A Chip Off the Old Block: Copyright Law and the Semiconductor Chip Protection Act, 7 Computer L.J. 245 (1986)

Frederic M. Wilf

Recommended Citation

A CHIP OFF THE OLD BLOCK: COPYRIGHT LAW AND THE SEMICONDUCTOR CHIP PROTECTION ACT*†

I. INTRODUCTION

Approximately 170 years elapsed between the time the framers of the Constitution gave Congress the power to "Promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries"[1] and the invention in 1958-59 of the semiconductor chip ("chip") by Jack St. Clair Kilby and Robert Noyce.[2] The framers preferred to give Congress the power to create intellectual property rights, rather than enumerate the rights in the Constitution, because scientists and authors of the future would be using techniques of which even the science-conscious thinkers of the 18th century could not conceive.

In the years since its invention, the chip has become a key component in devices ranging from consumer appliances to large-scale manufacturing components. As revenues from chip sales increased, the incentives for unscrupulous people to copy a successful chip and market the copy as an original also increased dramatically.[3] The American chip manufacturers were faced with the loss of billions of dollars. Many of these manufacturers had either watched or had survived numerous battles with software pirates; and an unclear interpretation of the Copyright Law[4] was their only weapon. American chip manufacturers appealed to Congress, which, after several false starts, enacted the Semiconductor Chip Protection Act ("Chip Act").[5] President Reagan

---

1. U.S. CONST. art. I, § 8, cl. 8.
2. Reid, *The Chip*, SCIENCE, Jan.-Feb. 1985, at 32, 40-41.
3. H.R. REP. NO. 781, 98th Cong., 2d Sess. 1, *reprinted in* 1984 U.S. CODE CONG. & ADMIN. NEWS 5750. This is the legislative history of the Act which, unfortunately, does not fully reflect all of the last-minute changes, such as the addition of sections 913-914 and the renumbering of some subsections.
4. 17 U.S.C. §§ 101-802 (1982 & Supp. III 1985).
5. Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, § 302, 98 Stat. 3335, 3347 (codified at 17 U.S.C. §§ 901-914 (Supp. III 1985)).

signed the bill into law on November 8, 1984.

The Chip Act resolves a number of problems. First and foremost, it gives chip designers and manufacturers protection in the form of legal rights and remedies against those who infringe upon a registered design.[6] Second, it creates a sui generis form of intellectual property protection separate and distinct from either patent or copyright law.[7] Third, the Chip Act is similar enough to copyright law in both expression and intent that copyright law may be used by analogy in the courts until a separate body of chip law is developed.[8] Finally, the existence of the Chip Act relieves both Congress and the courts from the burden of stretching the copyright statute to cover chips.[9]

This Note examines the Chip Act in light of the needs and problems of the semiconductor industry, thus providing a market-oriented approach.[10] The framework for this analysis is a case filed by NEC Corporation against Intel Corporation (*NEC v. Intel*).[11] Because the chips at issue in *NEC v. Intel* are too old to receive protection under the new act,[12] the possible and actual results of this case under copyright law will be compared with results one would expect under the Chip Act.

Please note that this is a comparison of an actual copyright case with a hypothetical chip case. In the actual case, the microcode used by a microprocessor chip is at issue; in the hypothetical case, the physical design of the chip is at issue.

---

6. 17 U.S.C. § 910 (Supp. III 1985).

7. H.R. REP. NO. 781, *supra* note 3, at 5, 1984 U.S. CODE CONG. & ADMIN. NEWS at 5754.

8. *Id.* at 10-11, 1984 U.S. CODE CONG. & ADMIN. NEWS at 5759-60. Thus the Chip Act is a "chip" off the old copyright block.

9. *Id.* at 8-11, 1984 U.S. CODE CONG. & ADMIN. NEWS at 5757-60. For the Congressional viewpoint on the choice of an appropriate statutory solution, see Kastenmeier & Remington, *The Semiconductor Chip Protection Act: A Swamp or Firm Ground?*, 70 MINN. L. REV. 417 (1985). *See also* 70 MINN. L. REV. 263-609 (1985) (This entire issue is devoted to the Chip Act.).

10. *See* Harris, *A Market-Oriented Approach to the Use of Trade Secret or Copyright Protection (or Both?) for Software*, 25 JURIMETRICS J. 147 (1985).

11. NEC Corp. v. Intel Corp., No. C84-20799 WAI (N.D. Cal., filed Dec. 21, 1984). NEC's First Amended Complaint for Declaratory and Injunctive Relief was filed with the court Feb. 14, 1985, perhaps in honor of St. Valentine's Day. Intel's Answer and Counterclaim was filed Feb. 26, 1985. Judge William A. Ingram filed his Partial Findings of Fact and Conclusions of Law on September 22, 1986. NEC Corp. v. Intel Corp., 645 F. Supp. 590 (N.D. Cal. 1986). As of February 1987, the docket was well over thirty-six pages long with over 500 filings.

12. The Chip Act retroactively protects any chip commercially exploited on or after July 1, 1983, provided that the chip is registered by July 1, 1985. 17 U.S.C. § 913(d)(1) (Supp. III 1985). Intel's 8086 and 8088 microcodes were registered in Aug. 1982 and published in 1979 and 1980.

The market-oriented approach is primarily a response to the abuse of analogies in the current literature. The Chip Act is, similarly, an alternative to the approach of stretching copyright law to cover problems resulting from new technologies. The stretching is usually done by comparing the new technologies to the older passive-observer literary and artistic forms. Until a distinct body of chip work precedent is developed, however, the courts are encouraged by the legislative history of the Chip Act to use copyright precedent by analogy.[13]

II. SEMICONDUCTOR TECHNOLOGY

A. INTEGRATED CIRCUITS

Chips are small devices imprinted on semiconductor material (usually silicon) that constitute an electrical circuit. Because the electrical circuit is integrated with the semiconductor material, the device is referred to as an integrated circuit.

The chip can contain many types of circuit designs, but two types are used for computers. These types are memories and microprocessors.

Memories fall into two broad categories: random access memories (RAM) and read-only memories (ROM). A computer may read information into and out of the RAM; it is an empty container that may be filled, depleted, or copied from, at will.

A ROM is a closed container. The computer may copy the contents of a ROM, but the contents may not be altered. The courts have held that a computer program embedded in a ROM retains any copyright it may have because the ROM is merely another way to store the program. Thus, in this respect, it is no different from a disk, tape, paper punch, or any other storage medium.[14]

A microprocessor is an integrated circuit that performs the instructions that it is given. Microprocessors often work as the central processing unit (CPU) of computers. Some chips include both microprocessors and memories, and thus are sufficiently complete to constitute a computer-on-a-chip.

The chip manufacturers design and produce chips to serve a specific use. Engineers first draft a schematic for the chip. This schematic is used to create stencils ("masks") which detail the placement of the circuit within each layer of the chip. A master mask is produced. Working masks are made from the master mask. The working masks are used to etch the circuits onto the semiconductor material via photoli-

---

13. H.R. REP. No. 781, *supra* note 3, at 7-11, 1984 U.S CODE CONG. & ADMIN. NEWS at 5756-60.

14. Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984).

thography. The layers of etched semiconductor are then stacked to form a single chip.[15]

B. MICROPROGRAMMING

A chip works like any other electrical circuit. An electrical impulse runs through the circuit following the path of least resistance. Thus, an electrical impulse will move down one wire in a chip until it meets another wire. At the intersection of the two wires is a gate. If the gate is open, the impulse will flow into the second wire. If the gate is closed, the electrical impulse will not flow into the second wire. The openings and closings collectively determine the procedure the computer is to carry out. Several sets of these gate openings may be needed to carry out one instruction from a higher-level computer language.

The signal which instructs the gate to be open or closed, allowing the computer to perform a particular task, may be encoded in binary. Thus, a "0" means the gate is closed, and a "1" means the gate is open. Therefore, "10011" in a chip that contains five gates mean that the first gate is open, the second and third gates are closed, and the fourth and fifth gates are open.

The openings and closings of the gates may be hard-wired into the chip. This means that each gate in the chip is designed to be permanently opened or closed. Most of the microprocessor chips built today, however, have soft-wired gates. The gates are opened or closed according to the instructions the chip is given. These instructions are called microcode. The microcode is stored in a small ROM that is part of the microprocessor chip. A set of instructions written in microcode is called a microprogram. The art of programming in microcode is called microprogramming.

Using a microcode, a chip designer may alter the manner in which the chip operates after the chip is built. By changing the microcode instruction set, the designer can change the manner in which the chip works without changing the physical layout of the chip. This results in lower development costs and fewer problems.[16]

ROMs that contain microcode or the object code of a source pro-

---

15. This is, of course, a simplification of a more complex procedure. For detailed discussions of the creation and uses of chips, see H.R. REP. NO. 781, *supra* note 3, at 11-13, 1984 U.S CODE CONG. & ADMIN. NEWS at 5760-62; Barker, *Copyright for Integrated Circuit Designs: Will the 1976 Act Protect Against Chip Pirates?*, 24 S. TEX. L.J. 817, 817-22 (1983). *See also*, SCI AM., Sept. 1977 (entire issue).

16. Patterson, *Microprogramming*, SCI. AM., Mar. 1983, at 50. "Besides reducing the cost of correcting the control system the introduction of microprogramming makes it possible to change the control system completely by changing the total contents of the microprogram memory. Thus a single hardware system can be made to serve many different functions." *Id.* at 56.

gram are classified as firmware; this designates a middle ground between software (instructions programmed by humans) and hardware (physical equipment, including the chips).[17]

Once a chip has been created, its mysteries may be revealed to another person by a process known as reverse engineering. In reverse engineering, a person places the chip under a microscope to read the circuitry, and may use chemicals to separate the layers. The microcode embedded on the chip may be read by a special machine in which the chip is placed. Many researchers and legitimate companies use reverse engineering to analyze the chip's operation. Unfortunately, reverse engineering is the primary tool for both teaching and piracy of chip architecture. A legitimate company or researcher creates an extensive paper trail in analyzing a chip, but a pirate merely copies the chip.[18]

The perceived need to continue the use of reverse engineering as a legitimate tool was one of the factors that motivated Congress to choose sui generis protection. The statutory allowance for reverse engineering is one of the features that distinguishes the Chip Act from the Copyright Act.[19]

III. PROVISIONS OF THE CHIP ACT

Although the Chip Act is located in Title 17 of the United States Code immediately after the Copyright Act, the Chip Act does not preempt or affect other federal intellectual property law. State law is preempted only to the extent that the state law affects mask works and provides similar protection.[20]

A. DEFINITIONS AND PROCEDURES

The Chip Act protects mask works fixed in semiconductor chip products. Title 17 section 901(a)(2)[21] defines "mask work" as "a series of related images, however fixed or encoded" which represent the chip. Section 901(a)(1) defines "semiconductor chip product" as the "final or intermediate form of any product" made from semiconductor material "in accordance with a predetermined pattern" that is "intended to perform electronic circuitry functions." Sections 901(a)(3)-(9) define fixation, commercial exploitation, the mask work's "owner" (which is the

---

17. *Id.* at 50.

18. H.R. REP. No. 781, *supra* note 3, at 21-22, 1984 U.S CODE CONG. & ADMIN. NEWS at 5770-71.

19. *See* Laurie, *NEC v. Intel: Compatibility Constraints and Choices*, COMPUTER LAW., Oct. 1986, at 9.

20. 17 U.S.C. § 912 (Supp. III 1985).

21. All references to code sections are to title 17 of the United States Code (Supp. III 1985), unless otherwise indicated.

employer in case of a work for hire), "innocent purchaser," "notice of protection," and "infringing semiconductor chip product." According to the legislative history, the definition of fixation in section 901(a)(3) is broad enough to cover data base tapes.

A data base tape contains a digital encoding of the coordinates of the relevant points in a mask or set of masks.[22] The reason such protection is important is that a pirate with access to a data base tape, a telephone line, and a modem, is able to transmit the contents of that tape over the telephone line. A mask work may be pirated from Silicon Valley to the Ruhr valley without the pirate ever leaving California or the premises of the mask work owner.

Despite the legislative history, the Chip Act's definition of fixation creates some ambiguity as to whether a data base tape is protected. The key language in section 901(a)(3) is that the fixation must be sufficiently stable to allow the mask work "to be reproduced from the product." Although the data base tape contains sufficient information to reproduce the product, and is a digital re-creation of the mask work, the data base tape is not necessarily a "semiconductor chip product" as defined in section 901(a)(1), as it does not have "two or more layers" of semiconductor material etched to perform the function of electronic circuitry. Until the clause "from the product" can be removed from section 901(a)(3), the best argument that the mask work is sufficiently fixed in a data base tape is that the tape is an intermediate form of the product in accordance with the first line of section 901(a)(1), and that such a reading is consistent with the clearly expressed congressional intent.

Section 902 defines the subject matter of the protection. If the owner is a United States national or domiciliary, the protection commences on the date the chip is registered, or is first commercially exploited anywhere in the world, whichever occurs first. The protection also applies to nationals of a foreign nation which, by treaty, affords reciprocal protection to United States mask works under its national laws. The President has the power to proclaim reciprocity (without a treaty) if a foreign country has a national law that gives foreigners and nationals in that nation equal protection under a mask work act substantially similar to the Chip Act.

Section 903 details ownership, transfer, licensing, and recording under the Chip Act, and is similar to the provisions of sections 105 and 201 of the Copyright Act. Section 904 limits the duration of protection to ten years after the work is registered or commercially exploited, whichever occurs first. Under section 905, the mask work owner has

---

22. H.R. REP. NO. 781, *supra* note 3, at 17, 1984 U.S. CODE CONG. & ADMIN. NEWS at 5766.

the right to reproduce the mask work, import, or distribute chips, and cause another to reproduce, import, or distribute the mask work or chip. The last provision is meant to make contributory infringement an act of infringement.[23]

B. REVERSE ENGINEERING AND INFRINGEMENT

Section 906 allows reverse engineering of a chip for the "purpose of teaching, analyzing, or evaluating" the chip's design and organization. Also, the results of such reverse engineering may be incorporated into another original mask work.[24] The legislative history states that this provision is similar to fair use under section 107 of the Copyright Act, but makes it clear that section 107 does not apply to mask works.[25] Section 906, however, does carry over the first sale doctrine in section 109(a) of the Copyright Act into section 906(b) of the Chip Act.

Section 907 does not extend liability to innocent infringers. An innocent infringer is liable for reasonable royalties only upon receiving notice of protection. Prior to receiving notice, an innocent infringer is immune from liability, and that immunity follows the product to innocent purchasers.

C. REGISTRATION AND NOTICE

Section 908(a) requires the mask work owner to apply to the Register of Copyrights within two years of the first commercial exploitation or forfeit the claim. The rest of section 908 discusses the administrative duties of the Register, who performs an examination similar to that under copyright law. Registration is prima facie evidence that the facts contained in the certificate were true and that the applicant has satisfied the Chip Act's requirements and the Register's procedures. Applicants may sue the Register if the application is rejected or if the Register fails to take any action for four months.[26]

Under section 909, an owner has the option of affixing notice of protection to the mask work and chips. The notice gives no greater protection to the owner per se, but it does constitute prima facie evidence that the infringer had notice of protection. The notice must have the name or generally known abbreviation of the mask work owner, plus

---

23. *Id.* at 21, 1984 U.S CODE CONG. & ADMIN. NEWS at 5770.

24. For more on reverse engineering, *see* Fisher, *Beyond Fair Use: Reverse Engineering and the Semiconductor Chip Protection Act,* COMPUTER LAW., Apr. 1986, at 9; Raskind, *Reverse Engineering, Unfair Competition, and Fair Use,* 70 MINN. L. REV. 385 (1985).

25. H.R. REP. NO. 781, *supra* note 3, at 21-23, 1984 U.S CODE CONG. & ADMIN. NEWS at 5770-72.

26. 17 U.S.C. § 908(g) (Supp. III 1985).

the words "mask work," the symbol *M*, or the letter M in a circle.[27] One annoying problem is that in both the United States Code and the Chip Act's legislative history, section 909(b)(1) reads "mask force" and not "mask work." The culprit is probably one of several transcription errors in the circulated copy of the Chip Act.[28] Whatever the cause, the Copyright Register makes it clear in its guidelines and registration forms that the magic words are "mask work."[29]

The enforcement of the owner's rights and remedies are defined in sections 910-911. The mask work owner or exclusive licensee may sue the infringer in a civil action. No criminal actions are allowed. There is no provision for an applicant to sue while the application is pending, but under section 910(b)(2), the applicant may sue and include a claim against the Register if the application has been rejected. A reading of this section with section 908(g) would indicate that an applicant may sue an infringer after the filing of the application if the Register has not taken any action for four months.

Upon a finding of infringement, the owner may be awarded actual damages and given the infringer's profits. The owner need only show the infringer's gross profits; the infringer must prove any deductions from the profits or miscalculations by the owner. Any time before a final judgement is reached, the owner has the option of choosing statutory damages not greater than $250,000.00 (as set by the court) instead of actual damages and profits. The court, at its discretion, may also award full costs and reasonable attorneys' fees to the prevailing party pursuant to section 911(f).

D. RELATION TO OTHER LAWS

Section 912 lists the relation (or non-relation) of the Chip Act to other laws. Copyright law is isolated from the Chip Act. In the first eight chapters of Title 17, any references to "this title" or "title 17" are deemed not to apply to chapter nine. The legislative history specifically states that any copyrighted program or writing does not lose its copyright protection because it has been embedded in a ROM.[30]

Thus, a copyrighted computer program may be embedded in a chip,

---

27. Id. § 909(b).

28. The word "symbol" was misspelled in the original as "sumbol." *See* 17 U.S.C. § 909(b)(1).

29. *See* Copyright Office Regulations, Mask Work Protection, 37 C.F.R. § 211.6 (1986). The original Interim Regulations of the Copyright Office (*reprinted in* 1 COPYRIGHT L.J. 112 (1985)) created some controversy with regard to the rule that more than twenty percent of the mask work had to be fixed in an intermediate form to be registerable, and the manner by which the mask work's "owner" was defined. 1 COPYRIGHT L.J. 141 (1985). These problems were subsequently solved.

30. H.R. REP. No. 781, *supra* note 3, at 28, 1984 U.S. Code Cong. & Admin. News at

the design of which is protected by the Chip Act. If that chip is part of an innovative process or invention, the process or invention may be patented. State-created trade secret and unfair competition law may also be applied at each level. Protection, under the different types of intellectual property law, may be stacked like layers in a chip.

Sections 913-914 list the Chip Act's transitional provisions. One of these provisions grants power to the Secretary of Commerce, for the first three years after enactment, to grant mask work protection to nationals of a foreign country if that country is making "good faith efforts and reasonable progress toward" entering a treaty with the United States for reciprocal protection or is enacting legislation substantially similar to the Chip Act. This provision was reputed to have been lobbied for by Japan, which argued that it was making progress towards a treaty or similar legislation.[31] In June 1985, the Secretary of Commerce provided interim protection to Japanese mask works. The protection is retroactive to November 8, 1984, when the bill was signed into law. Japan's protection was scheduled to terminate in June 1986 with the provision that it would be extended again if Japan continued to make progress on a bill under consideration by the Japanese parliament.[32]

The Secretary of Commerce has subsequently delegated its section 914 authority to the Commissioner of Patents and Trademarks, who has in turn issued interim orders to protect the mask works of Sweden, Australia, the United Kingdom, the Netherlands, Canada, and the European Communities. These interim orders have been extended to November 8, 1987.[33]

IV. *NEC CORPORATION v. INTEL CORPORATION*

One case filed in 1984 involves two giants in the semiconductor industry, Intel and NEC. These companies are openly engaged in commercial competition; this is not a question of an underfinanced chip

---

5777. *See also* Stern, *Preemption and Relation of SCPA to Other United States Laws*, COMPUTER LAW., Jan. 1985, at 9.

31. Note, *Semiconductor Chip Design*, 3 COMPUTER L. REP. 518 (1985). A recent report by the Commissioner of Patents and Trademarks to Congress recommends that the § 914 authority to issue interim orders be extended past its present expiration date of November 8, 1987. *Report Issued on International Transitional Provisions of SCPA*, 33 PAT. TRADEMARK & COPYRIGHT J. (BNA), No. 806, at 51 (Nov. 20, 1986) [hereinafter *Commissioner's Report*].

32. *Protection Extended to Japanese Mask Works*, COPYRIGHT L. REP. (CCH) ¶ 20,309 at 10,815 (1985).

33. *See Commissioner's Report, supra* note 31, at 51-52. *See also* Hart, *Questions Raised on Legally Protecting Semiconductor Chips in the UK*, COMPUTER L. & PRAC., May-June 1985, at 146.

pirate selling low-quality imitations on the black market. The stakes are much higher.

Two of the industry's more successful microprocessors are made by Intel, an American corporation, and are designated as the 8086 and the 8088.[34] The 8088 chip is used by International Business Machines Corporation (IBM) in the IBM Personal Computer (PC). Intel also sells these chips to other computer manufacturers who claim that their computers are IBM-compatible. These computers are often referred to as PC clones. Intel has registered the microcode used in their 8086 and 8088 chips with the Register of Copyrights.[35] Since the suit was filed, Intel has marketed more powerful chips, designated the 80286 and 80386, while continuing to market the 8086 and 8088.

NEC is a Japanese concern based in Tokyo. As part of a complete line of computer hardware, NEC manufactures and markets chips, some of which are the V20, V30, V40, and V50.[36] NEC imports the V20 and V30 chips into the United States via its American subsidiary, NEC Electronics.[37] The V20 chip has been used to replace the 8088 chip found in both the PC and its clones.[38] Intel, however, has claimed that the microcode used in the NEC "V" series of chips is a copy of the microcode in Intel's 8086 and 8088 chips.[39]

Most of the parties' allegations go to the nature of microcode and chip design. In its complaint, NEC discusses, at great length, the details of how its microcode and chip design differ from that of Intel's. NEC's arguments may be narrowed down to five points: (1) the microcode is merely a replacement or compromise for hardwired circuitry and thus should not be considered a computer program; (2) whether the microcode is a computer program or not, it is a utilitarian item, process, system, method of operation, or purely functional item; (3) NEC's chips are different from Intel's chips and, as a result, the microcode is very different; (4) whether or not the chips are the same, the microcode is different; and (5) the theory of estoppel, because Intel informed NEC that it was examining the V20 and V30 for possible copyright infringement, but Intel never followed through.

The first four points raise the issue of what the microcode is and

---

34. *See* Intel's Answer and Counterclaim, *supra* note 11, at 6-7, ¶ 22.

35. The registration numbers are TX 988-844 for the 8086 CRCOD, effective Aug. 16, 1982; and, TX 953-801 and TX 953-802 for the 8088 and 8086 microcode sources, respectively, both effective Aug. 27, 1982. Copies of the registrations are appended to Intel's Answer and Counterclaim, *supra* note 11.

36. *See* NEC's Complaint, *supra* note 11, at 2-3, ¶¶ 1-5.

37. *Id.* at 2-3, ¶¶ 2, 5. The V40 is used to power several PC clones sold in the United States.

38. Anacker, *Affordable Hardware*, A.B.A. J., Nov. 1, 1986, at 90.

39. *See* Intel's Answer and Counterclaim, *supra* note 11, at 8, ¶ 27.

does. The fifth point, estoppel, is a factual issue beyond the scope of this Note.

On September 22, 1986, Judge William A. Ingram issued his Partial Findings of Fact and Conclusions of Law in which he held that Intel has "good, valid and existing copyrights on its 8086/8088 microcode."[40] In his fifty-four findings of fact and ten conclusions of law, Judge Ingram held that the function performed by "defendant's 8086/8088 microprograms does not affect their status as copyrightable subject matter."[41]

V. THE APPLICATION OF COPYRIGHT LAW

A. THE NATURE OF MICROCODE

In 1980, the Copyright Act was amended to define a computer program as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."[42] Because the definition was placed in section 101, the courts have interpreted it as congressional intent that computer programs be protected.[43] This protection applies whether the program is written in source or object code, is an applications program or operating system, or is written on a tape, disk, or embedded in a ROM chip.[44] Unfortunately, the question of whether the microcode constitutes a computer program under section 101 has never been directly addressed before this case.[45]

NEC defines microcode as a structure of the chip's internal circuitry.[46] NEC separately defines a machine instruction set as "simply a list in binary form (i.e., '1's' and '0's') of all the different instructions to

---

40. 645 F. Supp. at 591.

41. *Id.* at 595. Several months after Judge Ingram handed down his decision that microcode is subject to copyright law, a plaintiff in a similar lawsuit added a claim of microcode copyright infringement by filing an amended complaint. Nat'l Semiconductor Corp. v. United Microelectronics Corp., No. C86-20762 WAI (N.D. Cal.). *See* 1987 COMPUTER INDUSTRY LITIGATION REP. (Andrews) 5226, 5267-73.

42. Act of Dec. 12, 1980, Pub. L. No. 96-517, § 10(a), 94 Stat. 3015, 3028 (codified as amended at 17 U.S.C. § 101 (Supp. III 1985)).

43. Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1247-49 (3rd Cir. 1983), *cert. dismissed*, 464 U.S 1033 (1984).

44. *Id.* at 1249-54.

45. The district court in *Apple* confused the question of an operating system embedded in a ROM with the hypothetical question of copyrighting "micro-object code" in a microprocessor chip. Apple Computer, Inc. v. Franklin Computer Corp., 545 F. Supp. 812, 821 n.14 (E.D. Pa. 1983). The Third Circuit disposed of the issue because Apple's testimony showed that the infringed works did not use microcode. "Apple does not seek to protect the ROM's architecture but only the program encoded upon it." *Apple*, 714 F.2d at 1249 n.7.

46. *See* NEC's Complaint, *supra* note 11, at 4, ¶ 10.

which a particular microprocessor can respond"[47] and as "the building blocks used to create computer programs."[48] The interface between the two, according to NEC, is that a machine instruction is "executed in the microprocessor either directly by means of dedicated hardware circuitry or by selection of a certain number of steps represented by one or more lines of microcode."[49] Because the microcode controls the path that the signal takes in processing the machine instruction, the microcode is not a program but merely a binary-encoded map of the hardware circuitry.[50]

Intel defines the microcodes as computer programs which "act as interpreters for the macroinstructions in computer programs which reside outside the microprocessor in ROM, tape or diskettes."[51] The microcode takes an instruction from an outside program and "interprets it into an expanded series of microinstructions, and through binary bit patterns which the microprocessor perceives, directly brings about a certain result in the microprocessor."[52] This language closely tracks the definition of a computer program under the 1980 amendment to the Copyright Act.

Much of the scientific literature refers to microcode as instructions, which is the word used in the 1980 amendment to the Copyright Act. As noted above, a set of instructions written in microcode is often called a microprogram.[53] The 1980 amendments constituted the statutory enactment of the recommendations made by the National Commission on New Technological Uses of Copyrighted Works ("CONTU").[54] According to CONTU, copyright protects the programmer's expression, not the methods or processes embodied in the programs.[55] The program, therefore, is protected "so long as it remains fixed in a tangible medium of expression."[56] Copyright, however, does not protect the "electromechanical functioning of a machine."[57] As a result, "one is always free to make a machine perform any conceivable process, [however] one is not free to take another's program."[58]

The views expressed in CONTU's report further Intel's position.

---

47. *Id.* at 4, ¶ 9.

48. *Id.* at 4, ¶ 11.

49. *Id.* at 5, ¶ 12.

50. *Id.*

51. See Intel's Answer and Counterclaim, *supra* note 11, at 3, ¶ 8.

52. *Id.*

53. *See, e.g.,* Patterson, *supra* note 16, at 50.

54. NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, FINAL REPORT (1979).

55. *Id.* at 19-20.

56. *Id.* at 20.

57. *Id.*

58. *Id.*

Although NEC is correct in arguing that the microcode is an alternative to hardwiring the circuit, the argument is unavailing because copyright law views microcode as a set of instructions and not as a replacement for hardwired circuits.[59]   Indeed, NEC's argument is similar to the line of cases prior to *Apple Computer, Inc. v. Franklin Computer Corp.*,[60] in that it argues that a program is too mechanical to be a literary work. The adoption of NEC's argument would remove copyright protection from computer programs. This is because all computer programming is an alternative to ENIAC, the first computer, which required the physical movement of wires and cables to reprogram it.

B. SUBSTANTIAL SIMILARITY

Since the decision in *Apple v. Franklin*, courts have had the task of construing computer programs in the copyright context. One case, *SAS Inst., Inc. v. S&H Computer Sys., Inc.*,[61] involved the infringement of an SAS program product. The product, which was designed to operate on one brand of computer, was copied and adapted by S&H to operate on a different brand of computer. Among the defenses raised by S&H were that only a small portion of the product was copied and that the two products were necessarily different as they operated on two different machines.

Testimony showed forty-four instances of copying from the SAS product to the S&H version. The court held that although the quantity of the copying was neither overwhelming nor insubstantial, the quality of the sections copied was high. Most of the structure and organization of the S&H product was stolen from the SAS product. The court also looked at the conduct of the parties, which showed that S&H had intentionally based their product upon that of SAS.[62] The court also held that the redesign of the SAS product to operate on a different computer did not bar a finding that the S&H product was a derivative, and thus infringing, work.[63]

NEC's third argument in its case against Intel, that different chips necessitate different microcode, is unavailing as it emphasizes the

---

59. *See* Harris, *Legal Protection for Microcode and Beyond*, 6 COMPUTER/L.J. 187 (1985).

60. 714 F.2d 1240 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984).

61. SAS Inst., Inc. v. S&H Computer Sys., Inc., 605 F. Supp. 816 (M.D. Tenn. 1985). *See also* 1 COPYRIGHT L.J. 126 (1985).

62. *SAS Inst.*, 605 F. Supp. at 831. *See also* E.F. Johnson Co. v. Uniden Corp. of America, 623 F. Supp. 1485 (D. Minn. 1985) (discussed with regard to the court's use of the "iterative approach" of determining substantial similarity at 2 COPYRIGHT L.J. 76 (1986)).

63. *SAS Inst.*, 605 F. Supp. at 831. *See also* Whelan Assoc., Inc. v. Jaslow Dental Laboratory, Inc., 609 F. Supp. 1307 (E.D. Pa. 1985), *aff'd*, 797 F.2d 1222 (3d Cir. 1986), *cert. denied*, 107 S. Ct. 877 (1987).

wrong factor. As in *SAS v. S&H*, the programs, and not the machines on which they run, are compared. This leads into NEC's fourth argument, that NEC's microcode is not substantially similar to Intel's microcode. It then becomes a question of fact as to whether the similarities in instructions, starting addresses, and overall organization, as alleged by Intel, are sufficient for a finding of infringement.

C. CONCLUSIONS UNDER COPYRIGHT LAW

A microcode comes under the definition of a computer program in section 101. In the NEC case, if only a few instructions had been encoded in ROM, then there might have been too few to create a full program. The pleadings, however, show a large and substantial microcode instruction set.

NEC's best remaining argument is that under the facts no infringement occurred. Estoppel has also been asserted as a defense, although not discussed in this Note.

VI. THE RESULTS UNDER THE CHIP ACT

Prior to the Chip Act, many commentators argued that copyright law could or should protect the chip masks and schematics.[64] Other commentators argued that copyrighting a chip's mask is merely a shabby attempt at copyrighting the chip, and thus should not be allowed.[65] Those who argued that a copyright did protect the schematics and mask usually noted that protecting the mask did not protect the chip itself.[66]

Intel once filed masks of its 8755 microprocessor with the Register of Copyrights. Intel also tried to deposit an 8755 chip as a copy of the published form of the masks, but the Register refused the chip. Intel sued, but the parties settled before trial. The masks were registered and the chip was placed in the file with the masks, but the chip was not accepted as the published form of the mask.[67]

Under the Chip Act, Intel could sue for infringement of the mask words.[68] Intel could still sue for infringement of the microcode as a separate count under copyright law. The tests of substantial similarity as

---

64. *See, e.g.*, Barker, *supra* note 15, at 832-42; Davidson, *Protecting Computer Software: A Comprehensive Analysis*, 1983 ARIZ. ST. L.J. 611, 706-11. Davidson looks to see how the microcode is authored to determine whether it is protected under copyright law or not.

65. Petraske, *Copyright for Machines—An Oxymoron*, 65 J. PAT. OFF. SOC'Y 410 (1983).

66. Barker, *supra* note 15, at 842.

67. Intel Corp. v. Ringer, No. C-77-2848 RHS (N.D. Cal., filed Apr. 13, 1978) (dismissed by stipulation), *reported in* Barker, *supra* note 15, at 842.

68. *See* Becker, *Legal Protection of Semiconductor Mask Works in the United States*,

developed under copyright law would apply to both claims until a test specific to the Chip Act, the test of "substantial identity," is developed and used.[69]

CONCLUSION

The Semiconductor Chip Protection Act appears to be the right statute at the right time. Several problems need to be eliminated from the statute. It is expected that some of the judicial interpretation problems that have plagued computer cases in the past will be resolved as judges more familiar with the technology are appointed.[70] Nevertheless, most of the parties involved (except the pirates) should be happy with the Chip Act. One may expect that the Founding Fathers would have been proud.

While many commentators argue that the success of the Chip Act is the best argument for sui generis protection of computer software,[71] it is unlikely that Congress, or the computer software houses will work toward a new statute to protect software. The computer industry has expended too much time and money to hammer the copyright law into its present state. The industry knows the limitations of copyright protection, even though the boundaries are still unclear. Congress, having labored to create the Chip Act to appease one segment of the computer industry, is unwilling to start over in order to appease another segment of the same industry that recently requested and received amendments to the Copyright Act. To fully realize the potential of the Chip Act, however, Congress will need to remove computer software, including microcode, from the ambit of the Copyright Act, and place it in a sui generis statute so that plaintiffs do not rely primarily on the broader protection of the Copyright Act.

The argument that computer programs, micro or macro, are nothing more than extensions of a computer's electronic circuitry and are thus uncopyrightable will never be eliminated. This argument has been employed, without success, by NEC in *NEC v. Intel*, by S&H in *SAS v. S&H*, by Franklin in *Apple v. Franklin*, and to a lesser degree by Jaslow in *Whelan v. Jaslow*.[72] The creation of software is equally analogous to the writing of a "how-to" book and the drawing of an electronic

---

6 COMPUTER/L.J. 589 (1985); Stern, *Determining Liability for Infringement of Mask Work Rights Under the Semiconductor Chip Protection Act*, 70 MINN. L. REV. 271 (1985).

69. *See Current Developments in Computer Law Explored*, 33 PAT. TRADEMARK & COPYRIGHT J. (BNA) 435, 435-36 (1987).

70. *See*, Elman, *A Personal View of the Whelan v. Jaslow Appellate Arguments— Fifty More Minutes on Software Copyright*, 4 COMPUTER L. REP. 840 (1986).

71. *See*, Samuelson, *Creating a New Kind of Intellectual Property: Applying the Lessons of the Chip Law to Computer Programs*, 70 MINN. L. REV. 471 (1985).

72. *See* Harris, *supra* note 59.

schematic. The problem remains that a computer becomes a different machine for each program that controls it, yet each of these machines creates a different environment for those who use the computer. The Chip Act teaches that it is better to create a new solution for a new problem than to stretch an old solution out of shape.

*Frederic M. Wilf **

---

* B.A., Rutgers University (1982); J.D., Case Western Reserve University (1985). The author practices corporate and computer-related law with the law firm of Elman Associates, Philadelphia, Pennsylvania. This Note was written when the author was a student.