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COMMENTS

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I. Introduction

Due to technological innovations, the computer industry has experienced tremendous growth in the last decade. Computers are fast becoming a fixture in many homes and offices. This expansion in the computer market has been accompanied by an even greater demand for software that will allow computers to perform various functions. The development of software requires substantial investments, yet the final product may be duplicated easily and inexpensively by consumers and competitors in the software industry. These circumstances have made protection of software manufacturers' proprietary rights a major concern.

In an effort to protect against software piracy, manufacturers began marketing their programs in an unintelligible form—in object form in ROM. Technological advances have since made it possible for competitors to copy the underlying program embodied in the ROM. Moreover, courts and commentators have expressed uncertainty whether copyright protection extends to such forms of computer programs. Recent decisions, however, hold that copyright

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protection extends to all forms of computer programs regardless of their function or format.\(^5\)

This comment traces the development of copyright law in relation to computer programs, including the 1976 copyright revision and the 1980 copyright amendments. It surveys judicial interpretation and application of copyright law to computer programs. Finally, this comment analyzes the arguments against copyrightability of computer programs in ROM and concludes that Congress intended to protect such works.

II. The Creation of a Computer Program

To understand the applicability of copyright to computer programs, it is helpful to examine how a program is created. A computer program goes through four generations before it can be used by a computer: flowchart, source code, object code, and object form. A program begins as an idea of how to solve a problem or perform a function.\(^6\) After reviewing the program’s objectives and specifications, the programmer designs the program’s logical structure. The programmer prepares a flowchart or schematic diagram that uses words and symbols to illustrate the precise sequence in which each operation is to be performed and to outline the program’s essential details and interrelationships.\(^7\)

The second step in program development is the translation of the flowchart into a set of specific instructions using one of the “source languages,” developed for communication between the

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\(^7\) Note, Copyright Protection for Computer Programs in Read Only Memory Chips, 11 Hofstra L. Rev. 329, 341-42 (1982-83) (“flowchart is the first expression of the programmer's ideas on the problem that will become a program”). See National Commission on New Technological Uses of Copyrighted Works, Final Report of the National Commission on New Technological Uses of Copyrighted Works 53 n.127 (1978) (“flowchart is a graphic representation for the definition, analysis or solution of a problem in which symbols are used to represent operations, data flow, or equipment.”) [hereinafter cited as CONTU FINAL REPORT]. See also Data Cash Sys., Inc. v. JS&A Group, Inc., 628 F.2d 1038, 1040 (7th Cir. 1980) (steps in development of a computer program).

Today, programmers rarely create flowcharts to memorialize the program's design. Instead they write a "prolog" which is an English-language recitation of the structure and function of the program. MacGrady, Protection of Computer Software—An Update and Practical Synthesis, 20 Hous. L. Rev. 1033, 1035 (1983).
programmer and the computer. The programmer may code the program into a higher level language, such as FORTRAN, COBOL, or BASIC, that employs English-like words and syntax, or a lower level symbolic assembly language such as BAL, AUTOCODER, or SPS that consists of alphanumeric labels.

The program written in source code language is commonly referred to as "source code" or "source program." A source program is a series of formalized statements or instructions that direct the computer to perform a sequence of operations to solve a problem or produce a desired output. When choosing the source code language statement to implement the program, the programmer selects those statements that will most efficiently execute the logical steps required by the design. After the program has been coded, it is stored on a machine-readable medium such as punched cards, magnetic tape, or floppy disks.

A computer, however, cannot understand a program written in source code; it can only execute machine-language instructions. Therefore, the source code statements must be translated in machine-readable object code before they can be executed. The conversion process varies with the form of the source code language. A compiler program is used to translate higher-level languages into object code. This is not usually a one-to-one translation; it is generally a multistage process in which one line of higher-level coding is compiled into many lines of machine-language instructions. In contrast, lower-level assembly language corresponds directly to object code on a one-to-one basis. A computer program called an assembler or assembly program is used to translate each symbolic language instruction into its equivalent machine-language instruction.

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10 See CONTU Final Report, supra note 7, at 53. "A source code is a computer program written in any of several programming languages employed by computer programmers." Id. at 53 n.127.
11 Stern, supra note 4, at 2.
12 MacGrady, supra note 7, at 1035-36.
13 A "floppy disk" is a flexible magnetic disk that stores information in concentric tracks of tiny magnetized regions. Note, supra note 4, at 1725 n.20. At this stage, the computer program is an exact copy of the author's original expression that has merely been electronically recorded in a manner similar to videotape or sound recording. Note, supra note 1, at 178.
14 See J. Boyce, Microprocessor and Microcomputer Basics 266 (1979); G. Shelly & T. Cashman, Introduction to Computer Programming Structured COBOL 2.21 (1977). "An object code is the version of a program in which the source code language is converted or translated into the machine language of the computer with which it is to be used." CONTU Final Report, supra note 7, at 54 n.128.
A computer does not record numbers or letters; it stores data electronically by sensing the presence or absence of electronic impulses generated by the program. The basic unit for storing data in a computer is the bit (binary digit), which can assume one of two possible values: "on" and "off." The computer's electronics identify the status of each bit, which is the basis for storing data in the main computer.

Data is represented in binary code by a series of eight bits. These combinations, commonly known as bytes, are used to represent all the numbers, letters, and symbols needed to process data on a computer system. The binary language of object code in its written version uses a series of "ones" and "zeroes" that correspond to the "on" and "off" electrical impulses that the computer will sense to execute the program. Thus, each phase of the program (flowchart, source program, object program) is an expression of the same list of instructions.

After being translated into object code, a computer program may be stored in a number of different medias such as printed form, punched cards, magnetic disks, silicon chips, or bubble memories. A common device for internal storage of a computer program is the ROM (Read Only Memory). A ROM is a silicon chip comprised of thousands of semiconductor transistors enclosed in an outer package that is plugged into the circuit boards of the computer. The ROM contains programming instructions, commonly called microcode, that are imprinted on the chip by photochemical process or electrically when it is manufactured. A computer can only read the program embodied in a ROM, it cannot be reprogrammed. A ROM is

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16 Id. at 510. See P. Freeman, Software Systems Principles 437 (1975).
18 R. Krutz, supra note 9, at 4.
21 Variations on the ROM include the PROM, a "programmable read only memory," which can be obtained as a "blank" and coded permanently by the user, and the EPROM, an "erasable programmable read only memory," which can be coded by the user in a permanent form and subsequently erased and reprogrammed. PROMs and EPROMs can be programmed at any time by a special device such as a ROM programmer or ROM duplicator, but not by the computer. D. McGlynn, Personal Computing 20-22 (1979); R. Verzelio & J. Reutter, III, supra note 9, at 181; Koenig, supra note 4, at 366-67.
22 "[O]bject code is not the ROM itself, but is stored in the ROM, much the same way it could be stored on a magnetic storage disk. While a ROM physically appears to be mechanical part, it is no more mechanical than a magnetic storage disk or a phonograph
considered to be a nonvolatile storage device; when the computer is turned off; the ROM will retain the information stored in it.\textsuperscript{23}

The copyright on a program stored in a ROM may be infringed in a number of ways: programming the computer to print out the contents of the ROM, programming a PROM from a ROM chip, duplicating the contents of the ROM with a development machine, or transferring the contents of the ROM to another ROM through a computer or a ROM duplicator.\textsuperscript{24} Moreover, the copyright holder's exclusive right to prepare derivative works\textsuperscript{25} is infringed by printing and then translating the computer language from one form to another, by photographing the ROM and producing an identical chip, or by making the changes necessary to adopt the program to run on a different computer.\textsuperscript{26}

ROMs are commonly referred to as firmware: software that is stored in hardware form. This combination represents a medium of expression different from that which has previously been encountered and has caused considerable confusion in the application of copyright law to computer programs stored in ROMs. Much of this confusion arises from the terms used and from a lack of understanding of the nature and function of a ROM.\textsuperscript{27}

III. Recent Revisions of the Copyright Act

Another source of confusion in applying copyright law to computer programs has been the recent revisions of the copyright law.\textsuperscript{28} The 1909 Copyright Act\textsuperscript{29} was completely revised by the Copyright record." Note, Copyright: Computer Firmware: Is It Copyrightable?, 36 Okla. L. Rev. 119, 128 (1983).

\textsuperscript{23} Another kind of memory in computers is a random access memory (RAM). A RAM is a volatile memory; it will store information only as long as the computer is on. When the power is turned off, the information stored in the RAM is lost. A RAM is more versatile than a ROM because the computer can erase it and write onto it new instructions or data. J. Frates & W. Moldrup, Introduction to the Computer: An Integrative Approach 355-54 (1980); R. Krutz, supra note 9, at 5; Koenig, supra note 4, at 366-67. See also Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1243 (3d Cir. 1983).

\textsuperscript{24} See Note, supra note 2, at 490-91.

\textsuperscript{25} The owner of a copyright has the exclusive right "to prepare derivative works based upon the copyrighted work." 17 U.S.C. § 106(2) (1982). The right to prepare derivative works includes the right to translate, reproduce, abridge, condense, recast, transform, adapt, revise, annotate, or elaborate upon the copyrighted work or to make any other modification that, as a whole, represents the original work of authorship. See 17 U.S.C. § 101 (1982) (definition of "derivative work").

\textsuperscript{26} See Comment, Copyright Protection for Programs Stored in Computer Chips: Competing with IBM and Apple, 7 Hamline L. Rev. 103, 108 (1984).

\textsuperscript{27} See Note, supra note 22, at 119.

\textsuperscript{28} Copyright law has its foundation in the United States Constitution, which states: "The Congress shall have Power ... To Promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." U.S. Const. art. 1, § 8, cl. 8.

Act of 1976, which was amended in 1980 with provisions applicable to computer programs.

The drafters of the 1909 Act did not envision the creation of computers and computer programs. The 1909 Act adopted the *White-Smith Publishing Co. v. Apollo* test for an infringing copy of a copyrighted work. The Supreme Court in *White-Smith* held that a piano roll was not an infringing copy of the copyrighted sheet music, because the perforated rolls of paper formed part of the machine, and the music visually could not be perceived as the original work. The Court reasoned that a copy in a medium that does not communicate in terms of human perception is not an infringement of the reproduction right. Thus, prior to the 1976 Act, reproduction of a copyrighted work from a medium that did not communicate directly to human senses was not a copyright infringement of the original work.

In 1964 the Copyright Office began accepting registrations of computer programs as literary works under its rule of doubt, provided they contained sufficient original authorship, had been published with the required copyright notice, and copies submitted for registration were in human-readable form. The significance of these registrations in terms of copyright protection, however, was never definitely decided, because their validity was never challenged administratively or in the courts.

In 1976 Congress revised the Copyright Act and greatly broadened the scope of copyright protection in many areas. The 1976 Act did not enumerate computer programs as copyrightable subject matter, but certain definitional references and legislative history indicate that Congress intended to extend copyright protection to computer programs. The Copyright Office focused on two issues with respect to the registrability of computer programs: (1) whether a program as such is the ‘writing of an author’ and thus copyrightable, and (2) whether a reproduction of the program in a form actually used to operate or be ‘read’ by a machine is a ‘copy’ that can be accepted for copyright registration.
licated that Congress intended to protect such works.\textsuperscript{38} Section 102 of the Act modified the subject matter of copyright to include “all 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.”\textsuperscript{39} Congress intentionally left the phrase “original work of authorship” undefined to preserve the originality requirement developed under the common law\textsuperscript{40} and to protect new forms of expression created by technological advances.\textsuperscript{41} Section 102, however, identifies music, literary works, and dramatic works as acceptable works of authorship.\textsuperscript{42} The definition of literary works includes works “expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the nature of the material objects . . . in which they are embodied.”\textsuperscript{43} The legislative history of the Act indicates that this definition was intended to include computer programs “to the extent that they incorporate authorship in the programmer’s expression of original ideas.


Works of authorship include: (1) literary works; (2) musical works, including any accompanying words; (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works; (5) pictorial, graphic, and sculptural works; (6) motion pictures and other audiovisual works; and (7) sound recordings. 17 U.S.C. § 102(a) (1982). The House Report states that these categories are “illustrative and not limitative,” and “do not necessarily exhaust the scope of the original works of authorship that the bill is intended to protect.” Rather, the list sets out the general area of copyrightable subject matter, but with sufficient flexibility to free the courts from rigid or outmoded concepts of the scope of particular categories. House Report, supra note 35, at 53, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5666.


\textsuperscript{41} The House did not want to “freeze the scope of copyrightable subject matter at the present stage of communications technology. . . .” House Report, supra note 35, at 53, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5666. See also M. Nimmer, supra note 37, at § 2.03 [A], at 2-25 (Congress intended flexible definition for copyrightable works).


\textsuperscript{43} Id. § 101 (definition of “literary work”). Source code and object code easily fall within the phrase “words, numbers or other verbal or numerical symbols or indicia.”
as distinguished from the ideas themselves."

For infringement purposes, the 1976 Copyright Act limits copyright protection to works that have been "fixed in a tangible medium of expression when its embodiment in a copy . . . is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration." In a somewhat circular fashion, the 1976 Act further defines a copy as "a material object in which a work is fixed by any method now known or later developed, and from which can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device." The term "copy," as so defined, implicitly abrogates the White-Smith requirement of human perception and eliminates from copyright consideration the form in which the original work is embodied. Thus, before a work can be protected by copyright, it must be "fixed" in a "copy" so that it is susceptible to being communicated or reproduced.

The 1976 Act also sets out the limitations of copyright. A fundamental principle of copyright law is that copyright protects only the expression of ideas and not the ideas themselves. This principle, known as the idea/expression dichotomy, is codified in section 102(b), which states that "[i]n 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 a work." Therefore, with respect to computer

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46 Id. (definition of "copy").
47 Addressing the "with the aid of a machine or device" language, the House Report expressed the intention that this language be read broadly, so as to "avoid the artificial and largely unjustified distinctions, derived from cases such as White-Smith Publishing Co. v. Apollo Co. . . . under which statutory copyrightability in certain cases has been made to depend upon the form or medium in which the work is fixed." House Report, supra note 35, at 53, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5665. See also Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1248 (3d Cir. 1983) ("[I]t is clear from the language of the 1976 Act and its legislative history that it was intended to obliterate distinctions engendered by White-Smith.").
49 Comment, supra note 26, at 105. "The term 'copies' includes the material object . . . in which the work is first fixed." 17 U.S.C. § 101 (definition of "copy").
50 See Baker v. Selden, 101 U.S. 99 (1879) (copyright on book explaining bookkeeping system did not protect the system but only the literary matter expressing the system).
51 See Comment, supra note 26, at 105.
52 17 U.S.C. § 102(b) (1982). "Section 102(b) is intended, among other things, to make 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." House Report, supra note 35, at 56-57, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5670. "Section 102(b) in no way enlarges or contracts the scope of copyright protection under the present law. Its purpose
programs, the "expression adopted by the programmer is the copyrightable element in a computer program, and the actual process or method in the programs are not within the scope of copyright law." Thus, computer programs are copyrightable only to the extent that they incorporate authorship in the programmer's original expression of ideas.

A closely related doctrine is the idea/expression identity. It provides that "copyrighted language may be copied without infringing when there is but a limited number of ways to express a given idea." Thus, where the idea and the expression are merged or inseparable, there can be no copyright infringement.

A second limitation on copyright protection is the principle that protection extends only to the author's expression, not to the mechanical or utilitarian portions of an article. Section 101 sets out this distinction between the copyrightable expression and the uncopyrightable utilitarian aspects of a work. Copyright law makes useful articles works of authorship only "insofar as their form but not their mechanical or utilitarian aspects are concerned" and only to the extent that their design incorporates features that can be identified separately from and exist independently of the articles' utilitarian aspects. Consequently, only those components of a ROM embodying a work of authorship apart from the medium's utilitarian aspects are entitled to copyright protection.

Although the 1976 Act extended copyright protection to computer programs, the scope of that protection was left undefined. In debating amendment of the Act, Congress recognized that the protection is to restate, in the context of the new single Federal system of copyright, that the basic dichotomy between expression and ideas remains unchanged." Id. 53


54 The Commission explained that the idea/expression identity exception is the "logical extension of the fundamental principle that copyright cannot protect ideas." CONTU FINAL REPORT, supra note 7, at 50. The idea/expression identity has been described as a test for infringeability whereas the idea/expression dichotomy is a test for Copyrightability. See Comment, supra note 26, at 105 n.16.

55 See Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738 (9th Cir. 1971) (jeweled bee pin expression inseparable from the idea); Morrissey v. Proctor & Gamble Co., 379 F.2d 675 (1st Cir. 1967) (sweepstakes contest rules were not copyrightable because idea and expression were inseparable). "When the idea and its 'expression' are thus inseparable copying the 'expression' will not be barred, since protecting the 'expression' in such circumstances would confer a monopoly of the 'idea' upon the copyright owner free of the conditions and limitations imposed by the patent law." See, e.g., Fred Fisher Music Co. v. Dillingham, 298 F. 145 (S.D.N.Y. 1924) (copyright protects only against copying and not against independent creation of the same work).

56 Mazer v. Stein, 347 U.S. 201 (1954) (Court upheld the copyright for a sculptural work that had been incorporated in a useful article).

57 17 U.S.C. § 101 (1982) ("A 'useful article' is an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or convey information.").

posed revisions failed to address the problems unique to the information processing field. Fearing premature change and inadequate treatment of the copyright problem as it related to computer uses of copyrighted works, Congress decided to maintain the status quo until further study could be completed.59

Previously, Congress had entrusted the responsibility for framing legislative recommendations in this area to the National Commission on New Technological Uses of Copyrighted Works (CONTU), which had the broad mandate to gather information and make specific recommendations on legislation concerning the reproduction and uses of copyrighted works of authorship in computer systems.60 Consequently, the 1976 Act contained a specific provision that preserved the previous law as it related to scope of protection accorded copyrighted works used in conjunction with computers, pending completion of CONTU’s study.61 This section created a problem initially in applying the language of the revised statute to object code. Because White-Smith and the 1909 Act required that a “copy” be in a


Since it would be premature to change existing law on computer uses at present, the purpose of Section 117 is to preserve the status quo. It is intended neither to cut off any rights that may now exist, nor create new rights that might be denied under the Act of 1909 or under common law principles currently applicable.

Id.


1. the reproduction and uses of copyrighted works of authorship—
   (a) in conjunction with automatic systems capable of storing, processing, retrieving, and transferring information; and
   (b) by various forms of machine reproduction by or at the request of instructors for use in face to face teaching activities; and

2. the creation of new words by the application or intervention of such automatic systems of machine reproduction . . . .

Id. See also Note, supra note 8, at 403.

61 Section 117 states:

Scope of Exclusive Rights: Use in Conjunction with Computers and Similar Information Systems

Notwithstanding the provisions of Sections 106 through 116 and 118, this title does not afford to the owner of copyright in a work any greater or lesser rights with respect to the use of the work in conjunction with automatic systems capable of storing, processing, retrieving, or transferring information, or in conjunction with any similar device, machine or process, than those afforded to works under the law, whether title 17 or the common law or statutes of a state, in effect on December 31, 1977 as held applicable and construed by a court in an action brought under this title.


Section 117 applied, however, only to the scope of protection to be accorded copyrighted works used in conjunction with a computer and not to the copyrightability of computer programs. The House Report notes that “[w]ith respect to the copyrightability of computer programs, the ownership of copyrights in them, the term of protection, and the formal requirements of the remainder of the bill, the new statute would apply.” House Report, supra note 35, at 116, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5731.
form intelligible to humans, some people interpreted section 117 to mean that machine-readable object code was not considered to be a "copy" within the meaning of the statute.62

CONTU submitted its final report to Congress in July 1978, and Congress adopted its recommendations in the 1980 Computer Software Act.63 The Software Act repealed the troublesome status quo provision, section 117 of the 1976 Act, and substituted a new section 117 specifying certain limitations on the rights of computer program owners.64 The Software Act permits the owner of a computer program to make another copy or adaptation to facilitate its use or guard against damage or destruction.65 Listing only two exceptions, Congress implicitly made any other copying or adaptation of a program an infringement of the copyright owner's exclusive right to reproduction.66 The Software Act also added a new definition to section 101: "A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."67

The explicit purpose of the 1980 amendment was to extend


The new copyright law should be amended: (1) to make it explicit that computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright; (2) to apply to all computer uses of copyrighted programs by the deletion of the present § 117; and (3) to ensure that rightful possessors of copies of computer programs may use or adapt these copies for their use.

CONTU Final Report, supra note 7, at 1.

64 Section 117 Limitations on exclusive rights: Computer Programs

Notwithstanding the provisions of section 106, it is not an infringement for the owner of a copy of a computer program to make or authorize the making of another 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, or

(2) that such new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful.

Any exact copies prepared in accordance within the provisions of this section may be leased, sold, or otherwise transferred, along with the copy from which such copies were prepared, only as a part of the lease, sale or other transfer of all rights in the program. Adaptations so prepared may be transferred only with the authorization of the copyright owner.


65 Id.


copyright protection to computer programs.\textsuperscript{68} Two factors, however, have restricted the scope of the amendment. First, the Commission in its final report, vacillated on the issue of duplication of object code stored in ROMs, ultimately leaving the issue to the courts.\textsuperscript{69} Second, and more important, is the strong dissent of Commissioner Hersey from the final recommendations.\textsuperscript{70} Hersey drew a distinction between the written and mechanical forms of computer programs, stating that copyright protection should not extend to a computer program in the form in which it is capable of being used to control computer operations.\textsuperscript{71} He contended that a computer program in its object form "is a machine control element, a mechanical device, having no purpose beyond being engaged in a computer program to perform mechanical work."\textsuperscript{72} This argument is based on the distinction between a work intended for human perception and a utilitarian object. Thus, Hersey viewed a computer program not as a writing that sets forth instructions, but as the mechanical embodiment of the instructions themselves.

Hersey further noted that the expression in the original writing that communicates to human perception is lost once a program is placed in a computer in object form; "work is its only utterance and its only purpose."\textsuperscript{73} Hersey also emphasized that even if a computer program is a writing, it is not copyrightable because it is addressed to and communicates with machines instead of human beings. "The computer program communicates, if at all, with only a machine."\textsuperscript{74}


\textsuperscript{69} The CONTU majority observed that "[c]opyright, therefore protects the program so long as it remains fixed in a tangible medium of expression but does not protect the electro-mechanical functioning of a machine." CONTU Final Report, supra note 7, at 21. In its summary, CONTU pointed out that it had not resolved the issues raised by programs imprinted on ROMs. "It is equally important to note that these recommendations do not deal with each and every technological issue affecting the interests of copyright users and owners. Specific topics may deserve congressional attention . . . (2) protection for topography or layout of microcircuit chips. Id. at 79. See Note, Microcomputer Emulation: Protecting Manufacturers from Computer Copying, 17 Suffolk L. Rev. 656, 672 (1983).

\textsuperscript{70} CONTU Final Report, supra note 7, at 69-93 (Hersey, Comm'r, dissenting). Commissioner Nimmer, concurring in the majority opinion, suggested that protection should be extended to only those computer programs "which produce works which themselves qualify for copyright protection . . ." not to those programs whose "operations do not result in copyrightable works." CONTU Final Report, supra note 7, at 68. The majority, however, rejected that view: "This distinction is not consistent with the design of the 1976 Act, which was clearly to protect all works of authorship . . ." Id. at 53.

\textsuperscript{71} Id. at 2.

\textsuperscript{72} Id. at 70.

\textsuperscript{73} Id. at 72.

\textsuperscript{74} Id.
Hersey maintains that extending copyright protection to computer programs in object form "would mark the first time copyright had ever covered a means of communication, not with the human mind and senses, but with machines." Thus, although Congress adopted the CONTU majority position extending copyright protection to computer programs, the issues of human intelligibility and utilitarian function have influenced the interpretation and restricted the application of the 1976 Act and the 1980 amendments in copyright infringement cases involving computer programs stored in ROM.

IV. Recent Developments in Copyright Case Law

The first case arising under the Copyright Act of 1976, Data Cash Systems, Inc. v. JS&A Group, Inc., involved the direct copying of a ROM. Plaintiff Data Cash manufactures and sells "Compu-Chess," a hand-held computerized chess game. The computer's program, which instructs the computer how to play chess at six different levels of difficulty, is stored in a ROM chip and installed in the computer's circuitry. In late 1978, plaintiff began marketing "Compu-Chess" without the copyright notice on the game or its packaging. The copyright notice, however, did appear on the source program which had been registered with the copyright office. The alleged infringement occurred in late 1978 when defendant JS&A began marketing the "Chess Computer," a less expensive game containing a ROM identical to the one in plaintiff's game.

The district court held that copyright protected programs in their flowchart, source, and assembly forms and assumed that defendant directly had copied plaintiff's ROM to produce its game. The court, however, refused to order a preliminary injunction restraining the sale of the "Chess Computer." Interpreting section 117 of the 1976 Act as a broad moratorium to preserve the status quo of copyright protection for computer programs as it existed prior to the effective date of the revision, the court decided that the 1909 Act, and not the 1976 Act, applied. Relying on the reasoning employed in White-Smith and embodied in the 1909 Act, the court denied copyright protection to plaintiff's ROM, holding that because it was in a form imperceptible to the human eye, the computer program in its

75 Id. at 69-70.
76 480 F. Supp. 1063 (N.D. Ill. 1979), aff'd on other grounds, 628 F.2d 1038 (7th Cir. 1980).
77 480 F. Supp. at 1065.
78 Id. at 1066.
79 Id.
80 Id. at 1068. Judge Flaum concluded that a computer program in its flowchart or source phase is a copy of a computer program because they are comparable technical writings. Id.
81 Id. at 1066-67.
object form was "a mechanical tool or machine part," not a "copy" within the meaning of the 1909 Act.\textsuperscript{82}

In controversial dictum, the district court stated that copying a ROM would not be an infringement under the 1976 Act. The court noted that object code in ROM is essentially a "mechanical device," not a work of authorship, and therefore, not entitled to copyright protection.\textsuperscript{83}

The Seventh Circuit affirmed the district court decision on alternative grounds.\textsuperscript{84} The court agreed that the 1909 Act, and not the 1976 Act, applied, but upheld the decision on the grounds that plaintiff had forfeited any infringement claim it had by failing to place the required copyright notice anywhere on the machine or chip.\textsuperscript{85} Although the court avoided the "copy" issue by deciding the case on other grounds, implicitly it ruled on the issue, because when a work is published, there is an underlying supposition that what was published was a "copy" of the work.\textsuperscript{86}

In \textit{Stern Electronics, Inc. v. Kaufman}\textsuperscript{87} the court ruled that the output of the computer program in a video game, the audiovisual display, satisfied the statutory requirements of fixation and originality, and therefore, qualified for copyright protection. Plaintiff Stern had exclusive license to distribute the video game, Scramble, in North and South America. Plaintiff failed to register the computer program used to implement the game, but had filed a videotape of the game's audiovisual display with the copyright office.\textsuperscript{88} Plaintiff alleged that defendant had infringed his copyright by marketing a game with an identical audiovisual display.\textsuperscript{89}

The district court issued a preliminary injunction after ruling that under sections 101 and 102 of the 1976 Act, the audiovisual display of a video game is copyrightable as an audiovisual work.\textsuperscript{90} The court also held that copying the audiovisual display of a video game constitutes an infringement regardless of whether the game's underlying computer program has been copied in any form.\textsuperscript{91}

On appeal, defendant claimed that plaintiff's game was not copyrightable, because the audiovisual display neither was an "origi-
nal work of authorship" nor "fixed in any tangible medium of expression" within the meaning of the statute.\textsuperscript{92} Defendant based these arguments on the fact that the visual images in play mode varied with each player's participation.\textsuperscript{93} The court held that although the sequence of some of the images appearing on the screen during the play of the game varied depending upon the actions taken by the player, "many aspects of the sights and sequence of appearance remained constant during each play, . . . and that the repetitive sequence of a substantial portion of the sights and sounds of the game qualifies for copyright protection as an audiovisual work."\textsuperscript{94}

Second, the court found that the game's memory devices satisfied the statutory requirement of a "copy" in which the work is "fixed," because the audiovisual work is embodied permanently in a material object, the ROM, from which it can be perceived with the aid of the other components of the game.\textsuperscript{95} Thus, Stern provides that actions for copyright infringement can be brought for duplication of the computer program or its output.

The first case to consider whether a computer program stored in a ROM inside a computer could be copyrighted and infringed was Tandy Corp. v. Personal Micro Computers, Inc.\textsuperscript{96} Plaintiff Tandy sued defendant, a competitor in the personal computer market, for copyright infringement and other acts of unfair competition. Tandy alleged that defendant had duplicated the input-output program contained in its home computer, the TRS-80, for use in their own computer, the PMC-80.\textsuperscript{97} The program that translated the programmer's source code into machine-readable object code was stored permanently on a ROM chip in the computer. Tandy registered the source program with the Copyright Office and claimed that defendant copied the program and then imprinted the copy on another ROM after changing any indicia of Tandy ownership.\textsuperscript{98}

Defendant moved to dismiss Tandy's copyright infringement claim, contending that "ROM chips are not copies of the original computer program within the meaning of the federal copyright laws and that therefore a ROM chip which is a copy of another ROM chip does not infringe the copyright covering the original program."\textsuperscript{99}

In considering defendant's contention, the court's analysis centered on sections 101 and 102 of the 1976 Act.\textsuperscript{100} First, the court

\textsuperscript{92} 669 F.2d at 855.
\textsuperscript{93} Id.
\textsuperscript{94} Id. at 856.
\textsuperscript{95} Id. at 855 & n.4.
\textsuperscript{97} Id. at 173.
\textsuperscript{98} Id.
\textsuperscript{99} Id.
\textsuperscript{100} Id. See 17 U.S.C. §§ 101, 102 (1982).
inquired as to whether a computer program is a “work of authorship” subject to copyright protection. Second, it questioned whether a silicon chip is a “tangible medium of expression” so as “to make a program fixed in that form subject to copyright laws.”

After reviewing the legislative history of the Copyright Act, the Tandy court expressly repudiated the Data Cash dicta interpreting section 117 to require application of pre-1978 law. Without distinguishing among the various program languages, the court held that all computer programs were “works of authorship” and “subject to copyright protection under the law as it existed prior to the 1976 Act, as well as under the new statute.” Turning to the fixation requirement, the court emphasized that “fixed in any tangible medium of expression” includes material objects that can be “perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device.” The court also noted that the legislative intent was to ignore the form in which the work was fixed. Consequently, the court concluded that because a computer can execute a program imprinted on a silicon chip, a computer program stored in ROM meets the statutory requirement of fixation and is therefore a “copy” of the original program, and any duplication of the chip is an infringement.

The court also noted that, as a matter of public policy, interpreting the copyright to permit a competitor lawfully to copy the object code from a silicon chip would render copyright protection for com-

101 Id.
103 524 F. Supp. at 174. “Section 177 modified only sections 106 through 116 and 118, which are the sections concerned with the scope of copyright protection.” Id. “[S]ection 117 makes clear on its face that its direction to apply pre-1978 law is not to apply to sections 101 and 102 of the act, which . . . clearly allows a program in this form [ROM] to be copyrighted and protected.” Id. See House Report, supra note 35, at 116, reprinted in 1976 U.S. Code Cong. & Ad. News 5659, 5731. Finally, the court concluded that section 117 was only addressed “to the problems surrounding the input of properly obtained copyrighted materials.” Id.
104 Id. at 173.
105 Id. (quoting 17 U.S.C. § 102(a) (1982)).
106 Id. The court cited the legislative history which indicated the expansive nature of the definition of “fixed”:

Under the bill it makes no difference what the form, manner, or medium of fixation may be—whether it is in words, numbers, notes, sounds, pictures, or any other graphic or symbolic indicia, whether embodied in a physical object in written, printed, magnetic, or other stable form, and whether it is capable of perception directly by means of any machine or device “now known or later developed.”

puter programs "virtually meaningless." The court further stated that the revised Act was not intended to provide a "loophole" through which a competitor could duplicate with impunity a computer program stored in "read-only memory."

The Tandy reasoning subsequently was adopted in GCA Corp. v. Chance, which held that object code was a copy of source code and protected under the source code copyright. GCA, a manufacturer of machines used to process silicon wafers for the creation of integrated circuits, sought to enjoin defendants from reproducing its computer programs in object form. Though registered in source code with the Copyright Office, the programs were employed in plaintiff's machine in object form. Defendants, several former employees who had access to the program, admitted copying it in object code, but contended that the object form in ROM was not a copy under the copyright laws and that copyrighting the source code did not protect the object code.

The GCA court issued a preliminary injunction after determining that "source code falls within the protection of copyright laws as a work of authorship fixed in any tangible medium of expression from which it can be perceived, reproduced, or otherwise communicated." The court reasoned that "[b]ecause the object code is the encryption of the copyrightable source code, the two are to be treated as one work; therefore, copyright of the source code protects the object code as well." The court was not persuaded by defendants' reliance on the Data Cash dicta, noting that the Seventh Circuit disregarded the district court's contention that a ROM is not a copy under the copyright laws.

The Third Circuit Court of Appeals in Williams Electronics, Inc. v. Artic International Inc. was the first appellate court to consider the issue whether duplication of the object form of a computer program infringes the copyright in the written program. Plaintiff Williams manufactures and sells video games that are controlled by a computer program in object form, a ROM. In 1980 Williams introduced the popular video game, Defender, and obtained copyright registrations on its computer program, audiovisual attract mode, and

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108 Id. at 175. See M. Nimmer, 2 Nimmer on Copyright, § 8.08, at 8-106.3 to 8-106.4 (1983).
109 Id.
111 Id. at 719.
112 Id.
113 Id.
116 Id.
117 685 F.2d 870 (3d Cir. 1982).
118 Id. at 871-72.
audiovisual display mode. Copyright notices were displayed prominently on the game's cabinet and on the screen during the attract and play modes. Other notices were affixed to the ROM's outer casing and within the computer program stored in the ROM. Defendant Artic manufactures electronic video game components, one of which, when connected with the game's other components, produces a visual display identical to plaintiff's Defender game.

The district court held that defendant had "copied substantial portions of the plaintiff's computer program for the game Defender and that such copying constitutes an infringement of plaintiff's computer program." The court issued a permanent injunction prohibiting further sale of the infringing components.

On appeal, the Third Circuit rejected defendant's arguments against copyrightability and reached the same conclusion as Tandy and GCA, ruling that a computer program stored in a ROM is a copy of a copyrighted work. First, defendant claimed that there could not be copyright protection for the game's video display, because the images in both the attract mode and the play mode are transient, and therefore, the work fails to meet the 1976 Act's fixation requirement. Citing provisions of the 1976 Act regarding audiovisual works and prior holdings establishing the copyrightability of both the attract and play modes of video games, the court rejected defendant's argument, stating that the fixation requirement is satisfied whenever a work is "sufficiently permanent or stable to permit it to be . . . reproduced, or otherwise communicated for more than a transitory period." The court reasoned that because the videogame's original audiovisual features repeated themselves over and over, the video game's original display satisfied the statutory definition of an original audiovisual work, and

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119 Id. at 872. "The 'attract mode' refers to the audiovisual effects displayed before a coin is inserted into the game. It repeatedly shows the name of the game, the game symbols in typical motion and interaction patterns, and the initials of previous players who have achieved high scores." Id. at 872 n.2. "The 'play mode' refers to the audiovisual effects displayed during the actual play of the game, when the game symbols move and interact on the screen, and the player controls the movement of one of the symbols . . . ." Id. at 872 n.3.

120 Id.

121 Id. at 872-73.


123 Williams, 685 F.2d at 871.


125 217 U.S.P.Q. 718 (N.D. Cal. 1982).

126 685 F.2d 870 (3d Cir. 1982).

127 Id. at 873.


130 Williams, 685 F.2d at 874.
that the memory device, a ROM, met the statutory requirement of a copy in which the work is fixed.\textsuperscript{131}

The court also rejected the defendant's contention that the player's participation in the play mode eliminates copyright eligibility because there is no set or fixed performance and the player becomes a co-author of what appears on the screen.\textsuperscript{132} The court stated that, although the audiovisual presentation of the play mode changes in some respects in response to the player's varying participation, "there is always a repetitive sequence of a substantial portion of the sights and sounds of the game, and many of the aspects of the display remain constant regardless of how the player operates the controls."\textsuperscript{133}

Defendant further contended that a ROM is a utilitarian device or a machine part used to control the activities of a machine, and therefore, not within the scope of the 1976 Copyright Act.\textsuperscript{134} The court rejected defendant's reasoning by drawing a critical distinction between a ROM and its contents: Williams was not trying to protect the ROM itself, but was instead seeking to protect only its copyrighted program embodied in the ROM. Because William's program was the expression of an original work of authorship that had met the statutory fixation requirement through their embodiment in ROM, the court concluded that the program was subject to copyright protection.\textsuperscript{135}

Finally, defendant claimed that a distinction should be drawn between the "source code" version of a computer program, which can be afforded copyright protection, and the object form, which cannot be protected, because a "copy" for infringement purposes must be fixed in a material object that is intended as a medium of communication to human beings.\textsuperscript{136} Rejecting defendant's argument, the court held that the 1976 Act sought to prevent infringement of a computer program by copying the object form, and cited the statute's broad definition of "copy" as a material object in which a work is fixed "by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."\textsuperscript{137} The court noted that the legislative history of the 1976 Act

\textsuperscript{131} Id.
\textsuperscript{132} Id.
\textsuperscript{133} Id.
\textsuperscript{134} Id.
\textsuperscript{135} Id. at 874-75. Although the court believed that the legislative history and the CONTU Report suggested that computer programs had already been covered under the 1976 Copyright Act, it did not consider the scope of prior acts for purposes of affirming the injunction order. Instead, the court held that the 1980 amendments firmly established the copyrightability of computer programs. Id. at 875.
\textsuperscript{136} Id. at 876-77.
\textsuperscript{137} Id. at 877 (quoting 17 U.S.C. § 101 (1982)).
expanded the scope of the “fixation” and “copy” requirements to encompass technological advances represented by electronic devices such as ROMs, and was intended to eliminate the artificial and largely unjustified distinction created by cases such as White-Smith.\(^\text{138}\)

Thus, the court concluded that the statutory requirements of “fixation” and “copy” were satisfied, and therefore, that computer programs in object form stored in ROM were copies protected by the 1976 Act.\(^\text{139}\) The court further reasoned that, as a matter of public policy, to hold otherwise “would afford an unlimited loophole by which infringement of a computer program is limited to copying of the computer program text, but not to duplication of a computer program fixed on a silicon chip.”\(^\text{140}\)

Copyright protection for computer programs stored in ROMs was further ensured in Midway Manufacturing Co. v. Strohon.\(^\text{141}\) Plaintiff Midway, manufacturer of the immensely popular PAC-MAN video game,\(^\text{142}\) alleged that defendant Strohon had infringed its copyrighted object code computer program by marketing a modification kit designed to “speed up” the PAC-MAN game.\(^\text{143}\) Defendant argued that a computer program in object code stored in a silicon chip is a form of computer circuitry or hardware, and therefore, is an unprotectible utilitarian object.\(^\text{144}\)

The court held that although defendant’s modification kit did not infringe the game’s copyrighted audiovisual component, it did infringe plaintiff’s “literary works” copyright, because it was substantially similar to the computer program stored in ROM in plaintiff’s game.\(^\text{145}\) According to the court, the current copyright legislation is intended to protect object code as well as source code, and machine-readable object code is a work of authorship that can be perceived with the aid of a machine or device, and therefore, is protectible by copyright.\(^\text{146}\) Also, copyright protection would be meaningless if object code, which is a direct transformation of a computer program in source code, could be freely reproduced without constituting an


\(^{139}\) Williams, 685 F.2d at 877.

\(^{140}\) Id.

\(^{141}\) 564 F. Supp. 741 (N.D. Ill. 1983).


\(^{143}\) 564 F. Supp. at 744. The purpose of a modification fit is to complicate and speed up the action of the game to make it more difficult for practiced players. By decreasing the time of each play and increasing the number of plays, “speed-up” kits make modified video games more profitable. Id.

\(^{144}\) Id. at 751.

\(^{145}\) Id. at 746-49.

\(^{146}\) Id. at 750. Focusing on § 101’s definition of a computer program as a set of instructions to be used directly in a computer to achieve a certain result, the court found it apparent that a computer program in object code is used directly by a computer in carrying out its operations. Id.
infringement.\footnote{Id. "To allow protection of the source code version of a program would be pyrrhic indeed if the object code version, the mechanical implementation of the same program, stored and marketed on discs or tapes, for example, could be freely reproduced without constituting an infringement." Id.}

The \textit{Midway} court used similar reasoning to find object code in ROMs to be copies under the statute. Comparing ROMs with magnetic tape and floppy disks, the court reasoned that because the function of each material object is to store information that directs the operation of a computer, it would be anomalous to provide copyright protection on the basis of the program's storage medium.\footnote{Id. at 751-52.}

Two recent cases, \textit{Apple Computer, Inc. v. Formula International}\footnote{562 F. Supp. 775 (C.D. Cal. 1983), aff'd, 725 F.2d 521 (9th Cir. 1984).} and \textit{Apple Computer, Inc. v. Franklin Computer Corp.},\footnote{545 F. Supp. 812 (E.D. Pa. 1982), rev'd and remanded, 714 F.2d 1240 (3d Cir. 1983), cert. dismissed, 104 S. Ct. 690 (1984).} both involving Apple software, have considered not only the copyrightability of computer programs in ROM, but also the more problematic issue whether certain kinds of computer programs—operating system programs as distinguished from application programs—are proper subject matter for copyright protection.\footnote{Operating system programs generally manage the internal functions of the computer or facilitate use of application programs. These programs allow the computer and its components to work together by controlling the operations between the peripheral equipment, such as the video monitor, disk drives, and printer, and the computer. Operating system programs also provide compatibility between the computer and other software manufactured in the general market place by translating those programs from higher-level languages to machine-language object code. In contrast, application programs usually perform a specific task for the computer user, such as word processing, checkbook balancing, record maintenance, payroll calculation, or playing a video game. Application programs can be used by a computer only in conjunction with an operating system program. \textit{See} J. \textsc{Frates} & W. \textsc{Moldrup}, \textit{supra} note 23, at 240-42; G. \textsc{Shelly} & T. \textsc{Cashman}, \textit{supra} note 14, at 2.19; \textit{Comment}, \textit{supra} note 26, at 112 nn.59-60. \textit{See generally} Apple \textit{Computer, Inc. v.} Franklin \textit{Computer Corp.}, 714 F.2d 1240, 1243-44 (3d Cir. 1983); Apple Computer, Inc. \textit{v.} Franklin \textit{Computer Corp.}, 545 F. Supp. 812, 813-15 (E.D. Pa. 1982), \textit{rev'd and remanded}, 714 F.2d 1240 (3d Cir. 1983).}

In \textit{Formula} Apple brought suit for copyright and trademark infringement after defendant Formula International began selling a computer kit under the trademark, "Pineapple." The Pineapple computer kit contained operating programs embodied in ROMs and diskettes that were identical to the programs used to control plaintiff's computer, the Apple II.\footnote{562 F. Supp. at 777.} Apple charged that Formula violated its copyright on the various computer programs embodied in the Apple ROMs and diskettes.\footnote{Id.} In defense, Formula contended that operations programs that are essential to the operation of the computer and do not create visually perceptible images or expressions, as distinguished from application programs, are not
Drawing on the language of the Copyright Act, its legislative history, and public policy, the court held that all computer programs, fixed in any medium, are protected under copyright law regardless of their purpose or function. Reviewing the Copyright Act, the court found that computer programs stored in ROM fit within the Act's definition, and therefore, are protected. Citing prior judicial interpretations, the court specifically noted that a computer program stored in ROM is a "work of authorship" and "a tangible medium of expression" and that the expression of a program in source code or object code is protected as a "copy." Thus, a computer program stored in ROM is included within the terms of the Act.

Defendant Formula also contended that computer programs that are essential to the operation of the computer and that do not create visually perceptible images or expressions are not copyrightable. The Formula court rejected defendant's argument, reasoning that although operating systems do not produce a direct visual expression, they communicate information. The court stated that "all computer programs as embodied in ROMs and diskettes are designed to operate a machine in such a way as to ultimately produce some useful communication to the user," whether the program directly communicates with the user or merely directs certain machine functions which eventually result in that expression.

The court thus concluded that there was no statutory authority suggesting different treatment for functionally different computer programs.

Turning to the Act's legislative history, the court declared that "[i]t is crystal-clear that CONTU recommended that all computer programs, fixed in any method and performing any function, be included within copyright protection. There likewise can be no doubt but that Congress accepted that recommendation as embodied in the 1980 Amendment to the copyright law." The court also rejected defendant's public policy argument that

154 Id. at 779-80.
155 Id. at 778-82.
156 Id. at 779.
158 562 F. Supp. at 779-80.
159 Id. at 780.
160 Id.
161 Id.
162 Id. at 781. In rejecting defendant's distinction between operation and application programs, the Formula court relied on the conclusions of the CONTU majority:
issuing a preliminary injunction would preserve Apple’s market position and hinder competition. The court stated that the phenomenal growth of the computer equipment and software industry contradicted defendant’s suggestion that Apple was capable of “dominating such an expanding market.” Furthermore, it would be to Apple’s advantage to have a greater variety of compatible programming software available for the owners of its computers. The court stated “that numerous methods exist for writing the programs involved here that would be ‘98% compatible’ with Apple’s computers, yet not so similar as to infringe its copyright.” Concluding that defendant was free independently to create programs to perform the same function as Apple software, the court warned, however, that defendant may not do so by directly copying plaintiff’s programs. To do so, the court reasoned, would permit defendant to misappropriate plaintiff’s substantial research and development costs, and thus, hinder rather than promote competition and innovation in the computer software market. Therefore, Apple was entitled to an injunction on copyright grounds.

In the Franklin case Apple sought injunctive relief against defendant Franklin, which allegedly had copied fourteen Apple programs and incorporated them into its own personal computer, the ACE 100. The Apple programs in issue were expressed in object code, some stored in floppy disks, and others embodied in ROMs.

This distinction is not consistent with the design of the Act of 1976, which was clearly to protect all works of authorship from the moment of their fixation in any tangible medium of expression. Further, it does not square with copyright practice past and present, which recognizes copyright protection for a work of authorship regardless of the uses to which it may be put. The copyright status of the written rules for a game of system for the operation of a machine is unaffected by the fact that those rules direct the actions of those who play the game or carry out the process. Nor has copyright been denied to works simply because of their utilitarian aspects. It follows, therefore, that there should be likewise no distinction made between programs which are used in the production of further copyrighted works and those which are not.

Id. at 781-82 (quoting CONTU FINAL REPORT, supra note 7, at 21).

163 Id. at 782-83.
164 Id. at 782.
165 Id.
166 Id. Judge Hill continued that “[i]f there were only one or two ways to write a program for a particular function, then extending copyright protection to the program might in effect give its author a patent on the idea itself. But those facts do not exist in this case.” Id.
167 Id. at 783. Although the court found for the plaintiff, it expressed reservations as to the adequacy of copyright protection for computer programs. The court suggested that a hybrid or entirely new form of protection be created, but that the legislature, not the court, would be the proper forum for that determination. The court concluded, however, that “to the extent [the court] is free to express public policy, its choice is to place computer programs into an existing category of legal protection as against affording them no protection at all.” Id.
169 Id. at 812-13.
within Apple's computer.\footnote{170}

The district court refused to grant a preliminary injunction, expressing "doubt as to the copyrightability of the programs described in this litigation."\footnote{171} Despite an extensive analysis of the 1976 Act, its legislative history, and prior cases, the court was unable to determine whether programs in object form were protected under copyright law.\footnote{172} The court found that the statute and accompanying legislative history were unclear as to the applicability of copyright law to ROMs and object code.\footnote{173} The court narrowed the issue to whether computer programs are the fixed expression of an author's original work. The court concluded that "[i]t is not clear whether the program-designer's idea of the operating system, the source program or the ROM is the original work of authorship."\footnote{174}

The court then focused on the issues of utilitarian function and human perception. Viewing a ROM as a pictorial three-dimensional object rather than a literary work, the court held that "ROMs encoded within an object program may be compared to a physical structure with an essential useful purpose or function . . . . As such, an object program encoded on a ROM would not be entitled to copyright protection."\footnote{175} Finally, as to whether object code is an expression, the court stated that copyright law only protects expressions directed to a human audience and not to "programs created by a computer to run other computers."\footnote{176}

Expanding on its decision in Williams, the Third Circuit reversed, holding that a computer program in object code embedded in a ROM chip is subject to copyright protection.\footnote{177} Unable to determine the basis for the district court decision,\footnote{178} the court identified three issues for review: (1) whether copyright can exist in a

\begin{itemize}
\item \textit{Id.} at 815-16.
\item \textit{Id.} at 812.
\item \textit{Id.} at 820-25.
\item \textit{Id.}
\item \textit{Id.} at 820.
\item \textit{Id.} at 823.
\item \textit{Id.} at 825. The court stated that copyright protection extended only to the fixed expression of human languages, not machine language:
\end{itemize}

\begin{quote}
To go beyond the bounds of this protection would be ultimately to provide copyright protection to the programs created by a computer to run other computers. With that, we step in the world of Gulliver where horses are "human" because they speak a language that sounds remarkably like the one humans use. It is an intriguing analogy but false.
\end{quote}


\footnote{177} 714 F.2d 1240 (3d Cir. 1983), cert. dismissed, 104 S. Ct. 690 (1984).

\footnote{178} 714 F.2d at 1246. The court interpreted the decision of the district court as the expression of "a series of generalized concerns which may have led the court to its ultimate conclusion," rather than a holding. \textit{Id.} The court stated that "there is no finding, statement, or holding on which clearly sets forth the district court's view." \textit{Id.}
computer program expressed in object code; (2) whether copyright can exist in a computer program embedded in a ROM; and (3) whether copyright can exist in an operating system program.\textsuperscript{179}

The court summarily rejected defendant Franklin's initial argument that a computer program expressed in object code, as distinguished from source code, is not subject to copyright protection.\textsuperscript{180} After reviewing the broad language of the 1976 Act, the 1980 amendments, the CONTU Report, and Williams, the court held that a computer program, whether in source code or object code, is an original work of authorship fixed in a tangible medium of expression perceivable directly or with the aid of a machine or device, and therefore, is protected under the Copyright Act as a "literary work."\textsuperscript{181} The court further held that a computer program in object code embedded in a ROM chip also is an appropriate subject of copyright, because it falls within the statutory requirement of fixation.\textsuperscript{182}

The court then addressed an issue of first impression: whether operating system programs, as distinguished from application programs, are the proper subject of copyright.\textsuperscript{183} First, relying on Section 102 and Baker v. Selden,\textsuperscript{184} Franklin contended that operating system programs are excluded per se from copyright protection, because such programs are a "process," "system," or a method of operation that might be patented but cannot be copyrighted.\textsuperscript{185} Second, defendant argued that under the idea/expression dichotomy, as embodied in section 102(b), operating system programs are ideas and are not copyrightable.\textsuperscript{186} In the most comprehensive opinion to date, the court dismissed each of defendant's arguments.

First, while the court agreed that copyright law protects only the expression of a process or method and not the process or method itself, it found that defendant had misapplied the distinction, because plaintiff sought only to copyright the program's instruction themselves, and not the actual method, which instructs the computer to perform its operating function.\textsuperscript{187} The court further found defendant's distinction between copyrightable application programs and noncopyrightable operating system programs inconsistent, because defendant conceded that application software is copyrightable, and that both kinds of programs instruct the computer to perform a par-

\textsuperscript{179} Id.
\textsuperscript{180} Id. at 1246-47.
\textsuperscript{181} Id. at 1246-49.
\textsuperscript{182} Id. at 1249. Accord Williams, 685 F.2d at 876; Tandy, 524 F. Supp. at 173.
\textsuperscript{183} Id. at 1249.
\textsuperscript{184} 101 U.S. 99 (1879) (copyright does not protect ideas).
\textsuperscript{185} 714 F.2d at 1250.
\textsuperscript{186} Id.
\textsuperscript{187} Id. at 1250-51. The court stated that "the method would be protected, if at all, by the patent law, an issue as yet unresolved. . . ." Id. See Diamond v. Diehr, 450 U.S. 175 (1981).
The instructions are protected, not the “process.” Therefore, the court concluded that both operating system programs and application programs are protected under copyright law regardless of their specific function or purpose.\textsuperscript{189}

In a similar “process” argument, defendant contended that an operating system program stored in a ROM or other storage medium is a machine or machine part, and therefore, not protected by copyright law.\textsuperscript{190} The court stated that defendant mistakenly focused on the physical characteristics of the instructions. Comparing ROMs and other storage media, the court emphasized that the “medium is not the message” and held that the copyrightability of a computer program does not depend on the medium in which the program is stored.\textsuperscript{191}

In its final “process” argument, defendant argued that operating system programs cannot be copyrighted, because they are “purely utilitarian works.”\textsuperscript{192} Citing \textit{Mazer v. Stein}\textsuperscript{193} and the CONTU Report, the court stated that the intended use or use in industry of a program does not bar copyright protection, and that a program used in the implementation of a process is copyrightable.\textsuperscript{194} The court further supported its rejection of the defendant’s process claims by indicating that the statutory definition of a computer program—a set of instructions to be used in a computer to bring about a certain result—makes no distinction between application programs and operating system programs.\textsuperscript{195}

Second, Franklin claimed that, based on the idea/expression dichotomy, operating system programs are excluded from copyright protection, because they are ideas that merged with their expression—they could be written only in one way.\textsuperscript{196} Noting the difficulty in articulating the difference between an idea and an expression, the Franklin court attempted to strike a balance between the competing considerations of free competition and copyright protection.\textsuperscript{197}

\textsuperscript{188} \textit{Id.} at 1251.
\textsuperscript{189} \textit{Id.} The court concluded there is “no reason to afford any less copyright protection to the instructions in an operating system program than to the instructions in an applications system program.” \textit{Id.}
\textsuperscript{190} \textit{Id.}
\textsuperscript{191} \textit{Id.}
\textsuperscript{192} \textit{Id.}
\textsuperscript{193} 347 U.S. 201 (1954) (copyrightability is not precluded if the copyrighted work is put to a utilitarian use).
\textsuperscript{194} 714 F.2d at 1252. To support its conclusion, the court referred to the CONTU majority’s finding that copyright practice “recognizes copyright protection for a work of authorship regardless of the uses to which it may be put” and concluded “that the words of a program are used ultimately in the implementation of a process should in no way affect their copyrightability.” \textit{Id.} (quoting CONTU FINAL REPORT, supra note 7, at 21). \textit{Accord Formula}, 562 F. Supp. at 784.
\textsuperscript{195} 714 F.2d at 1252.
\textsuperscript{196} \textit{Id.}
\textsuperscript{197} \textit{Id.} at 1253.
court focused pragmatically on whether the underlying idea is capable of various modes of expression, reasoning that if only one of a few other expressions are possible for a particular idea, the expression is “necessarily dictated by the underlying subject matter,” and therefore, the idea and expression have merged and are not protected by copyright.\textsuperscript{198} Although unable to decide the issue on the record before it, the court established its own test for merger: “If other programs can be written or created which perform the same function as . . . Apple’s operating system program, then that program is an expression of the idea and hence copyrightable.”\textsuperscript{199}

Finally, the court rejected Franklin’s argument that regardless of whether Apple’s programs can be rewritten, granting them a copyright would be protecting an idea, because only a limited number of ways exist “to arrange operating systems to enable a computer to run the vast body of Apple-compatible software.”\textsuperscript{200} Holding that the commercial and competitive objective of achieving total compatibility with Apple software is not to be considered when making an idea/expression merger determination, the court stated that “the idea which may merge with the expression, thus making the copyright unavailable, is the idea which is the subject of the expression,” not the idea of how to arrange a particular operating system to accommodate Apple-compatible software.\textsuperscript{201}

Before Franklin could be heard on remand, the parties settled, and the case was dismissed.\textsuperscript{202} The merger question, however, was considered in the appeal of the Formula case.\textsuperscript{203} Affirming the district court’s decision, the Ninth Circuit ruled that copyright protection obtains for operating system computer programs under the language of the Copyright Act, its legislative history, and case law. Thus, according to the Ninth Circuit, operating system programs are copyrightable expressions of ideas, not uncopyrightable ideas or processes.\textsuperscript{204} The court again rejected Formula’s contention that programs are copyrightable if they interact directly with the computer user, but not if they simply manage the computer system, stating that no such distinction exists under the copyright law. The court found that the Act “makes no distinction between the


\textsuperscript{199} Id. “In essence, this inquiry is no different than that made to determine whether the expression and idea have merged, which has been stated to occur where there are no or few other ways of expressing a particular idea.” Id.

\textsuperscript{200} Id.

\textsuperscript{201} Id.

\textsuperscript{202} In January 1984 the parties announced the settlement of Apple’s suit for $2.5 million. Franklin agreed also not to infringe Apple’s copyrights in the future subject to Franklin’s right to dispose of its inventory. Wall St. J., Jan. 5, 1984, at 10.

\textsuperscript{203} 725 F.2d 521 (9th Cir. 1984).

\textsuperscript{204} Id.
copyrightability of those programs which directly interact with the computer user and those which simply manage the computer system." Moreover, Congress considered and rejected excluding protection for operating system programs when it extended copyright protection to all computer programs. The court also stated that the Copyright Act has never "required that the expression be communicated to a particular audience." 

The court also answered the question left open by the Franklin dismissal: whether operating system programs are ideas capable of only one mode of expression. Applying the Franklin merger test, it held that Apple's operating system programs are not uncopyrightable ideas or processes, because there were numerous methods of writing programs to perform the same functions. The court found instead that Apple's operating programs are copyrightable expressions of an idea, because Apple's copyright only protects its particular set of operating instructions, and not the underlying computer process.

V. Conclusion

These recent judicial decisions have strongly affirmed that computer programs are proper subject matter of the copyright laws. Courts have extended this protection to programs represented in both source code and object code, to programs in ROM, and to operating system programs as well as application programs. The copyrightability of computer programs in object code in ROM is consistent with and supported by the 1976 Act, the 1980 Amendments, and the attendant legislative history. Computer programs in ROM meet the statutory requirements of originality and fixation.

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205 Id. at 523-24.
206 Id. at 524.
207 Id. at 525.
208 Id. The district court had reached the same conclusion. See supra note 166 and accompanying text. One witness testified at a CONTU meeting that a computer program can be written in an infinite number of ways in principle and in hundreds of ways in practice. CONTU FINAL REPORT, supra note 7, at 20 n.108 (testimony of Dan McCracken, vice president, Association for Computing Machinery). Because the ideas used in a computer program can be expressed in several ways, copyright protection does not "threaten to block the use of ideas or program language previously developed." Id. at 20. See M. Nimmer, supra note 37, § 2.18 [C][2], at 2-202 (no system or method can be performed with a single form of expression).
209 Id.
210 See supra note 5.
211 Congress has taken further steps to ensure protection for new technologies. In July 1984 a bill was introduced in the House to expand copyright protection for computer software. H.R. 6024 would revise the definition of "computer program" and add new definitions for "program description," "support material," and "computer software." The amendment would define a "computer program" as "a set of instructions capable, when incorporated in a machine-readable medium, of causing a machine having information processing capabilities to perform or achieve a particular function, task or result." The amendment would also add "computer software" to the list of copyrightable subject
in a tangible medium or form. The authorship of a computer program in ROM is embodied in the programmer's original written computer instructions. This authorship consists of the symbolic representation of a set of instructions in a particular computer language. This authorship expressed in "words, numbers, or other verbal or numerical symbols or indicia" clearly falls within the Act's definition of "literary work." These representations include both the original writing in the English-like form of source code and the ones and zeroes of object code. The production of object code is merely the mechanical transformation of source code into another computer language. While the letters, numbers, and symbols of the various program languages are dissimilar, the underlying expression remains the same. Thus, a computer program should not lose copyright protection as it proceeds through its developmental stages.

Computer programs in ROM also meet the statutory requirement of fixation. The definition of "copy" and the description of authorship state that copyright protection subsists in authorship fixed in a permanent and tangible medium of expression from which the work "can be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device." The form of the medium of expression of the authorship is irrelevant so long as the program can be reproduced with the aid of a machine or device. Computer programs in ROM can be reproduced by printing out its contents or displaying them on the computer's video terminal. Thus, because computer programs in object code in ROM embody original works of authorship and satisfy the statutory requirement of fixation, they are a proper subject matter of copyright law.

Some commentators argue that the proviso that a work must be in a form from which it can be "perceived, repro-

matter in section 102 (b) of the Copyright Act. 1984 COPYRIGHT L. REP. (CCH) ¶ 20,271, at 10,721-25.

On November 9, 1984, the President signed the Semiconductor Chip Protection Act of 1984. The new Act defines "mask works" and "semiconductor products" and gives owners exclusive rights to reproduce, import, and distribute mask works. The Act creates a new form of protection separate from copyright protection that protects mask works fixed in a semiconductor chip product for a ten-year period. The new Act also permits reverse engineering. 1984 COPYRIGHT L. REP. (CCH) ¶ 20,263, at 10,663-68.


213 Note, supra note 1, at 179.


215 Davidson, supra note 212, at 667.


217 Davidson, supra note 212, at 662.

218 See, e.g., Stern, ROMs in Search of a Remedy: Can They Find It?, 1 COMPUTER L. REP. 4, 6-7 (1982).

duced, or otherwise communicated” creates a requirement of direct human intelligibility. That is, a work must be intended to communicate the author’s original expression directly to the human senses to qualify as a protected copy under the statute. This interpretation is incorrect for several reasons. First, it is inconsistent with prior copyright practice. The Copyright Act extends protection to many works that were not intended to communicate any original expression. Compilations of facts, such as telephone directories, that are intended to convey only factual data to the user, are copyrightable even though the facts themselves are not original, copyrightable expressions. Moreover, other works that convey no expression at all have been copyrighted so long as the original authorship subsists in the work itself.

Second, the human intelligibility requirement misconstrues the language of the statute. The Act does not require a copy to be communicative. The fixation requirement and the definition of “copy,” phrased in the disjunctive, require only that a work be capable of being “perceived, reproduced, or otherwise communicated . . . .” Reproduction is sufficient; communication and perception are not required. Works can be reproduced from ROMs with the aid of a machine or device. A computer easily can reproduce a copy of the object code in ROM by printing it out or displaying it on a video terminal. These expressions are sufficient reproductions, because there is no requirement within the statute that the reproduction be in the same medium of expression. Moreover, even if the statutory language were interpreted to require communication to humans, it would be satisfied, because skilled programmers are capable of understanding computer programs written in object code.

Third, the view that copyright protects only works intended to communicate an original expression to humans wrongly forces a computer program to qualify as both an audiovisual work and a literary work. These are two separate categories of copyrightable works of authorship, and there is no basis under the statute for requiring that a literary work produce any output to receive copyright

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224 Brooks, Object Code in ROM: Is It Really a Problem?, in COMPUTER LAW INSTITUTE 335, 359-60 (P.L.I. 1983). See also Davidson, supra note 212, at 653; Note, supra note 4, at 1791.
225 See Davidson, supra note 212, at 662-63, 675.
protection. Thus, a computer program in ROM need not produce any output; it is sufficient that the original written program it embodies is found to consist of authorship.

Finally, the human intelligibility argument ignores the legislative intent and statutory construction of the 1976 Act. The legislative history shows that Congress intended to protect all computer programs as literary works regardless of their medium or form and overrule the White-Smith requirement of human perception. In addition, the statutory phrases, "with the aid of a machine or device," "now known or later developed," and "by any method" represent Congress' intent to protect new forms of expression created by technological advances.

Some litigants have argued that because object code in ROM can be used directly in a computer, it is a machine part protected by patent not copyright law. This argument misconstrues what the copyright protects, because it fails to distinguish the medium of expression from the work of authorship contained therein. Copyright prohibits only the copying of the writing stored within the mechanical medium; it does not protect the medium itself. Computer programs are symbolic, not mechanical. Although ROMs are used in conjunction with machines, they contain writings that are separate and exist independently from the chip itself. These works of authorship Congress intended to protect, not the particular mechanical configuration embodying the writing. Section 202 of the 1976 Act codifies this distinction between copyright in the work of authorship and the material object that embodies the work.

Furthermore, the extension of copyright to computer programs in ROM is analogous to copyright of programs on magnetic tapes and disks, which are mentioned as copies and fixations by Congress. The form of embodiment is irrelevant: copyright protection depends only on whether the material object embodies an original work of authorship.

Copyright protection for object code in ROM is also implicit in the 1980 amendment, which defines a "computer program" as "a set of statements or instructions to be used directly or indirectly in a

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228 Davidson, supra note 212, at 674; Note, supra note 4, at 1732.
230 See supra note 47 and accompanying text.
231 Brooks, supra note 224, at 359. See Williams, 685 F.2d at 877.
232 See Rodau, supra note 66, at 548 (ROM is not a machine part or utilitarian object, it is merely a device that embodies copyrightable subject matter).
233 The Act's legislative history notes: "The principle restated in section 202 is a fundamental and important one: that copyright ownership and ownership of a material object in which the copyrighted work is embodied are entirely separate things." House Report, supra note 35, at 124, reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5739.
234 Brooks, supra note 224, at 365.
computer in order to bring about a certain result.”

This definition is functional rather than formal; “[i]t does not define computer
program with respect to a certain form of the program or a certain
type of program.” It requires only that a certain function be per-
formed. This definition naturally includes object code in ROMs that
are used directly in a computer.

Other litigants have asserted that computer programs in ROM
are useful articles, and that to extend copyright protection would re-
sult in a monopoly of the art or idea embodied in the work. Copy-
right protection extends only to the particular expression of an idea,
not to the idea itself. The useful article doctrine encompasses
“pictorial, graphic, and sculptural works” and provides that such
works are copies only to the extent that they embody separate copy-
rightable features. This doctrine, however, does not apply to
computer programs that are literary, not pictorial, graphic, or sculp-
tural works. Thus, any such analysis is inappropriate in the case
of computer programs in ROM.

A final argument is that computer programs in ROM are
processes, systems, or methods of operation that are not copyright-
able. This argument again misconstrues the scope of copyright. The
programmer’s expression is the only copyrightable element of a
computer program and the actual processes or methods employed
by the program are not covered by copyright law. The program-
mer’s expression is not the process, but a symbolic representation of
the process. It represents how the process or method of operation
will proceed when the program is executed, but it is not the process
or method of operation itself.

Failure to extend copyright protection to computer programs in
ROM would severely limit protection to all forms of computer pro-
grams. The purpose of the 1976 Act and 1980 amendment was to
extend copyright protection to all computer programs regardless of
their form or function. Copyright protection of computer programs
in ROM reflects Congress’ “receptivity to new technologies and its
desire to encourage through the copyright laws, continued imagina-
tion and creativity in computer programming.” Protection of
ROMs is not a corruption of copyright law; ROMs merely represent
another in the series of advances in communications technology
which has resulted in the continual expansion of the number of

236 Davidson, supra note 212, at 654-55.
238 See id. § 101 (definition of “useful article”).
239 Brooks, supra note 224, at 363; Davidson, supra note 212, at 672.
240 Rodau, supra note 66, at 547.
241 Davidson, supra note 212, at 660.
242 Franklin, 714 F.2d at 1253-54. See also Formula, 562 F. Supp. at 783.
forms of expression or media included as copyrightable subject matter.

—ANDREW COGDELL