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NOTES

COPYRIGHTABILITY OF COMPUTER OPERATING SYSTEMS

Federal copyright law¹ prohibits unauthorized copying of original works

1. 17 U.S.C. § 102(a) (1982). The copyright clause of the Constitution authorizes Congress to secure for authors the exclusive rights to their writings for limited times. U.S. CONST., Art. I, sec. 8, cl. 8. Copyright reflects the economic philosophy that encouragement of individual efforts through personal gain advances the public welfare by assuring that authors receive rewards commensurate with their endeavors. *Mazer v. Stein*, 347 U.S. 201, 219 (1954); *Imperial Homes Corp. v. Lamont*, 458 F.2d 895, 898 (5th Cir. 1972). The first federal copyright statute, which Congress enacted in 1790, protected only maps, charts, and books. Act of May 31, 1790, 1 Stat. 124. Since 1790, Congress periodically has expanded the scope of copyright protection in response to technological advances and societal demands. See Act of April 29, 1802, 2 Stat. 171 (historical and other prints); Act of Feb. 3, 1831, 4 Stat. 436 (musical compositions); Act of Aug. 18, 1856, 11 Stat. 138 (public performance of printed drama); Act of March 3, 1865, 13 Stat. 540 (photographs and negatives); Act of July 8, 1870, § 86, 16 Stat. 198, 212 (paintings, drawings, chromos, statues, and statuary intended as works of fine art).

In 1909, Congress enacted a major revision of the federal copyright law by explicitly including motion pictures, compilations and periodicals, and speeches in the scope of copyright. See Copyright Act of 1909 (1909 Act), Pub. L. No. 60-349, 35 Stat. 1075. The 1909 Act granted authors the exclusive right to copy their works for a period of 28 years from the date of first publication of the work. *Id.* § 24. At the expiration of the first 28 year period of copyright protection, the copyright owner could renew the copyright for an additional 28 years simply by filing an application for renewal with the copyright office of the Library of Congress. *Id.* The 1909 Act only protected works that an author fixed in a medium of expression from which a human being could perceive the work without the aid of special training or equipment. See *White-Smith Music Pub. Co. v. Apollo Co.*, 209 U.S. 1, 17-18 (1908) (punched paper roll designed to operate mechanical player piano did not constitute protectible copy since human being could not perceive music without special training). Moreover, the 1909 Act protected an author's writings only when an author published his work. See 1909 Act, § 10, Pub. L. No. 60-349, 35 Stat. 1075. The 1909 Act reserved for authors an enumerated list of exclusive rights, including the rights to copy, print, reprint, publish, vend, and translate the work. *Id.* § 1. State common-law copyright protected unpublished works and categories of works that the 1909 Act did not protect. See *Goldstein v. California*, 412 U.S. 546, 558 (1973) (state law prohibiting unauthorized duplication of phonograph records and tapes did not violate supremacy clause of Constitution even though federal copyright law did not prohibit duplication).

In 1976, Congress revised the federal copyright law to provide copyright protection to a broad category of works that Congress denominated as original works of authorship. See Copyright Act of 1976 (1976 Act) § 102(a), Pub. L. No. 94-553, 90 Stat. 2541 (codified at 17 U.S.C. § 102(a) (1982)) (copyright subsists in original works of authorship); KITCH & PERLMAN, *LEGAL REGULATION OF THE COMPETITIVE PROCESS* 622-23 (1979) (1976 Act changed basic structure of American copyright law). Although the 1976 Act defines several categories of works of authorship, such as literary, musical, and dramatic works, Congress did not intend the enumeration of categories to be exclusive. See 17 U.S.C. § 102(a) (1982) (works of authorship include enumerated categories). Under the 1976 Act, the subject matter of copyright may include forms

of authorship.² A copyright owner's rights arise when he fixes his works in any tangible medium of expression.³ Copyright protects an author's form of expression, but does not grant an author a monopoly over the idea that the work expresses.⁴ Copyright seeks to advance the public welfare by ensuring that authors receive compensation that reflects the author's originality and

of authorship unforeseen when Congress adopted the act. *See* H.R. REP. 1476, 94th Cong., 2d Sess. 51 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5664 (authors continually develop new and unforeseeable forms of expression that copyright protects).

Under the 1976 Act, federal copyright protection attaches as soon as an author fixes his work in a tangible medium of expression. 17 U.S.C. § 102(a) (1982). Furthermore, the 1976 Act expressly preempts the application of state copyright laws to subject matter within the scope of federal copyright protection. *Id.* § 301. Since federal copyright attaches at the time an author fixes a work in a tangible medium of expression, state law can provide little, if any, protection to works of authorship. *See* KITCH & PERLMAN, *supra*, at 624 (state law may protect works conceived but not reduced to writing or otherwise recorded).

The 1976 Act protects copyrighted works for the life of the author plus fifty years or, in the case of corporate or anonymous authors, seventy-five years from the date of fixation of the work. 17 U.S.C. § 302 (1982). The 1976 Act reserves for authors a short list of broadly defined exclusive rights. *Id.* § 106. Authors retain the exclusive right to exploit their works by reproduction, preparation of derivative works, distribution of copies, performance, and display. *Id.* Rather than enumerating an exhaustive list of exclusive rights, as Congress did in the 1909 Act, in the 1976 Act Congress enunciated broad, exclusive exploitation rights along with a specific list of limitations on the author's right to maintain the exclusivity of his work. *Id.* §§ 106-108; *see* KITCH & PERLMAN, *supra*, at 622-23 (guiding principle of 1976 Act is that owner has exclusive right to exploit work).

2. *See* Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 102-03 (2d Cir. 1951) (originality means that work owes its origin to its author). In the context of copyright law, an author's work is original if the work is more than a mere copy of another work. *Id.*; *accord* Franklin Mint Corp. v. National Wildlife Art Exch., 575 F.2d 62, 65 (3d Cir.), *cert. denied*, 439 U.S. 880 (1978). The originality requirement does not demand ingenuity, novelty, or aesthetic merit. H.R. REP. No. 1476, 94th Cong., 2d Sess. 51 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5664; *see* Catalda, 191 F.2d at 102-03 (originality requires no large measure of novelty); *accord* Sid & Marty Krofft Television Prods., Inc. v. McDonald's Corp., 562 F.2d 1157, 1163 n.5 (9th Cir. 1977).

3. 17 U.S.C. § 102(2) (1982). The fixation requirement, which acts as a prerequisite to statutory copyright protection, requires an author to record his work in some stable medium. H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5665. A work is fixed when the work is sufficiently permanent or stable to permit perception, reproduction, or communication of the work for more than a transitory duration. 17 U.S.C. § 101 (1982). The 1976 Act expressly recognizes that an author may fix his work in a tangible medium of expression even though a machine or device is necessary to perceive the work. *Id.* § 102(a). Phonorecords, magnetic tapes and disks, and computer punch cards are several examples of acceptable media that require the use of special equipment to perceive the copyrighted work. *Id.* § 101; H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS, 5659, 5665. A particular medium of expression may qualify under the 1976 Act even though the medium is not yet in existence. 17 U.S.C. § 102(a) (1982); H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5665.

4. 17 U.S.C. § 102(b) (1982); *see* Baker v. Selden, 101 U.S. 99, 101 (1879) (use of accounting system does not infringe copyright owner's form of expression); *infra* notes 41-49 and accompanying text (discussing dichotomy between idea and expression).

creativity.⁵ The Copyright Revision Act of 1976 (1976 Act)⁶ encompasses various forms of expressions, including computer programs.⁷ A computer program is the set of instructions that a computer programmer writes which cause a computer to react in a certain manner.⁸ The extension of copyright protection to computer software⁹ has forced the federal judiciary to examine the esoteric details of computer technology.¹⁰ To date, the judicial foray into this technical minutiae has resulted in broad protection for computer software.¹¹ Several courts recently have held that copyright protects even the operating system of a computer.¹² These recent decisions raise the issue of

5. *Mazer v. Stein*, 347 U.S. 201, 219 (1954).

6. Pub. L. No. 94-553, 90 Stat. 2541 (1976) (codified as amended at 17 U.S.C. (1982)); see *supra* note 1 (discussing major aspects of 1976 Act).

7. See 17 U.S.C. § 101 (1982) (defining computer program as set of instructions that bring about certain results when used in computer); *Tandy Corp. v. Personal Micro Computers, Inc.*, 524 F. Supp. 171, 173 (N.D. Cal. 1981) (computer programs are works of authorship under 1976 Act); *infra* notes 14-40 and accompanying text (discussing computer terminology).

The terms "computer" and "computer program" are subject to a variety of definitions depending on the conceptual perspective and purposes of the person using the terms. Rosen, *Software*, in *ENCYCLOPEDIA OF COMPUTER SCIENCE* 1283 (A. Ralston & C. Meek eds. 1976). One may view a computer merely as a piece of hardware that stores and manipulates electrical impulses. *Id.* From a more conceptual perspective, one may think of a computer as a structured composite of hardware and software layers. H. LORIN & H. DEITEL, *OPERATING SYSTEMS I* (1981); see *infra* notes 14-40 and accompanying text (describing computer hardware and software). People typically use the term computer, however, to refer to the physical aspects of the computer system, which also is known as hardware. See *FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS* 9-11 (1978) (referring to computers as machines) [hereinafter cited as *CONTU FINAL REPORT*]. Computer programs refer to the written instructions that, when converted into electrical impulses, operate the computer. See *id.*; *infra* notes 32-40 and accompanying text (describing computer software).

8. See *infra* notes 32-40 and accompanying text (discussing computer software).

9. See *infra* notes 32-40 and accompanying text (computer software includes computer programs).

10. See, e.g., *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1254 (3d Cir. 1983) (computer operating systems are copyrightable), *cert. dismissed*, 104 S.Ct. 690 (1984); *Williams Elecs., Inc., v. Artic Int'l, Inc.*, 685 F.2d 870, 877 (3d Cir. 1982) (computer programs expressed in object code are copyrightable); *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 752 (N.D. Ill. 1983) (object code program fixed in read-only memory of computer is copyrightable); *infra* notes 25-31 and accompanying text (read-only memory stores permanent information); *infra* notes 38-40 and accompanying text (object code constitutes machine-readable phase of computer program); *infra* note 33 (operating system controls internal management of computer). See generally Note, *Copyright Protection of Computer Program Object Code*, 96 HARV. L. REV. 1723 (1983) [hereinafter cited as *Object Code*]; Note, *Copyright Protection for Computer Programs in Read Only Memory Chips*, 11 HOFSTRA L. REV. 329 (1982) [hereinafter cited as *Memory Chips*].

11. See *infra* notes 136-146 and accompanying text (courts have protected all phases of computer programs regardless of storage medium).

12. See *Apple Computer, Inc. v. Formula Int'l, Inc.*, No. 83-5875, slip op. at 698 (9th Cir. Feb. 8, 1984) (copyright recognizes no distinction between operating system program and application program); *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1252 (3d Cir. 1983) (copyright does not distinguish between programs based upon program's function), *cert. dismissed*, 104 S.Ct. 690 (1984).

whether the courts have applied the copyright laws too generously and have granted benefits intended for developers of computer software to manufacturers of computer hardware.¹³

Microcomputer hardware consists of several components.¹⁴ The central processing unit (CPU) is the conceptual center of the computer.¹⁵ The CPU accepts, decodes, and executes instructions while controlling the timing of all processes within the computer.¹⁶ The CPU communicates with computer programmers and operators by accepting input from the operator's keyboard and writing output to the operator's video display terminal or printer.¹⁷ The CPU also responds to instructions and information that the CPU receives from other parts of the computer, such as the computer's random-access memory (RAM).¹⁸ RAM acts as the CPU's primary repository for information and instructions and contains thousands of distinct locations for the storage of the electrical signals that drive the computer.¹⁹ RAM allows the speedy storage, retrieval, and manipulation of information.²⁰

Since RAM stores information in the form of electrical impulses, which immediately fade as soon as the computer loses power or malfunctions, most

13. See *infra* notes 147-72 and accompanying text (discussing effect of extending copyright protection to computer operating systems).

14. See *infra* notes 15-28 and accompanying text (describing essential components of computer hardware); see also Wiatrowski & House, *Microcomputers and Programming*, in THE MCGRAW-HILL COMPUTER HANDBOOK, 25-1 (H. Helms ed. 1983) (microcomputers are computers in which central processing unit consists of single integrated circuit chip).

15. See A. KHAMBATA, MICROPROCESSORS/MICROCOMPUTERS: ARCHITECTURE, SOFTWARE AND SYSTEMS 8-9 (1982) (central processing unit and its components constitute fundamental building blocks of all digital computers). A digital computer is an electronic device that automatically executes a sequence of operations on given data. *Id.* at 6. The presence or absence of a single pulse of electricity that opens or closes the binary logic gates of the central processing unit (CPU) represents a binary digit, or bit, of information. *Id.* As a matter of convention, the computer industry has adopted the symbols of "1" and "0" to represent the presence or absence of an electrical pulse. See K. SHORT, MICROPROCESSORS AND PROGRAMMED LOGIC 146 (1981) (binary digits of 1 and 0 represent machine language of computer). A continuous group of eight bits constitutes a byte, or a single word in the computer's machine language. See A. KHAMBATA, *supra*, at 6 (group of bits constitutes word); Wiatrowski & House, *supra* note 14, at 25-8 (eight concatenated bits constitute a byte). Each byte of electrical impulses may constitute either an instruction, which directs the CPU to act in a certain manner, or information, which constitutes the data upon which the CPU acts. A. KHAMBATA, *supra*, at 6. Whether a particular byte constitutes an instruction or information depends upon the significance that a computer programmer attaches to the byte. Wiatrowski & House, *supra* note 14, at 25-8.

16. A. KHAMBATA, *supra* note 15, at 8. In addition to controlling the timing and synchronization of computer processes, the CPU performs all arithmetic operations within the computer. *Id.*

17. *Id.* at 19.

18. *Id.* at 7.

19. *Id.* The microcomputer's random-access memory (RAM) is a semiconductor chip or group of semiconductor chips that stores both instructions and information. *Id.* The CPU can assess information or instructions from any location in RAM in equal amounts of time. *Id.*

20. *Id.*

computers employ off-line storage devices that allow long-term retention of information.²¹ Floppy disks and cassette tapes constitute the most common off-line information storage media for microcomputers.²² Storage of information on magnetic media such as floppy disks or cassette tapes allows the computer to refresh its memory quickly, without requiring the computer operator to retype the data through the computer keyboard.²³ Moreover, off-line storage allows compatible microcomputer systems to exchange information.²⁴

In addition to RAM and disk or tape drives, most microcomputer hardware includes read-only memory (ROM) chips which permanently store information within the computer.²⁵ The ROM chip, unlike a magnetic tape or disk, resides within the computer's hardware.²⁶ To the untrained eye, the ROM chip is indistinguishable from any other integrated circuit located within the circuitry of the machine.²⁷ ROM functions similarly to RAM since the CPU may draw instructions from either RAM or ROM.²⁸ ROM differs from RAM in that the CPU may not write instructions in ROM, but may replace information or instructions in RAM at will.²⁹ More importantly, the information

21. See K. SHORT, *supra* note 12, at 355 (mass data storage systems allow storage and exchange of large quantities of information). The three most common types of mass storage media available for use with microcomputers are punched paper tape, cassette tapes, and floppy disks. *Id.* The paper tape medium consists of a roll or strip of paper or mylar plastic that contains punched holes which correspond to bits of data. *Id.* Cassette tapes are the familiar magnetized mylar tapes and plastic housings that comprise audio cassettes used in home stereos. Bartee, *The Memory Element*, in THE MCGRAW-HILL COMPUTER HANDBOOK, at 7-69, (H. Helms ed. 1983). Floppy disks are flexible disks of magnetized mylar that come in sizes of five-and-one-quarter or eight inches in diameter. *Id.* at 7-61.

Each off-line storage medium enjoys the advantage over RAM storage of being inexpensive and non-volatile. K. SHORT, *supra* note 15, at 355. A storage medium is non-volatile when the medium retains information even though the computer's power is off. *Id.* Most RAMs lose information when the computer loses power and, therefore, are volatile. A. KHAMBATA, *supra* note 15, at 192. The ability to store information off-line also provides the computer with access to more information than the computer could store at one time. K. SHORT, *supra* note 15, at 355; see A. KHAMBATA, *supra* note 15, at 7 (computer may acquire data from external storage sources when internal data memory is too small for given application).

22. See Bartee, *supra* note 21, at 7-61 (convenience and low price have broadened use of floppy disks).

23. See *id.* at 7-22 (computer operator may interchange floppy disks easily).

24. See K. SHORT, *supra* note 15, at 355 (compatibility of storage media facilitates exchange and portability of information).

25. See *id.* at 54 (read-only memories store permanent information).

26. See Bartee, *supra* note 21, at 7-31 (read-only memories constitute permanent component of computer's memory).

27. See *id.* (read-only memories are integrated circuit chips); see also *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 751 (N.D. Ill. 1983) (read-only memories are integral to circuitry of computer).

28. A. KHAMBATA, *supra* note 15, at 182. Read-only memory (ROM) shares with RAM the desirable characteristic of being able to provide information from any location in memory at the same rate of speed. *Id.*

29. See *id.* at 181-82 (CPU may read and write on RAM but only may read from ROM). The information stored in a given ROM chip is unalterable once the manufacturer completes the

in ROM does not disappear when the computer loses power.³⁰ ROM, therefore, permits the long-term storage of information that the computer uses frequently.³¹

The instructions and information that operate the computer hardware are called computer software.³² Software includes applications programs, which instruct the computer to perform specific tasks, and operating systems programs, which facilitate the development and use of applications programs.³³

ROM. *Stern Elecs., Inc. v. Kaufman*, 669 F.2d 852, 854 n.1 (2d Cir. 1982). Although information in ROM generally is permanent, several variations of ROMs exist that permit programming by someone other than the manufacturer. A. KHAMBATA, *supra* note 15, at 184. Programmable ROMs (PROMs) allow a programmer in the field to install a program using special equipment. *Id.* Like ROMs, a user may program a PROM only once. *Id.* A programmer may reprogram an erasable PROM (EPROM), however, by removing the EPROM chip from the computer and exposing the EPROM to ultraviolet light for fifteen to twenty minutes. *Id.* at 184-85. By using an electrically-erasable PROM (EEPROM), a programmer may reprogram the non-volatile memory with the chip still in the computer. Wheeler, *The Practical EEPROM*, in *BYTE*, July 1983, at 460. Some rewiring of the computer's circuitry, however, may be necessary to use an EEPROM. *Id.* at 460-61.

30. A. KHAMBATA, *supra* note 15, at 182; *see Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1243 n.3 (3d Cir. 1983) (loss of power erases information in RAM but does not affect ROM), *cert. dismissed*, 104 S.Ct. 690 (1984).

31. A. KHAMBATA, *supra* note 15, at 185. ROMs typically contain a variety of frequently used data such as trigonometric, multiplication, division, logarithm, and square root tables, as well as operating systems programs such as compilers and bootstrap loaders. *Id.*; *see infra* note 33 and accompanying text (operating systems programs manage internal functions of computer); *infra* notes 40-41 and accompanying text (compilers translate source code into object code); *infra* note 85 and accompanying text (bootstrap loader initiates computer's operation).

32. *See* 17 U.S.C. § 101 (1982) (computer program is set of instructions used directly or indirectly in computer to bring about certain result); *CONTU FINAL REPORT*, *supra* note 5 at 9-10 (computer programs consist of sets of instructions that one may use in limitless number of ways). Some commentators use the term software generally to refer to all aspects of a computer system that are not hardware. A. KHAMBATA, *supra* note 15, at 363. Other commentators, however, use the term software interchangeably with the term computer program. *See* Hamacher, Vranesic, & Zaky, *Software*, in *THE MCGRAW-HILL COMPUTER HANDBOOK*, at 8-1 (H. Helms ed. 1983) (software refers to programs that run on computer); *Wiatrowski & House*, *supra* note 14, at 25-4 (software refers to programs and hardware refers to logic circuits).

33. *See Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1243 (3d Cir. 1983) (computer programs constitute either applications software or operating systems software), *cert. dismissed*, 104 S.Ct. 690 (1984). Applications software includes programs that prepare payrolls, operate assembly lines, balance checkbooks, perform word processing, and play games. *See id.* (applications programs are programs which perform tasks that make computers worthwhile investments); *CONTU FINAL REPORT*, *supra* note 7, at 10.

In contrast, operating systems software comprises the tools that facilitate the development and use of application programs. A. KHAMBATA, *supra* note 15, at 367. A computer hardware manufacturer generally develops an operating system for use on a single computer and provides a copy of the operating system with the computer when sold. *Id.* An operating system manages the internal functions of the computer that all applications programs commonly use. *Id.*; Hamacher, Vranesic, & Zaky, *supra* note 32, at 8-2; *see* 714 F.2d at 1243 (operating systems manage internal functions of computer or facilitate use of applications programs). The goal of an operating system is to enhance the accessibility of the system, improve operational efficiency, and reduce

All computer programs undergo various phases of development before they actually can operate a computer.³⁴ A computer programmer initially will write a program in a high level computing language such as BASIC, FORTRAN, or COBOL.³⁵ The instructions that comprise the program, although esoteric, are comprehensible to a person who is familiar with computer programming.³⁶ A

the cost of programming by accomplishing tasks common to most users of a specific computer. H. LORIN & H. DEITEL, *supra* note 7, at 25. Operating systems bridge the gap between the user's needs and the hardware's characteristics. R. ECKHOUSE, JR., *MINICOMPUTER SYSTEMS: ORGANIZATION AND PROGRAMMING (PDP-11) 226 (1975)*.

Although the distinction between applications software and operating systems software is intelligible in the abstract, no bright line actually distinguishes applications software from operating systems. *See* H. LORIN & H. DEITEL, *supra* note 7, at 25-26 (disagreement exists concerning line between applications programs and operating systems). Whether a particular program is an applications program or part of the operating system depends partly on convention and partly on the history of the particular computer system's development and marketing. *Id.* at 26. Although operating systems are not radically different from applications programs, the distinction is worthwhile since applications programs must conform to the operating system of a given machine to take advantage of the operating system's utilities. *See* P. BRINCH HANSEN, *OPERATING SYSTEM PRINCIPLES 3-4 (1973)*.

34. *See* A. KHAMBATA, *supra* note 15, at 364-67. Computer software development involves a number of steps. *Id.* A software developer begins the programming process by verbally defining the problem to be solved. *Id.* at 364. Having defined the problem, a programmer will outline a program that resolves the problem by designing a flowchart of the program. *Id.* The programmer will reduce the outline to a symbolic computer language by writing a source code program in a high-level computer language. *Id.* at 366; *see infra* notes 35-38 and accompanying text (discussing source code programs). The programmer will then use a number of software development aids, including a computer, to convert the source code program into machine language, or object code. A. KHAMBATA, *supra* note 15, at 366; *see infra* notes 39-40 and accompanying text (describing process of translation from source to object code).

35. *See* K. SHORT, *MICROPROCESSORS AND PROGRAMMED LOGIC 149-153 (1981)* (software development process begins with design and coding and ends with debugging of machine level object code program). BASIC, FORTRAN, and COBOL are examples of high level programming languages. *See* Helms, *Survey of High-Level Programming Languages*, in *THE MCGRAW-HILL COMPUTER HANDBOOK 12-3, 12-4* (H. Helms ed. 1983). BASIC stands for Beginners All-purpose Symbolic Instruction Code. *Id.* FORTRAN stands for Formula Translator. *Id.* COBOL stands for Common Business Oriented Language. *Id.* BASIC, FORTRAN, and COBOL are examples of high-level symbolic programming languages that employ jargon that is familiar to a programmer who is writing programs in a field for which each language was designed. A. KHAMBATA, *supra* note 15, at 366, 370. COBOL, for instance, emphasizes business terminology whereas FORTRAN emphasizes scientific operations. *Id.* at 370. As its name implies, BASIC is comprehensible even to a layperson. *See* Lipson, *Lawyer's Short Course in BASIC Computer Language*, 24 *JURIMETRICS* 154, 155 (1984). A simple BASIC program that will print the number "7" on the operator's console when executed is as follows:

```
10 LET A1 = 5
20 LET B = SQR (4)
30 PRINT A1 + B
40 END
```

See id. at 157.

36. *See supra* note 31 and accompanying text (programmer is familiar with programming language jargon).

program written in a high level language is known as source code.³⁷ Even though source code may reside on any number of media that a computer can read, such as punched cards, floppy disks, or cassette tape, source code alone is insufficient to operate the computer. The CPU understands only object code.³⁸ Although a programmer theoretically could write a program in object code, the existence of compiler programs that translate source code into object code obviates such an endeavor.³⁹ Compiler programs, otherwise known as compilers, accept source code as input and, after several intermediate steps, produce object code as output.⁴⁰

Although the advent of computer technology represents a relatively recent occurrence in the history of the copyright laws, several Supreme Court copyright cases decided prior to the invention of computers still affect the applicability of copyright to computer software.⁴¹ *Baker v. Selden*⁴² expresses the fundamental tenet that copyright protects the expression of an idea but not the idea itself.⁴³ In *Baker*, the plaintiff's testator owned a copyright on a book that described a bookkeeping system.⁴⁴ The book contained blank forms designed for use with the described system.⁴⁵ The defendant published a book that described the same system and included forms that fulfilled the same purposes as the forms in the plaintiff's book.⁴⁶ The Supreme Court held

37. See Hamacher, Vranesic, & Zaky, *supra* note 32, at 8-3 (source program is any program written in higher level language than machine language); A. KHAMBATA, *supra* note 15, at 366 (programs written in BASIC, FORTRAN, and COBOL are source code programs).

38. See *supra* note 15 and accompanying text (CPU understands only digital electric pulses of binary information).

39. See K. SHORT, *supra* note 15, at 150 (computers convert source code program into object code).

40. See Hamacher, Vranesic, & Zaky, *supra* note 32, at 8-3 (output of compiler is object code). Object code is the presence or absence of electrical pulses that open and close the binary logic gates of the CPU. K. SHORT, *supra* note 15, at 146.

41. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1252 (3d Cir. 1983) (*Baker v. Selden* and *Mazer v. Stein* still control application of copyright law), *cert. dismissed*, 104 S.Ct. 690 (1984); *infra* notes 42-70 and accompanying text (Supreme Court precedent affects copyright law despite reenactment of copyright acts); see also *Mazer v. Stein*, 347 U.S. 201, 218 (1954) (copyright may protect works of authorship that have utilitarian functions); *Baker v. Selden*, 101 U.S. 99, 101 (1879) (copyright protects expression of idea but not idea itself).

42. 101 U.S. 99 (1879).

43. See *id.* at 101-02 (each author has right to express common knowledge in own way); see also *Mazer v. Stein*, 347 U.S. 201, 217 (1954) (copyright protects expression of idea but not idea itself); *Reyher v. Children's Television Workshop*, 533 F.2d 87, 90 (2d Cir.) (axiomatic that copyright protection extends only to particular expression of idea but never to idea itself), *cert. denied*, 429 U.S. 980 (1976); *Herbert Rosenthal Jewelry Corp. v. Kalpakian*, 446 F.2d 738, 740 (9th Cir. 1971) (copyright protects only expression of idea unlike patent which protects idea); *Crume v. Pacific Mut. Life Ins. Co.*, 140 F.2d 182, 183-84 (7th Cir. 1944) (disclosed information is within public domain); *Dymow v. Bolton*, 11 F.2d 690, 691 (2d Cir. 1926) (copyright protects means of expressing idea).

44. 101 U.S. at 100.

45. *Id.*

46. *Id.* at 101.

that use of the blank forms did not infringe upon the plaintiff's copyright.⁴⁷ The Court reasoned that the plaintiff's copyright on the book did not give the plaintiff the right to control the use of the bookkeeping system that the book described.⁴⁸ The *Baker* doctrine stands for the proposition that use of an idea, method, system, or process does not infringe a copyright in an expression of the same.⁴⁹

In *Mazer v. Stein*,⁵⁰ the Supreme Court expanded the *Baker* doctrine by holding that copyright may protect a work even though the work has utilitarian functions.⁵¹ The *Mazer* plaintiff produced and claimed copyright in statuettes designed for use as bases for table lamps.⁵² The defendant copied the plaintiff's statuettes and sold the statuettes as lamp bases.⁵³ The Court held that the use of a copyrighted work in a utilitarian object is not inconsistent with copyright.⁵⁴ The *Mazer* Court reasoned that nothing in the copyright law prohibited extension of copyright to a work of authorship simply because the author used the work in industry.⁵⁵ The Court noted, however, that copyright protects only the artistic expression and form in a work but not the mechanical or utilitarian aspects of the work.⁵⁶ The principles that the Supreme Court expressed in *Baker* and *Mazer* are crucial cobblestones that have paved the way for copyright protection of computer programs, which, like the ledger in *Baker* and the lamp base in *Mazer*, contain utilitarian aspects.⁵⁷

47. *Id.* at 107.

48. *Id.* at 103.

49. M. NIMMER, 1 NIMMER ON COPYRIGHT § 2.18[D], at 2-207 (1983) [hereinafter cited as NIMMER].

50. 347 U.S. 201 (1954).

51. *Id.* at 218.

52. *Id.* at 202.

53. *Id.* at 203.

54. *Id.* at 217-18.

55. *Id.*

56. *Id.* at 218.

57. See *Apple Computer, Inc. v. Formula Int'l, Inc.*, No. 83-5875, slip op. at 697, 699 (9th Cir. Feb. 8, 1984) (*Baker* doctrine prohibits monopolization of idea when limited number of ways to express idea exist); *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1252 (3d Cir. 1983) (*Baker* and *Mazer* remain benchmarks of copyright law for proposition that use of copyrighted work in utilitarian object is not inconsistent with copyright), *cert. dismissed*, 104 S.Ct. 690 (1984).

Like *Baker* and *Mazer*, the Supreme Court's decision in *White-Smith Music Publishing Co. v. Apollo Co.* has affected the copyrightability of computer software. See *White-Smith Music Pub. Co. v. Apollo Co.*, 209 U.S. 1 (1908). In *White-Smith*, the plaintiff published several songs in the form of sheet music. *Id.* at 8. The defendant, a manufacturer of automated pianos, produced perforated piano rolls that caused the defendant's pianos to play the plaintiff's melodies. *Id.* at 9. The Supreme Court held that the production of perforated piano rolls did not infringe the plaintiff's copyright in the sheet music. *Id.* at 18. The Court stated that copying occurred only when people could see and read the result work. *Id.* at 17. Since the perforated piano rolls were unreadable, the rolls did not constitute copies of the original work. *Id.* at 18. The *White-Smith* Court reasoned that since the perforated rolls were parts of a machine, they were not copies within the meaning of the copyright act. *Id.* Since object code stored on floppy disk or cassette

In response to the rapid growth of technology that characterized the first half of the twentieth century, Congress sought in 1964 to revamp federal copyright law.⁵⁸ Congress took no action on the general revision until 1976, but in 1974 established the National Commission on New Technological Uses of Copyrighted Works (CONTU) to study the impact of computers on the use of copyrighted materials.⁵⁹ Without awaiting the completion of CONTU's studies, Congress enacted the 1976 Act.⁶⁰ The 1976 Act codified the *Baker* doctrine by expressly denying copyright protection to ideas, procedures, processes, systems, methods of operation, concepts, principles, and discoveries.⁶¹ The 1976 Act's legislative history indicates that Congress intended to maintain the traditional dichotomy between ideas and expressions.⁶²

tape is unreadable without the aid of a computer, the *White-Smith* doctrine, if applicable, would prevent effective application of copyright to computer software. See *Data Cash Systems, Inc. v. JS&A Group, Inc.*, 480 F. Supp. 1063, 1068-69 (N.D. Ill. 1979) (*White-Smith* precludes copyright protection for information in ROM since person cannot see or read information with naked eye), *aff'd*, 628 F.2d 1038 (7th Cir. 1980); *Synercom Technology, Inc. v. University Computing Co.*, 462 F. Supp. 1003, 1011 (N.D. Tex. 1978) (material must undertake to express to obtain copyright protection).

58. See H.R. REP. No. 1476, 94th Cong., 2d Sess. 47 (1976), reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5660. The technologies that emerged and developed during the first half of the twentieth century include radio, television, video and audio recording, satellite, laser, and information technologies. H.R. REP. No. 1476, 94th Cong., 2d Sess. 47 (1976), reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5660.

In 1971, Congress issued emergency legislation to provide limited protection for sound recordings. See Pub. L. No. 92-140, 85 Stat. 391 (1971). Congress enacted the 1971 sound recording legislation in response to pressure from the sound recording industry, which was suffering significant financial loss at the hands of tape and record pirates. See *Goldstein v. California*, 412 U.S. 546, 562-63 n.17 (1973). Since the 1971 legislation protected works fixed on magnetic tapes and plastic disks, which a human cannot read, the legislation effectively overruled *White-Smith*, at least in regard to sound recordings. See CONTU FINAL REPORT, *supra* note 7, at 10 (1971 congressional action effectively reversed *White-Smith*).

59. Pub. L. No. 93-573, 88 Stat. 1873 (1974). In 1974, Congress established the National Commission on New Technological Uses of Copyrighted Works (CONTU) as a department of the Library of Congress. *Id.* § 201(a). Congress charged CONTU with the responsibility of studying and compiling data on the use of copyrighted works in conjunction with automated information systems and print production systems. *Id.* § 201(b). Congress further charged CONTU with the responsibility of recommending changes in copyright law. *Id.* § 201(c). CONTU consisted of twelve presidential appointees and the Librarian of Congress. *Id.* § 202.

60. Pub. L. No. 94-553, 90 Stat. 2541 (1976) (codified as amended at 17 U.S.C. (1982)); see *supra* note 1 (discussing major aspects of 1976 Act).

61. 17 U.S.C. § 102(b) (1982).

62. H.R. REP. No. 1476, 94th Cong., 2d Sess. 51 (1976), reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5660. The legislative history of the 1976 Act indicates that Congress did not intend section 102(b) of the 1976 Act to enlarge or contract the scope of copyright protection that existed under the 1909 Act. H.R. REP. No. 1476, 94th Cong., 2d Sess. 57 (1976), reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5670. According to the legislative history of the 1976 Act, § 102(b) merely restated then-current understanding of the dichotomy between idea and expression. H.R. REP. No. 1476, 94th Cong., 2d Sess. 57 (1976), reprinted in 1976 U.S. CODE CONG. & AD. NEWS 5659, 5670; see *supra* notes 41-49 and accompanying text (use of an idea does not infringe copyright on work that expresses same idea).

The legislative history, however, also indicates that Congress intended to provide that an author may fix a copyrighted work in a tangible medium of expression now known or later developed.⁶³ Since CONTU had not completed its studies, the 1976 Act froze the status quo pending final report of CONTU.⁶⁴

CONTU issued its final report in 1978, recognizing the reaffirming the principles that the Supreme Court enunciated in *Baker* and that Congress codified in the 1976 Act.⁶⁵ The CONTU final report stated that only the expression that a programmer adopts is copyrightable and that copyright does not protect the processes or methods that a programmer employs.⁶⁶ CONTU emphasized that, although copyright should not protect the electromechanical functioning of a computer, the mere fact that computer programs operate machinery should not affect their copyrightability.⁶⁷ The CONTU report compared computer programs to videotapes and phonorecords, both of which operate machinery yet are still copyrightable.⁶⁸ The majority of the CONTU members recommended that Congress explicitly extend copyright protection to computer programs.⁶⁹ In 1980, Congress amended the 1976 Act, incor-

63. H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5665. The legislative history of the 1976 Act states that the form, manner and medium of fixation is irrelevant for determining copyright protection under the 1976 Act, provided that the work is fixed in a stable medium from which a person using a machine or other device may perceive the work. H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5665. The legislative history specifies that any graphic or symbolic idea embodied in a physical object satisfies the fixation requirement. H.R. REP. No. 1476, 94th Cong., 2d Sess. 52 (1976), *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5665.

64. See Pub. L. No. 94-553 § 117, 90 Stat. 2565 (1976), *repealed*, Pub. L. No. 96-517 § 10(b), 94 Stat. 3028 (1980).

65. See CONTU FINAL REPORT, *supra* note 7, at 18-20 (expression that programmer adopts is copyrightable element of computer program).

66. *Id.*

67. *Id.* at 21-22.

68. *Id.* at 20.

69. *Id.* at 1-2. The CONTU majority recommended that Congress should amend the 1976 Act explicitly to provide that computer programs are the proper subject of copyright, to apply to all uses of copyrighted materials in computers, and to ensure that rightful owners of proprietary software may use or adapt their copies for use. *Id.* at 1. The CONTU majority also recommended that Congress review the economic effects of the copyright acts on a periodic basis. *Id.* at 2.

The CONTU dissent vigorously discouraged the adoption of the majority's recommendations on several grounds. *Id.* at 27 (Commissioner Hersey, dissenting). The dissent asserted that a computer program in its object code form does not constitute a writing within the meaning of the Constitution. *Id.* at 27-28; see U.S. CONST., Art. I, sec. 8, cl. 8 (Congress may grant author limited monopoly on author's writings). The CONTU dissent also stated that although source code programs clearly satisfied the writings requirement, object code programs actually control the electrical impulses of the computer and, therefore, merge with the machinery. CONTU FINAL REPORT, *supra* note 7, at 28 (Commissioner Hersey, dissenting). The dissent asserted that the essence of copyright is the protection of communications between people and that the absence of a human audience should preclude copyright. *Id.* at 29-30. The dissent further asserted that extension of copyright to computer programs would result in the concentration of economic power

porating CONTU's recommendations without material change.⁷⁰

The extension of copyright protection to computer programs has made copyright law the central legal factor in defining the competitive relationships between vendors of hardware and software.⁷¹ The recent Third Circuit decision in *Apple Computer, Inc. v. Franklin Computer Corp.*,⁷² exemplifies the commercial conflict that currently exists in the microcomputer marketplace.⁷³ Apple Computer (Apple) established the microcomputer market in 1976 by introducing the Apple-II personal computer (Apple-II).⁷⁴ Each Apple-II in-

in large corporate computer manufacturing concerns rather than the protection of communications. *Id.* at 34-37. The dissent, thus, recommended that Congress amend the 1976 Act to specify that copyright does not extend to computer programs in the form in which they are capable of controlling computer operations. *Id.* at 37.

The CONTU concurrence shared several of the dissent's doubts over the propriety of extending copyright protection to computer programs. *Id.* at 26-27 (Commissioner Nimmer, concurring). The concurrence criticized the majority for failing to articulate any rationale that would justify limiting copyright protection to computer software. *Id.* at 26. The concurrence characterized the majority's recommendations as a general misappropriation law, applicable to all tangible expressions of original ideas. *Id.* As did the dissent, the concurrence considered extension of copyright to computer programs a substantial strain on the Constitution's use of the terms "author" and "writing." *Id.* The concurrence, however, supported the majority's recommendations and suggested a possible future line of demarcation between copyrightable and uncopyrightable computer programs. *Id.* at 27. The concurrence urged Congress to re-examine copyright in the future and, if the majority's recommendations prove to be unduly restrictive, to grant copyright protection only to those programs that result in communication to human beings. *Id.*

70. Pub. L. No. 96-517, 94 Stat. 3029 (1980) (codified at 17 U.S.C. §§ 101, 117 (1982)).

71. See *Object Code*, *supra* note 10, at 1723-24 (copyright protects against misappropriation of computer programs).

72. 714 F.2d 1240 (3d Cir. 1983).

73. See, e.g., *Williams Elecs., Inc. v. Artic Int'l, Inc.*, 685 F.2d 870, 871 (3d Cir. 1982) (defendant copied plaintiff's program for DEFENDER video game); *Stern Elecs., Inc. v. Kaufman*, 669 F.2d 852, 853 (2d Cir. 1982) (defendant copied program for SCRAMBLE coin-operated video game); *Hubco Data Prods. v. Management Assistance, Inc.*, 1983 COPYRIGHT L. REP. ¶ 25,529 at 18,101 (D. Idaho 1983) (defendant copied plaintiff's operating system to upgrade and sell copies); *Tandy v. Personal Micro Computers, Inc.*, 524 F. Supp. 171, 173 (N.D. Cal. 1981) (defendant copied plaintiff's input-output routine designed for use in Radio Shack TRS-80 personal computer); *Data Cash Systems, Inc. v. JS&A Group, Inc.*, 480 F. Supp. 1063, 1065-66 (N.D. Ill. 1979) (defendant copied plaintiff's computer program for chess game), *aff'd*, 628 F.2d 1038 (7th Cir. 1980).

74. *Apple Computer, Inc. v. Formula Int'l, Inc.*, 562 F. Supp. 775, 776 (C.D. Cal. 1983), *aff'd*, No. 83-5875, slip op. at 696 (9th Cir. Feb. 8, 1984). In *Formula*, the defendant copied five of Apple's operating system programs for distribution with the defendant's Pineapple Computer. *Id.* at 776-77. Apple sued for copyright infringement and moved to obtain a preliminary injunction. *Id.* at 777-78. The district court granted the motion for a preliminary injunction, reasoning that operating systems programs are copyrightable and that Apple had demonstrated substantial likelihood of success on the merits. *Id.* at 779-84. The *Formula* court noted that the facts in *Formula* were nearly identical to the facts in *Franklin*. *Id.* at 784. The Third Circuit's review of the *Franklin* case represents the first appellate review of either case. The Ninth Circuit recently affirmed the district court's decision in *Formula*. See *Apple Computer, Inc. v. Formula Int'l, Inc.*, No. 83-5875, slip op. at 696 (9th Cir. Feb. 8, 1984) (district court properly issued preliminary injunction to prevent Formual from infringing Apple's copyrights).

cludes a software package that facilitates the use of the computer.⁷⁵ Apple has nurtured the growth of its hardware sales by developing a large library of applications programs⁷⁶ that run on the Apple-II.⁷⁷ The huge library of Apple-compatible applications programs written by independent computer programmers, however, dwarfs the number of programs that Apple itself distributes.⁷⁴

An independent developer of applications software must design programs with more in mind than just the hardware specifications of the Apple-II. Applications programs must accommodate aspects of Apple's operating system software to achieve compatibility.⁷⁹ Accordingly, Apple and the independent programmers have developed a symbiotic relationship. The existence of a large library of software increases the Apple-II's marketability and the large number of Apple-II computers in use increases the potential market for independently developed software.⁸⁰

75. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1244 n.4 (3d Cir. 1983), cert. dismissed, 104 S.Ct. 690 (1984). Apple Computer, Inc. (Apple) provides each purchaser of an Apple-II microcomputer with all of the software necessary to operate the computer. *Id.* For instance, Apple provides Apple-II users with *Copy*, a program that enables a user to copy programs from one floppy diskette to another. *Id.* Apple also provides *Master Create*, *Hello*, and *Autostart-ROM*, programs which prepare the computer for use each time someone uses the computer. *Id.* Together, these programs along with several others comprise the Apple-II operating system. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 545 F. Supp. 812, 815 (E.D. Pa. 1982) (programs constitute operating system), rev'd, 714 F.2d 1240 (3d Cir. 1983), cert. dismissed, 104 S.Ct. 690 (1984). The majority of the Apple-II operating system programs reside on floppy disks. *Id.* The *Autostart-ROM* program resides in ROM. 714 F.2d at 1244 n.4; see *infra* note 85 and accompanying text (discussing function of bootstart programs).

76. See *supra* note 33 and accompanying text (application program performs specific tasks).

77. See 714 F.2d at 1242 (Apple distributes more than 150 applications programs).

78. See Brief for Appellee at 6, *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983) (independent programmers have developed thousands of applications programs for Apple-II), cert. dismissed, 104 S.Ct. 690 (1984).

79. 714 F.2d at 1244 n.4. The terms "format" and "compatibility" refers to the standard specifications that a given program or piece of computer equipment must meet to interface or mesh with another program or piece of equipment. Meek, *Compatibility*, in *ENCYCLOPEDIA OF COMPUTER SCIENCE* 236-37 (A. Ralston & C. Meek eds. 1976). Microcomputer operating systems provide the crucial interface between an application program and a computer. See Rubin & Strehlo, *Why So Many Computers Look Like the "IBM Standard,"* in *PERSONAL COMPUTING*, March 1984, 52, 59 (operating system acts as middle man handling interactions between application program and computer). The aspects of an operating system that interact with a particular computer may be tailored to operate the particular hardware. *Id.* The portion of the operating system that interacts with applications programs, however, must meet the specifications that constitute a particular format to achieve compatibility with applications software designed for the format. See *id.* (standardized operating system allows software to run on variety of computer systems). Standardization encourages the independent production of applications software by expanding the potential market for a given application program that complies with the standard. *Id.* at 56.

80. See Stern, "Idea" Swallows "Expression" or a Left Handed Way to Say That Second Comers Should Build Their Own Highways to the Market, 2 *COMPUTER L. REP.* 380, 380 (1983) (hardware manufacturer may control availability of operating system software in attempt to con-

Franklin Computer Corporation (Franklin) products the ACE-100 microcomputer, which functions similarly to the Apple-II. At the time of the district court hearing in *Franklin*, Franklin had sold fewer than 1,000 ACE-100 computers.⁸¹ In designing the ACE-100, Franklin decided to adopt the format⁸² of the Apple-II to capitalize on the existing market for Apple-compatible products.⁸³ Franklin officials determined that to compete successfully with Apple, one hundred percent compatibility was necessary.⁸⁴ Franklin also determined that writing its own Apple-compatible operating system was technologically infeasible and, therefore, copied fourteen of Apple's operating system programs, including several bootstrap programs stored in ROM.⁸⁵ Although Franklin openly admitted copying Apple's soft-

trol market). Apple's annual sales of \$335 million and total unit sales of more than 400,000 Apple-IIs attest to the success of Apple's marketing strategy. 714 F.2d at 1242.

81. 714 F.2d at 1243. Although Franklin sought to design a personal computer that was compatible with the Apple-II, Franklin claimed that the ACE-100 computer was superior to the Apple-II in several respects. Brief for Appellee at 9 n.3, *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983), cert. dismissed, 104 S.Ct. 690 (1984). Franklin claimed that the ACE-100 had a larger memory and a better keyboard than the Apple-II, as well as upper and lower case capability, which the Apple-II lacked. *Id.*

82. See *supra* note 79 (format refers to interface standards).

83. 714 F.2d at 1243.

84. *Id.* at 1245.

85. *Id.* In *Franklin*, the operating systems programs that Franklin copied resided both in ROM and on floppy disks. *Id.* at 1244 n.4. The ROM-based programs consisted of *Autostart-ROM*, *Applesoft*, *Apple 13-Sector Boot ROM*, and *Apple 16-Sector Boot ROM*. *Id.*; see *supra* note 75 (discussing Apple operating systems programs). The *Applesoft* program is a BASIC interpreter which, like a compiler, translates high-level BASIC source code into machine-readable object code. 714 F.2d at 1244 n.4; see *supra* notes 32-40 and accompanying text (compilers translate source code into machine-readable object code). The remaining ROM-based programs are bootstrap programs which enable the computer to begin operation and accept further instructions. W. Schmidt, *Legal Proprietary Interests in Computer Programs: The American Experience*, 21 JURIMETRICS 345, 350-51 (1981); see 714 F.2d at 1244 n.4 (ROM-based programs enable computer to run other programs).

In early minicomputers, a human operator manually loaded a computer's initial instructions into the computer's memory each time the operator activated the system. D. Batoron, *Loader*, in *ENCYCLOPEDIA OF COMPUTER SCIENCE* 804 (A. Ralston & C. Meek eds. 1976). The initial instructions enabled the computer to load more sophisticated operating systems programs automatically from tape or disk storage devices. *Id.* at 806-08. To load the initial instruction set, the computer operator had to depress a series of front-panel switches in a predefined pattern and enter the pattern by pressing an "Enter" or "Deposit" button. See R. ECKHOUSE, JR., *supra* note 33, at 167-70 (describing bootstrap procedure for DEC PDP-11 series minicomputer). The operator would reset the switch pattern and repeat this process from half a dozen to several dozen times, depending on the number of initial instructions that the given computer required. See *id.* Once the operator had entered the instructions correctly, the computer could begin to run. See *id.* at 317 (operator begins execution of bootstrap program by pressing "start" button); see also *id.* at 315 (photograph of operator's console). The name for this process, bootstrapping, or bootstarting, or booting the computer refers to the impossible feat of lifting oneself by one's own bootstraps. Halpern, *Bootstrap*, in *ENCYCLOPEDIA OF COMPUTER SCIENCE* 183-84 (A. Ralston & C. Meek eds. 1976). The advent of ROM chips, which can store a program even when

ware, Franklin assumed that the operating system constituted a purely utilitarian process and thus was not copyrightable.⁸⁶

Apple sued in the United States District Court for the Eastern District of Pennsylvania, seeking to enjoin Franklin from infringing Apple's copyrights.⁸⁷ At the preliminary injunction hearing, Franklin contended that copyright does not protect a computer program in its object code phase, an object code program stored in ROM, or a computer operating system.⁸⁸ The district court, however, denied Apple's motion for a preliminary injunction on the grounds that Apple had not shown a likelihood of success on the merits.⁸⁹ The court doubted that copyrighted protected Apple's operating system software, reasoning that the operating system constituted an unprotectible idea rather than a copyrightable expression.⁹⁰ Moreover, the district court concluded that pending full trial on the merits, Apple could withstand the possible injury of infringement better than Franklin could bear the effects of a preliminary injunction.⁹¹

On appeal, the Third Circuit reversed the district court's denial of Apple's motion for a preliminary injunction.⁹² The *Franklin* court held that the district court erred by failing to recognize that copyright does not exclude computer operating systems from protection.⁹³ The Third Circuit also held that copyright protects object code, even when the object code resides in

a computer's power fails, rendered the process of manual bootstrapping obsolete. See R. ECKHOUSE, JR., *supra* note 33, at 167-70. Since modern microcomputers do not have front panels, the bootstrap process depends entirely on programs stored in ROM. See 714 F.2d at 1244 n.4 (*Autostart-ROM* performs internal functions that ready computer for use); A. KHAMBATA, *supra* note 15, at 372-73 (ROM-based bootstrap relieves operator of burden of manual entry of initial instructions). The bootstart programs stored in ROM are not portable from one computer to another, but rather are entirely dependent in design on the peculiarities of a given type of computer system. Hamacher, Vranesic, & Zaky, *supra* note 32, at 8-5.

86. 714 F.2d at 1245.

87. *Id.* at 1244. In *Franklin*, Franklin responded to Apple's claim of copyright infringement by counterclaiming for a declaratory judgment that Apple's copyrights were invalid and unenforceable. *Id.* Franklin argued that the extension of copyright to Apple's operating system would deprive non-Apple owners of the ability to take advantage of the vast body of independently written Apple-compatible applications programs. *Apple Computer, Inc. v. Franklin Computer Corp.*, 545 F. Supp. 812, 815 (E.D. Pa. 1982), *rev'd*, 714 F.2d 1240 (3d Cir. 1983). Franklin defended its own conduct, reasoning that Franklin had not manufactured an Apple-compatible system but rather a system that was compatible with the large body of Apple-compatible software. *Id.*; see *infra* notes 119-21 and accompanying text (Franklin asserted that Apple programs were ineligible for copyright).

88. 545 F. Supp. at 817.

89. *Id.* at 812.

90. *Id.*

91. *Id.* at 825; see *infra* note 135 and accompanying text (*Franklin* court held that presumption of irreparable harm arises when copyrighted material is central to essence of plaintiff's operations and plaintiff shows substantial likelihood of success on merits).

92. 714 F.2d at 1242.

93. *Id.* at 1253-54.

ROM.⁹⁴ Because Apple had invested substantial amounts of capital in the development of its operating system, the *Franklin* court determined that the existence of Apple's substantial economic investment warranted a presumption of irreparable injury.⁹⁵ The *Franklin* court, therefore, reversed and remanded the case.⁹⁶

Although the distinction between source code and object code presents an intellectual hurdle in characterizing object code programs as original works of authorship, the *Franklin* court held that object code is a proper subject for copyright protection.⁹⁷ The court found support for its position in the 1980 amendment to the 1976 Act which defined computer programs as a set of statements or instructions to be used directly or indirectly in a computer.⁹⁸ The Third Circuit reasoned that since a computer understands only object code and not source code, only object code can act directly in a computer.⁹⁹ The *Franklin* court declared that the statutory use of the term "directly," therefore, implies that Congress intended to protect object code.¹⁰⁰ The court also relied on the CONTU majority's definition of an object code program as a conversion or translation of the source code program for the proposition that an object code program is the same work of authorship as the corresponding source code program.¹⁰¹ The *Franklin* court noted that even the CONTU dissent, which advocated denial of copyright to all computer programs, acknowledged that an object code program is a phase of the same work of authorship that yields the associated source code program.¹⁰²

The Third Circuit rejected the district court's reasoning that a program in object code is not copyrightable since a person cannot perceive the work.¹⁰³

94. *Id.* at 1246-49.

95. *Id.* at 1254-55.

96. *Id.* at 1242.

97. *Id.* at 1246-49; see *supra* notes 32-40 (compiler rewrites source code to create object code); *supra* note 69 and accompanying text (CONTU Commissioner Hersey disputed majority's assertion that object code program constitutes original work of authorship).

98. 714 F.2d at 1247-48; see 17 U.S.C. § 101 (1982) (computer program is set of statements or instructions to be used directly in computer in order to bring about certain result).

99. 714 F.2d at 1248.

100. *Id.*

101. *Id.*; see CONTU FINAL REPORT, *supra* note 7, at 21 (object code is phase of source code program).

102. 714 F.2d at 1248; see CONTU FINAL REPORT, *supra* note 7, at 28 (Commissioner Hersey, dissenting) (object code program constitutes final phase of programming process); *supra* note 69 (Commissioner Hersey recommended denial of copyright to computer programs).

103. 714 F.2d at 1248. The district court's theory in *Franklin* that copyright protects only readable computer programs closely resembled Professor Nimmer's suggestions in his CONTU concurrence. Compare 545 F. Supp. at 821 (copyright protects humanly-readable works) with CONTU FINAL REPORT, (Nimmer, concurring), *supra* note 7, at 27 (copyright should protect only those computer programs that have expressive purpose). The CONTU majority, however, expressly rejected Professor Nimmer's approach, reasoning that such an approach would preclude from copyright many useful programs such as programs that regulate traffic flow during rush hours or programs that monitor the vital signs of patients in intensive care units. CONTU FINAL REPORT, *supra* note 7, at 21; see *supra* notes 65-70 and accompanying text (discussing CONTU's recommendations).

The *Franklin* court stated that the district court's reasoning stemmed from an earlier Supreme Court case that Congress expressly overruled in the 1976 Act.¹⁰⁴ The *Franklin* court emphasized that the 1976 Act permits an author to fix a work in any medium from which a person can perceive the work with the aid of a machine or device such as a computer.¹⁰⁵ The Third Circuit, therefore, held that a computer program in object code is copyrightable regardless of the need to use a computer to perceive or reproduce the work.¹⁰⁶

The Third Circuit in *Franklin* briefly discussed the question of whether copyright protects ROM-based object code since, shortly after the *Franklin* district court issued its opinion, the Third Circuit decided the same issue in *Williams v. Artic International, Inc.*¹⁰⁷ In *Williams*, the defendant had copied the plaintiff's ROM-based video game computer programs.¹⁰⁸ The Third Circuit rejected the defendant's argument that copyright does not protect ROMs because ROMs are machine parts.¹⁰⁹ The *Williams* court held that a copyright protects object code programs stored in ROM.¹¹⁰ The court stated that copyright does not protect the design of the ROM itself but only the information stored in the ROM chip.¹¹¹ The *Williams* court reasoned that the 1976 Act encompassed the fixation of copyrightable works in technologically advanced media such as ROMs.¹¹² In *Franklin*, the Third Circuit reaffirmed the analysis employed in *Williams* regarding the copyrightability of object code programs stored in ROM.¹¹³

Although prior cases had established the copyrightability of object code even when stored in ROM,¹¹⁴ the question of copyrightability of computer operating systems presented the *Franklin* court with an issue of first impression at the appellate level.¹¹⁵ *Franklin* asserted that the fourteen operating systems programs that *Franklin* copied constituted systems, processes, or

104. 714 F.2d at 1248; see *White-Smith Music Pub. Co. v. Apollo Co.*, 209 U.S. 1, 17-18 (1908) (unreadable piano rolls did not constitute copies of copyrighted music); 17 U.S.C. § 102(a) (1982) (copyright subsists in original work of authorship fixed in tangible medium of expression perceptible with aid of machine or device); *supra* note 57 (discussing *White-Smith*); *supra* notes 58-64 and accompanying text (Congress overruled *White-Smith* in 1976 Act).

105. 714 F.2d at 1248.

106. *Id.* at 1248-49.

107. 685 F.2d 870 (3d Cir. 1982); see 714 F.2d at 1249 (*Williams* court held that ROM-based object code meets fixation requirement).

108. 685 F.2d at 871.

109. *Id.* at 874.

110. *Id.*

111. *Id.* at 877.

112. *Id.* at 875 n.5.

113. 714 F.2d at 1249.

114. See *supra* notes 25-31 (ROMs provide long-term storage of information and instructions).

115. See 714 F.2d at 1250 (question of copyrightability of operating system constitutes issue of first impression); Raysman & Brown, *Major Computer Software Issues Resolved in Programming Ruling*, Nat'l L.J., Sept. 19, 1983 at 50 (*Franklin* resolves confusion regarding scope of copyright for computer programs).

methods of operation, and therefore were ineligible for copyright protection.¹¹⁶ Franklin also asserted that the programs represented the only means of expressing the idea underlying the programs and that Apple had no right to monopolize the idea.¹¹⁷ Franklin contended that Apple's operating system format constituted an element of the underlying idea of an Apple-II operating system and was not merely a form of expression.¹¹⁸

The Third Circuit rejected Franklin's contention that an operating system constitutes an unprotectible system, process, or method of operation.¹¹⁹ The court reasoned that no meaningful distinction exists between applications programs and operating systems programs since both applications and operating systems programs control the functions of a computer.¹²⁰ The *Franklin* court noted that CONTU similarly had refused to distinguish between computer programs on the basis of a program's intended use.¹²¹ Moreover, the Third Circuit rejected Franklin's claim that the *Baker* doctrine stands for the proposition that utilitarian articles are not copyrightable.¹²² The *Franklin* court stated that the Supreme Court's later decision in *Mazer* clarified any potential ambiguities in the *Baker* decision by rejecting the proposition that utilitarian devices are ineligible for copyright protection.¹²³ The Third Circuit noted that

116. 714 F.2d at 1250; see Brief for Appellee at 13-16, *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983), reprinted in 1 *COMPUTER L. REP.* 681, 691-93 (1983). Franklin argued on appeal that Apple's operating systems programs constituted processes, systems, or methods of operation, which § 102(b) of the 1976 Act precluded from copyright. *Id.* at 13, reprinted in 1 *COMPUTER L. REP.* at 691. Franklin emphasized that Apple's own witnesses at the preliminary injunction hearing characterized Apple's programs as a system and concept that related to the operation of the computer itself. *Id.* at 15-16, reprinted in 1 *COMPUTER L. REP.* at 692-93. The Third Circuit refused to attach significance to the phraseology that the witnesses used since the witnesses were not lawyers and did not use the phrases in a legal sense. 714 F.2d at 1250 n.8.

Franklin further asserted that the *Baker* decision precluded Apple from asserting copyright in programs that are necessary incidents to the use of a machine. Brief for Appellee at 25, *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d at 1240 (3d Cir. 1983), reprinted in 1 *COMPUTER L. REP.* at 681, 697-98 (1983); see *supra* notes 41-57 and accompanying text (*Mazer* expanded *Baker* by holding that copyright may protect work that has utilitarian functions). An amicus curiae, Pro-Log Corporation, argued in support of Franklin's contention that copyright should not permit a hardware manufacturer to establish a legal monopoly over computer hardware. See Brief of Amicus Curiae Pro-Log Corporation, at 2, *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983), reprinted in 1 *COMPUTER L. REP.* at 872, 876 (1983) (Congress did not intend that copyright foster 75-year monopolies for machines). Pro-Log, therefore, specifically objected to the extension of copyright to operating systems programs based in ROM. *Id.* at 6, reprinted in 1 *COMPUTER L. REP.* at 880.

117. 714 F.2d at 1251.

118. *Id.* at 1252-53.

119. *Id.* at 1252.

120. *Id.* at 1251-52.

121. *Id.*; see CONTU FINAL REPORT, *supra* note 7, at 21 (fact that computer programs ultimately implement processes should not affect copyrightability of programs).

122. 714 F.2d at 1251-52.

123. *Id.* at 1252; see *supra* notes 41-57 and accompanying text (*Mazer* expanded *Baker* by holding that copyright may protect work that has utilitarian functions).

if operating systems software were ineligible for copyright because of the operating system's utilitarian nature, then all software would be ineligible for the same reason.¹²⁴ The *Franklin* court held that since Congress intended broad protection for computer programs, operating systems are eligible for copyright protection.¹²⁵

The Third Circuit rejected Franklin's assertion that the merger of Apple's expression and idea barred a finding of infringement.¹²⁶ The *Franklin* court recognized that articulating where the line falls between idea and expression is a difficult task.¹²⁷ The court noted that maintenance of the balance between

124. 714 F.2d at 1252.

125. *Id.*

126. *Id.* at 1253. Although the *Franklin* court's holding that the idea underlying Apple's operating system programs had not merged with Apple's expression of the idea represents an important delineation of the rights of software competitors, the court's opinion on the merger issue constitutes dictum. See 714 F.2d 1253 (competitive and economic goals are irrelevant to determination of dividing point between idea and expression). Franklin openly admitted copying the programs. *Id.* at 1245. The district court found that Franklin's copies contained the secretly embedded name of the Apple programmer who had authored several of Apple's operating system programs. *Id.* The majority of courts that have considered the issue hold that direct evidence of verbatim copying is actionable even if the idea and expression have merged. See *Atari, Inc. v. North Am. Philips Consumer Elecs. Corp.*, 672 F.2d 607, 616 (7th Cir.) (copyright will protect only against identical copying if idea and expression are indistinguishable), *cert. denied*, 459 U.S. 880 (1982); *Sid & Marty Krofft Television Prods., Inc. v. McDonald's Corp.*, 562 F.2d 1157, 1168 (9th Cir. 1977) (copyright will prohibit only identical copying when idea and expression coincide); *Herbert Rosenthal Jewelry Corp. v. Grossbardt*, 436 F.2d 315, 316-17 (2d Cir. 1970) (copying jeweled bee pin from rubber mold constituted copyright infringement); see also Knowles & Palmieri, *Dissecting Krofft: An Expression of New Ideas in Copyright?*, 8 SAN FERNANDO VALLEY L. REV. 109, 139 n.108 (1980) (exact duplication may infringe even most minute quantum of expression). *But see Crume v. Pacific Mut. Life Ins. Co.*, 140 F.2d 182, 184 (7th Cir. 1944) (no infringement can occur when idea and expression have merged).

A comparison of *Grossbardt* and *Herbert Rosenthal Jewelry Corp. v. Kalpakian* illustrates the proposition that direct evidence of copying precludes consideration of whether idea and expression have merged. Compare *Herbert Rosenthal Jewelry Corp. v. Grossbardt*, 436 F.2d 315, 316-17 (2d Cir. 1970) (defendant produced exact copy of plaintiff's jeweled bee pin) with *Herbert Rosenthal Jewelry Corp. v. Kalpakian*, 446 F.2d 738, 739 (9th Cir. 1971) (defendant produced jeweled bee pin that was similar to plaintiff's jeweled bee pin). The *Grossbardt* court held that the exact duplication constituted copyright infringement. 436 F.2d at 316-17. In *Kalpakian*, however, the defendant did not duplicate the plaintiff's bee from a rubber mold, but went through the process of crafting a similar jeweled bee pin himself. 446 F.2d at 739. The *Kalpakian* court held that the defendant had not infringed plaintiff's copyright, reasoning that the defendant copied only the idea of a bee and not plaintiff's form of expression. *Id.* at 742.

Regardless of whether verbatim copying is actionable when idea and expression have merged, the district court in *Apple Computer, Inc. v. Formula International, Inc.* expressly held that a microcomputer hardware or software developer could reproduce the functioning aspects of Apple's system without infringing Apple's copyrights. 569 F. Supp. 775, 782 (C.D. Cal. 1983), *aff'd*. No. 83-5875, slip op. at 696 (9th Cir. Feb. 8, 1984). Since the existence of multiple forms of expression of an idea precludes a finding of merger of idea and expression, the *Franklin* court's discussion of idea and expression constitutes dictum.

127. 714 F.2d at 1253. Many courts have confronted the difficult task of determining where to draw the line between idea and expression. See, e.g., *Atari, Inc. v. North Am. Philips Consumer Elecs. Corp.*, 672 F.2d 607, 615 (7th Cir.) (no litmus paper test exists to distinguish idea

competition and protection of originality is important in determining whether a particular aspect of a program is a copyrightable expression or an unprotectible idea.¹²⁸ The Third Circuit rejected Franklin's contention that the format of the Apple-II constitutes an element of the underlying idea of an Apple operating system.¹²⁹ The *Franklin* court defined the idea of an Apple operating system at a very basic level.¹³⁰ To illustrate its perspective on the nature of an operating system, the court cited as an example that the underlying idea of a compiler is to translate source code into object code.¹³¹ The *Franklin* court held that Apple's operating system format is a characteristic of Apple's expression of an operating system.¹³² The court reasoned that Franklin's commercial and competitive goal of compatibility is irrelevant to the metaphysical determination of whether ideas and expressions have merged.¹³³ The court noted that if Franklin could have written programs that performed the desired functions, then Franklin's copying would constitute copyright infringement.¹³⁴ Since the district court made no finding regarding whether Apple's programs constituted the only means of expressing the underlying ideas, the Third Circuit remanded the case for a factual determination of this issue.¹³⁵

from expression), *cert. denied*, 459 U.S. 880 (1982); *Durham Indus., Inc. v. Tomy Corp.*, 630 F.2d 905, 911 (2d Cir. 1980) (legal principles are of limited value in particular cases since merger of idea and expression turns on facts); *Crume v. Pacific Mut. Life Ins. Co.*, 140 F.2d 182, 184 (7th Cir. 1944) (difficult to distinguish between that which is taught and idea disclosed thereby). Case law is particularly unhelpful in determining the dividing point between idea and expression in computer programs, since the existing case law centers on works of music, art, and literature, which are substantially different from computer programs. *See Atari, Inc. v. North Am. Philips Consumer Elecs. Corp.*, 672 F.2d 607, 617 (7th Cir. 1982) (defendant's K. C. MUNCHKIN video game infringed expression of plaintiff's PAC-MAN video game); *Durham Indus., Inc. v. Tomy Corp.*, 630 F.2d 905, 911 (2d Cir. 1980) (mechanical and structural similarity between plaintiff's "Pass the Nuts" game and defendant's "Mickey Mouse Peanut Putter" game did not infringe plaintiff's artistic expression); *Hoehling v. Universal City Studios Inc.*, 618 F.2d 972, 978-79 (2d Cir.) (plaintiff's theory as to cause of Hindenburg explosion constituted unprotectible idea), *cert. denied*, 449 U.S. 841 (1980); *Sid & Marty Krofft Television Prods., Inc. v. McDonald's Corp.*, 562 F.2d 1157, 1167 (9th Cir. 1977) (defendant's McDonald's Land characters infringed plaintiff's copyright in H. R. Pufnstuf characters); *see also Grogan & Kump, 'Apple' Enhances Computer Software Protection*, *Legal Times*, Feb. 13, 1984 at 18, 19 (prior cases dealing with literature and art are inapposite to copyrightability of computer programs).

128. 714 F.2d at 1253.

129. *Id.*

130. *Id.*

131. *Id.*

132. *Id.*

133. *Id.*

134. *Id.*

135. *Id.* at 1253-54. In addition to reversing the district court's interpretation of copyright law, the Third Circuit in *Franklin* reversed the district court's choice of standard for determining the existence of irreparable harm, a prerequisite to the issuance of a preliminary injunction. *Id.* at 1255. The Third Circuit noted that the district court had applied an inverse relationship approach in which the required showing of irreparable harm varies inversely with the plaintiff's showing of likelihood of success on the merits. *Id.* at 1254; *see Kontes Glass Co. v. Lab Glass*,

The policy consideration that copyright seeks to encourage creativity and originality supports the *Franklin* court's extension of copyright to object code programs stored in ROM.¹³⁶ Common sense indicates that limiting copyright protection to source code would provide an unlimited loophole for software pirates.¹³⁷ Since software vendors frequently distribute only the object code version of a program to customers, software pirates could purchase a single copy and legally duplicate the program at a negligible cost if copyright did not protect the object code version.¹³⁸ Denial of copyright protection to object code programs, therefore, would render the protection of source code meaningless.¹³⁹ The majority of courts that have considered the copyrightability of object code similarly have extended copyright protection to the object code.¹⁴⁰

Inc., 373 F.2d 319, 320-31 (3d Cir. 1967) (degree of irreparable harm needed to issue preliminary injunction is inversely related to likelihood of success on merits). Although the *Franklin* court's treatment of the substantive copyright issues suggests that on remand Apple would have a high likelihood of success on the merits, the court did not base its reversal of the injunction issue on these grounds. 714 F.2d at 1254. The Third Circuit instead rejected the inverse relationship approach and held that when the copyrighted material is central to the essence of the plaintiff's operations, a prima facie case of copyright infringement or a showing of substantial likelihood of success on the merits raises a presumption of irreparable harm. *Id.* The court noted that although the inverse relationship approach provides flexibility in applying equitable remedies when the actual injury is minimal, limited, or conjectural, application of the inverse relation approach to cases in which the plaintiff has shown substantial economic investment would undermine the copyright law's policy of encouraging creativity. *Id.*

Prior to any further action by the district court, Apple and Franklin settled their dispute. See Rinkerman & Cohen, *Apple and Franklin Settle*, 2 COMPUTER L. REP. 553, 553 (1984). Franklin agreed to pay Apple \$2.5 million in damages and to cease selling computer systems containing Apple's software by April 1, 1984. *Id.* Counsel for Franklin remarked that by April 1, 1984, Franklin will have sold approximately 100,000 computers containing Apple software. *Id.* at 554.

136. See *infra* notes 137-46 and accompanying text (case law and common sense support extension of copyright to ROM-based programs).

137. See *Williams Elecs., Inc. v. Artic Int'l, Inc.*, 685 F.2d 870, 877 (3d Cir. 1982) (denial of copyright protection to object code version of program would create unlimited loophole in copyright protection); *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 751 (N.D. Ill. 1983) (protection of source code version of program without protection of object code version would constitute pyrrhic victory for copyright owner).

138. See *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 751 (N.D. Ill. 1983) (vendors frequently market object code versions of program on disk or tape).

139. See *id.* (no copyright protection would exist if unauthorized person could copy object code freely).

140. See *Williams Elecs., Inc. v. Artic Int'l, Inc.*, 685 F.2d 870, 871 (3d Cir. 1982) (defendant copied plaintiff's object code program for DEFENDER video game); *Stern Elecs., Inc. v. Kaufman*, 669 F.2d 852, 853 (2d Cir. 1982) (defendant copied object code program for SCRAMBLE coin-operated video game); *Hubco Data Prods. v. Management Assistance, Inc.*, 1983 COPYRIGHT L. REP. ¶ 25,529 at 18,101 (D. Idaho 1983) (defendant copied plaintiff's operating system to upgrade object code and sell copies); *Tandy v. Personal Micro Computers, Inc.*, 524 F. Supp. 171, 173 (N.D. Cal. 1981) (defendant copied plaintiff's object code input-output routine designed for use in Radio Shack TRS-80 personal computer). But see *Data Cash Systems, Inc. v. JS&A Group, Inc.*, 480 F. Supp. 1063, 1065-66 (N.D. Ill. 1979) (defendant's copying of plaintiff's ROM-based object code program for chess game did not infringe plaintiff's copyright), *aff'd on other grounds*, 628 F.2d 1038 (7th Cir. 1980).

In *Midway Manufacturing Co. v. Strohon*,¹⁴¹ for example, the district court for the Northern District of Illinois elaborated on the *Williams* decision in a case also involving the copying of a ROM-based video game program.¹⁴² The *Strohon* court enjoined the defendant from selling copies of plaintiff's program.¹⁴³ The court reasoned that a ROM is no more utilitarian than a magnetic tape or disk since the purpose of both ROMs and magnetic tape media is to store information that directs the operation of a computer.¹⁴⁴ The *Strohon* court also recognized that granting protection to object code programs residing on disks or tapes but not to programs in ROM would provide an incentive for computer system developers to adopt a less efficient technology to protect their intellectual property.¹⁴⁵ Common sense, therefore, supports the recent case law that extends copyright protection to object code programs stored in ROM.¹⁴⁶

Although the *Franklin* court correctly recognized that CONTU did not distinguish between operating systems software and applications software, the court erred by extending copyright to Apple's ROM-based bootstart program.¹⁴⁷ A bootstart program based in ROM enables the computer to load the remainder of the operating system from a floppy disk into the computer's memory.¹⁴⁸ Without the bootstart program or an equivalent program stored in ROM, the Apple-II computer would be useless for any purpose.¹⁴⁹ While an independent programmer supposedly could reproduce the function of any operating system program and could store his program on a floppy disk, without special equipment the normal independent programmer could not install his version in a ROM chip.¹⁵⁰ Even if an independent software developer owned ROM programming equipment, the typical consumer does not purchase microcomputer programs based in ROM.¹⁵¹ Floppy disks and cassette tapes comprise the media upon which vendors normally distribute and consumers purchase a microcomputer program.¹⁵² If a consumer were to pur-

141. 564 F. Supp. 741 (N.D. Ill. 1983).

142. *Id.* at 749-52. In *Strohon*, the plaintiff sought to enjoin the defendant from infringing plaintiff's copyright on PAC-MAN video game computer programs. *Id.* at 742. The defendant asserted that computer programs stored in ROM were not the proper subject of copyright. *Id.* at 749.

143. *Id.* at 754.

144. *Id.* at 751.

145. *Id.*

146. *See id.*

147. *See supra* note 85 (describing bootstart programs); *infra* notes 148-49 (ROM-based bootstart program is not work of authorship).

148. *See* 714 F.2d at 1244 n.4; *supra* note 85 (describing bootstart programs).

149. *See* 714 F.2d at 1244 n.4; *supra* note 85 (describing bootstart programs).

150. *See* K. SHORT, *supra* note 15, at 54-55. The development of a ROM-based program involves photo-masking, etching, and diffusion, in addition to program design. *Id.* PROMs, however, are programmable after manufacture by the use of special programming equipment. *Id.* at 60-61; *see supra* notes 12-27 and accompanying text (development of ROMs requires special skill and equipment).

151. *See* *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 751 (N.D. Ill. 1983) (vendors distribute programs on disks and tapes).

152. *Id.*

chase a ROM-based program, to install the new program the consumer would have to invade the computer hardware, unplug the original chip, and replace the old chip with the desired ROM.¹⁵³ Apple's decision to design a computer that requires the presence of a ROM-based program, therefore, presents a substantial impediment to the development and commercial exploitation of competing microcomputer programs.¹⁵⁴ Since CONTU noted that the absence of significant barriers to entry into the program-writing market is a hallmark of the computer software industry, the commercial impediments to distribution of ROM-based bootstart programs weigh against extension of copyright protection.¹⁵⁵

The *Baker* doctrine suggests that copyright does not extend to the design, construction, or use of computer hardware.¹⁵⁶ Moreover, the *Mazer* decision, which permits the extension of copyright to works of authorship that an author uses in conjunction with a utilitarian device, requires the physical or conceptual separability of the work of authorship from utilitarian aspects of the device.¹⁵⁷ Bootstart programs, however, conceptually and physically are intertwined with and dependent upon the peculiarities of the hardware that they operate.¹⁵⁸ The commercial impediments, the indispensable nature of a ROM-based bootstart, and the physical and conceptual inseparability of a bootstart program from the computer it operates suggest that the bootstart ROM shares fewer common attributes with computer programs than it shares with computer hardware.¹⁵⁹ The ROM-based bootstart program, therefore, is not a work of authorship eligible for copyright protection.¹⁶⁰

Although no court has enunciated a concrete method for defining how to distinguish an expression from its underlying idea,¹⁶¹ several courts have recognized that the location of the line between idea and expression depends on a

153. See De Jong, *HMS 3264 EPROM Programmer*, in *BYTE*, June, 1983, at 288 (insertion of ROMs requires removal of cover and poses risk of harm or breakage of equipment).

154. See *supra* notes 148-53 and accompanying text (storing program in ROM poses technical and financial impediment to marketing of program).

155. See CONTU FINAL REPORT, *supra* note 7, at 23 (ease of entry into software writing market is hallmark of computer software industry). CONTU notes that new software firms could enter the market with minimal capital investment. *Id.* To illustrate its point, CONTU explained that Computer Sciences Corporation, a major software producer, enjoys annual sales in excess of \$100 million from an original investment of less than \$1,000. *Id.*

156. See *supra* notes 41-57 and accompanying text (copyright protects expression but not idea or system).

157. See *supra* notes 50-57 and accompanying text (*Mazer* doctrine extends copyright to works of authorship that are conceptually distinct from utilitarian objects).

158. See Schmidt, *supra* note 85, at 350-51 (bootstrap programs constitute minimum programming necessary to operate computer and usually are not considered software).

159. See *Midway Mfg. Co. v. Strohon*, 564 F. Supp. 741, 751 (N.D. Ill. 1983) (ROM-based programs share attributes of software when programs contain information beyond minimum necessary to turn computer on).

160. See *supra* notes 147-59 (ROM is component of hardware).

161. See *supra* note 142 (articulating distinction between idea and expression is difficult task); see also CONTU FINAL REPORT, *supra* note 7, at 18 (line between copyrightable programs and uncopyrightable processes is not clear).

case-by-case determination of how large an area of protection Congress intended to reserve for a copyright owner.¹⁶² In its final report to Congress, CONTU emphasized that programmers should be free to make a computer perform any conceivable process, provided that a programmer does not take another's program.¹⁶³ In defining format compatibility as a form of expression rather than as an underlying idea, however, the *Franklin* court ignored the fact that strict adherence to a particular format is a fundamental consideration for the author of any computer program.¹⁶⁴ An applications programmer must follow the format of the operating system on which the programmer wants his program to function.¹⁶⁵ Since the Apple-II operating system actually consists of fourteen interdependent programs, each program must comply with the common Apple-II format.¹⁶⁶ Moreover, since new sales of Apple computers depend on the availability of the existing body of Apple-compatible applications programs, Apple must adhere to its own format when publishing operating system modifications and upgrades for the Apple-II.¹⁶⁷ The fundamental importance of an operating system's format, therefore, suggests that the *Franklin* court defined the idea of an operating system too narrowly.

Contrary to the Third Circuit's opinion in *Franklin*, determination of where to draw the line between an idea and an expression should not involve a foray into metaphysical considerations.¹⁶⁸ In determining the scope of copyright protection, courts should continue to examine the countervailing policies of protection and encouragement of creativity and originality, on the one hand, and free interchange and use of ideas on the other.¹⁶⁹ Although Congress clearly intended that copyright should provide broad protection for computer software,¹⁷⁰ Congress also established limitations on the scope of

162. See *Sid & Marty Krofft Television Prods., Inc. v. McDonald's Corp.*, 562 F.2d 1157, 1167 (9th Cir. 1977) (determination of what constitutes expression is actually determination of size of congressionally authorized monopoly); *Herbert Rosenthal Jewelry Corp. v. Kalpakian*, 446 F.2d 738, 742 (9th Cir. 1971) (determination of distinction between idea and expression depends on determination of size of congressionally authorized monopoly).

163. CONTU FINAL REPORT, *supra* note 7, at 20.

164. See *Miastkowski, Microcomputer Operating Systems*, in *THE MCGRAW-HILL COMPUTER HANDBOOK*, 28-3 (H. Helms, ed. 1983) (applications software developed on one system is not transferable to another system).

165. *Id.*

166. See 714 F.2d at 1244 n.4 (Apple-II's operating system consists of fourteen interdependent programs).

167. See *Miastkowski, supra* note 177, at 28-4 (Apple has recognized that large body of applications software guarantees strong consumer demand for Apple hardware).

168. See 714 F.2d at 1253 (determination of whether idea and expression have merged is metaphysical).

169. See *Mazer v. Stein*, 347 U.S. 201, 219 (1954) (encouragement of individual effort by personal gain constitutes essence of economic philosophy of copyright clause of Constitution); U.S. CONST., Art. 1, § 8, cl. 8.

170. See *supra* notes 51-57 and accompanying text (CONTU recommended broad protection for computer programs).

copyright protection.¹⁷¹ The legislative history of the 1976 Act indicates that courts should consider the commercial and competitive goals of computer software developers in determining the scope of copyright protection.¹⁷² The *Franklin* court, therefore, should have recognized that adherence to a particular format is an essential element of the idea of an operating system.

In deciding that microcomputer operating systems are eligible for copyright, the courts have reaffirmed the principle that all original works of authorship are eligible for copyright protection regardless of their storage medium.¹⁷³ The Third Circuit in *Franklin* expressly followed CONTU's tenet that the copyrightability of a computer program does not depend on the communicative value or purpose of the program.¹⁷⁴ The extension of copyright to computer operating systems implements the fundamental policy of copyright that society should encourage creative endeavor by allowing an author to profit from the author's creativity.¹⁷⁵ The term "computer program," however, is not a magical incantation that raises the copyright shield whenever a proprietor seeks to obtain an exclusive right to vend his wares. To qualify for copyright, a creative work of intellect must be a work of authorship and not an idea, system, or process.¹⁷⁶ Since bootstart programs are conceptually and physically inseparable from the computer hardware, courts should deny copyright protection to bootstart programs fixed in ROM.¹⁷⁷ Moreover, the federal courts should consider competitive and economic factors in determining the dividing point between idea and expression.¹⁷⁸ As the *Mazer* decision indicates, copyright's economic incentive to create and compete constitutes the underlying policy of the copyright law.¹⁷⁹ Since the extension of copyright protection to computer software represents a form of economic regulation, the courts should consider the economic effects of granting monopolies on certain types of programs in determining the scope of copyright.

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171. See 17 U.S.C. § 102(b) (1982) (copyright does not extend to ideas).

172. See CONTU FINAL REPORT, *supra* note 7, at 23-25 (courts must limit scope of copyright since copyright constitutes monopoly power).

173. 714 F.2d at 1249; see *supra* notes 136-45 (copyright policy considerations support extension of copyright to ROM-based programs).

174. 714 F.2d at 1247-50; see CONTU FINAL REPORT, *supra* note 7, at 21 (copyright protects even those computer programs that produce no copyrightable output).

175. See *Mazer v. Stein*, 347 U.S. 201, 218-19 (1954) (copyright seeks to encourage individual effort).

176. 17 U.S.C. § 102(b) (1982).

177. See *supra* notes 147-60 and accompanying text (ROM-based bootstart programs are not protectible works of authorship).

178. See *supra* notes 161-72 and accompanying text (economic considerations illuminate division between idea and expression).

179. See *Mazer v. Stein*, 347 U.S. 201, 219 (1954) (economic incentive to create constitutes policy rationale for copyright).

