minimal* scheme. The minimal approach would remove all legal protections except those absolutely necessary for the production of works. The problems of technological obsolescence could be avoided by avoiding entirely the need for legal categorization of subject matter and rights. Such an approach is described by Judge Stephen Breyer in an article, “The Uneasy Case for Copyright."[144] The minimal approach would be particularly well suited to a technological environment that is fast changing, and where the economic viability of creative ventures relies on the pace of innovation, rather than on legal protection for works that have already been created. One result of the minimal approach might be to speed up the production and marketing of works such as computer programs, since those who are first to the market with the best products are most likely to recoup rewards. The minimal approach would also ostensibly lower prices and eliminate the costs of copyright transactions.

The minimal approach, like all other solutions, suffers severe drawbacks. Notwithstanding its likely serious political impediments, the minimal scheme relies heavily on publishers' purported advantages in lead time and ability to retaliate in the marketplace-advantages that may be offset by the speed and low cost of modern communication technologies. A minimal approach would entail many risks to authorship and publishing as we know it, some of which are detailed in chapter 2.

Finally, another alternative approach would dispense with the notion of property, per se, and instead concentrate on remuneration based on *access.* Indeed, because of the advent of electronically disseminated works, many publishers are moving to an access-based system anyway. By removing concepts of property entirely, the conceptual and legal difficulties with respect to the boundaries of intellectual property that are caused by technology can be avoided entirely. The issues surrounding access-based systems are discussed in detail in chapter 7, and will not be dealt with here.

[143] Specifically, S. 31 and 11. R. 1030. Like the distributional approach, these bills attempt to set ‘‘fair’ rates of taxation on blank tapes, and distribute the taxes to the recording and motion picture industries.

[144] Stephen Breyer, “The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs, ” ***84 Harvard Law Review 281 (1970).***