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REVERSE ENGINEERING UNDER THE SEMICONDUCTOR CHIP PROTECTION ACT: AN ARGUMENT IN FAVOR OF A “VALUE-ADDED” APPROACH

I. INTRODUCTION

The computer chip industry recognizes and accepts reverse engineering (an advanced form of copying) as a legitimate form of competition.¹ Enacted in 1984, the Semiconductor Chip Protection Act² provides protection to semiconductor chips outside of federal copyright law, but allows competitors to reverse engineer.³ At the time of its passage, commentators questioned the SCPA's ability to detect and protect computer chip owners from pirating by their competitors. One commentator questioned whether the reverse engineering exception was too similar to copyright law to provide meaningful protection.⁴ Another commentator questioned whether the

1. Raskind, *Reverse Engineering, Unfair Competition, and Fair Use*, 70 MINN. L. REV. 385, 386 (1985) [hereinafter Raskind].

2. Semiconductor Chip Protection Act, 17 U.S.C. §§ 901-914 (Supp. 1991) [hereinafter SCPA].

3. 17 U.S.C. § 906 (Supp. 1991) provides,

(a) Notwithstanding the provisions of Section 905, it is not an infringement of the exclusive rights of the owner of a mask work for-

(1) a person to reproduce the mask work solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques embodied in the mask work or the circuitry, logic, flow, or organization of components used in the mask work; or

(2) a person who performs the analysis or evaluation described in paragraph (1) to incorporate the results of such conduct in an original mask work which is made to be distributed.

(b) Notwithstanding the provisions of Section 905(2), the owner of the particular semiconductor chip or by any person authorized by the owner of the mask work, may import, distribute, or otherwise dispose of or use, but not reproduce that particular semiconductor chip product without the authority of the owner of the mask work. *Id.*

4. Boorstyn, N., *Copyright Law*, § 2:30 at 81 (Supp. 1991) [hereinafter Boorstyn]. Notes that Section 906(a)(2), the originality requirement, is a virtual restatement of traditional copyright law and therefore effectively diminishes the “exception.”

SCPA could continue to provide protection to the highly competitive and ever-changing nature of the computer chip industry.⁵ The legislators who passed the SCPA admitted there would be a grey area in determining what was legitimately or illegitimately reverse engineered.⁶

Because the computer chip industry is based on a rapidly changing technology, competitors must create compatible products quickly in order to remain competitive. The new technology of computer chips does not fall within existing copyright law, and before 1984, computer chips did not receive any type of copyright protection.⁷ Subsequently, the SCPA was enacted as an exception to the federal copyright statute prohibiting copying except in limited and specifically enumerated circumstances.⁸

The reverse engineering exception allows a reverse engineered chip to compete against the original chip.⁹ A recent

5. Raskind, *supra* note 1, at 388. Questions whether the SCPA tries to protect products in terms of a technology that is already obsolete. *Id.*

6. Metalitz, *Legislative History of the Semi-Conductor Chip Protection Act of 1984: Observations From The Senate Side in THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984* 60 (J. Baumgarten, ed. 1984).

7. Raskind, *supra* note 1 at 385 (noting that the chip industry went through its formative stages when there was neither patent nor copyright protection).

8. 17 U.S.C. § 107 (1991) provides,

[T]he fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright. In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include—

- (1) the purpose and character of the use, including whether such use is of a commercial nature or is for non-profit educational purposes;
- (2) the nature of the copyrighted work;
- (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
- (4) the effects of the use upon the potential market for or value of the copyrighted work. *Id.*

9. H.R. 425, 98th Cong., 2d Sess. (1984) *reprinted in* Reams, *THE SEMICONDUCTOR CHIP AND THE LAW: A LEGISLATIVE HISTORY*, VOL. I (1986) [hereinafter H.R. 425] The report provides in part, "[R]everse engineering serves a valuable function in the chip industry. This enables the second chip to compete directly against the original chip, or to become a second source for it, thus assuring stability of supply. Reverse engineering also spurs innovation and technological progress, as competitors seek to develop ever faster and more efficient chips, to perform similar or related functions. Such legitimate reverse engineering is not prohibited by the bill." *Id.*

Ninth circuit preliminary ruling, *Atari v. Nintendo*,¹⁰ provides a useful framework from which to test the scope of this exception. Judge Fern Smith of the Northern California District Court granted a preliminary injunction which prohibited a competitor, Atari, from making and selling its reverse engineered, Nintendo-compatible video game cartridges. Judge Smith determined that Atari had copied *too much* of Nintendo's computer chip. As will be discussed below, the *Atari v. Nintendo* fact situation demonstrates the inadequacies of the SCPA reverse engineering exception.

II. PURPOSE AND OVERVIEW OF THE NOTE

The purpose of this note is to question whether the SCPA reverse engineering exception adequately protects the rights of chip owners while allowing competitors to develop compatible products. This note concludes that the SCPA reverse engineering exception falls short of providing meaningful protection. The note also concludes that a "value-added"¹¹ approach to the reverse engineering exception is superior to the existing approach (which is too closely allied with copyright law and fosters lengthy and expensive litigation).

Part III is a discussion of the practice of reverse engineering in general and under the SCPA. Part IV, using *Atari v. Nintendo* as a factual basis, analyzes reverse engineering in the compatible computer products industry. Subsection A of Part IV reviews the facts of *Atari v. Nintendo*, and Subsection B analyzes the decision which was argued and decided under copyright law. Subsection C of Part IV analyzes the *Atari v. Nintendo* fact situation under the SCPA reverse engineering exception. Part V reviews a proposed alternative to the existing SCPA and applies the alternative to the *Atari v. Nintendo* fact situation.

III. REVERSE ENGINEERING IN THE SEMI-CONDUCTOR CHIP INDUSTRY

A. THE REVERSE ENGINEERING PROCESS

Reverse engineering is a simple concept not unique to the computer chip industry.¹² The process begins with a finished

10. *Atari v. Nintendo*, C-88-4805-FMS, C-89-0027-FMS, C-89-0824-FMS (N.D. Cal. 1991) [hereinafter *Atari*] (a copy of the ruling is on file at the Golden Gate University Law Review Office).

11. See Ladd, Liebowitz & Joseph, *infra* note 41.

12. See, *CMI Corp. v. Jakob*, 209 U.S.P.Q. 233 (W.D. Okla. 1980). This case provides an example of the concept of reverse engineering: the defendant observed his

product and, working backwards, the product is taken apart to determine how it was put together.¹³ At this point, a reverse engineer should be able to make a similar, if not identical copy of the original product without access to, or use of, any confidential information.¹⁴

Reverse engineering in the computer chip industry is more complex, but the underlying process and result is similar. A computer chip industry reverse engineer will examine and analyze a competitor's computer chip in order to determine its structure and function. The computer chip is then "peeled" from the outside in, and photographed for further study and analysis. Once the structure and function of the original chip have been ascertained, a compatible chip can be created.¹⁵

Without reverse engineering, the incentive for creating competitive products is lessened.¹⁶ Reverse engineering is both an acceptable and necessary practice because new technology is developed rapidly in the computer chip industry. A competitor must be able to develop compatible products within a short period of time. Otherwise, competing products would be obsolete if competitors were forced to develop the products from scratch.

B. REVERSE ENGINEERING UNDER THE SCPA

Under the SCPA, however, reverse engineering is an affirmative defense which must be pleaded and proved. The SCPA reverse engineering exception examines both the *product* and the *conduct* of the reverse engineer. In an infringement action, the resulting compatible work must be an original mask work. A two-prong test determines whether the reverse engineering exception applies: (1) the work must not be substantially

competitor's machine, recorded data and measurements, and took photos. The defendant was subsequently able to duplicate the product without access to or use of any confidential information. Patent issues aside, the court found the defendant's conduct acceptable and legal. *Id.*

13. *Kewanee Oil Co. v. Bicron*, 416 U.S. 470, 476 (1973) This trade secret case involved the production of crystals. The court notes that "trade secret law does not offer protection against discovery by fair and honest means, such as by reverse engineering, that is, by starting with the known product and working backward to divine the process which aided in its process and manufacture." *Id.*

14. See *Atari*, *supra* note 10.

15. Hart, R.J., *High Technology "Reverse Engineering:" The Dual Standard*, 14 N. KY. L. REV. 237, 238 (1987) [hereinafter Hart].

16. See 17 U.S.C. § 906(a)(2), *supra* note 3.

similar to the original chip, and (2) the competing work must be accompanied by a record of investment and toil by the reverse engineer.¹⁷

The legislative history of the SCPA contains evidence that Congress gave great deference to the computer chip industry standards allowing reverse engineering in order to stimulate growth and competition.¹⁸ It appears that the SCPA should be able to meet the needs of an ever expanding technology, as well as follow the Constitutional mandate of Article I, Section 8¹⁹ by putting the economic interests of the computer chip owner second to society's interest in the progress of science and the useful arts.

The SCPA creates a *separate* and *distinct* form of legal protection for original mask works²⁰ that are fixed or embodied in semiconductor chips. At the time of the SCPA's passage, the existing copyright laws did not protect computer chips. This was because the mask work is considered to be a purely utilitarian process and not eligible for federal copyright protection.²¹ Subsequently, reverse engineering is contrary to the copyright principle of fair use. The Fair Use statute prohibits copying except in limited circumstances, such as library or archival uses.²²

17. See 17 U.S.C. § 906(a)(2), *supra* note 3 (requiring that the reverse engineer incorporate and summarize the reverse engineering in an original work).

18. H.R. 425, *supra* note 9 (providing in part, "[r]everse engineering serves a valuable function in the chip industry.").

19. U.S. CONST. art. I, § 8, cl. 7. "The Congress shall have the power [t]o promote the progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Rights to their respective Writings and Discoveries." *Id.*

20. 17 U.S.C. § 901(b)(2) (Supp. 1991), *supra* note 2. the statute defines a mask work as,

[a] "mask work" is a series of related images, however fixed or encoded—

(A) having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semi-conductor chip product; and

(B) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor product. *Id.*

21. 17 U.S.C. § 102(b) (1991) This statute provides in part, "[I]n no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, *regardless of the form in which it is described, explained, illustrated, or embodied in such work.*" (emphasis added) *Id.*

22. 17 U.S.C. § 107(1991), *see supra* note 8.

The reverse engineering exception allows *copying* of a mask work for purposes of "teaching, analyzing, or evaluating the concepts or techniques embodied in the mask work, or the circuitry, logic, flow or organization of the components used in the mask work, or a person who performs the analysis or evaluation described above to incorporate the results of such conduct in an original mask work which is made to be distributed."²³

To qualify for protection, the second mask work cannot be substantially identical to the first, and the reverse engineer must support his or her efforts by a record of investment or toil.²⁴ These requirements are the focus of the debate surrounding the reverse engineering exception.²⁵ The originality, or substantial similarity requirement is similar to the originality requirement under the Federal Copyright Act²⁶ even though the SCPA was intended to fall outside of this Act.²⁷

While the underlying legislative intent was to accommodate established practices in the computer chip industry which would in turn facilitate competition and heightened technology, the originality requirement might ultimately diminish that purpose. This is because the originality requirement takes the "exception" back into a copyright type of analysis which does not protect copied products. A competing computer chip (which is effectively a copy of the original chip) *always* will be substantially similar to the original chip.

An earlier version of the SCPA reverse engineering exception excluded the originality requirement. Congress believed that legitimate reverse engineers would carefully document their efforts by leaving some type of paper trail as evidence (believing that chip pirates would *not* leave extensive documentation because little effort was involved). Chip pirates would be detectable by their lack of documentation.²⁸ Even

23. 17 U.S.C. § 906(b) (Supp. 1991), *see supra* note 3.

24. 130 CONG. REC. S12,917 (daily ed., Oct. 3, 1984) (statement of Sen. Mathias); *see also*, Raskind, *supra* note 1.

25. Boorstyn, *supra* note 4, at 81.

26. 17 U.S.C. § 102(a)(1991).

27. H.R. 781, 98th Cong., 2d Sess. 5 (1984) *reprinted in* Reams, *THE SEMICONDUCTOR CHIP AND THE LAW: A LEGISLATIVE HISTORY*, VOL. II (1986) (protection for mask works should be granted apart from the Copyright Act).

28. *Id.* at 21.

though some pirates would be able to create phony documentation, most competitors would be unable and unwilling to go to such trouble and expense. As enacted, the SCPA retains this approach only when the competing chip is substantially similar to the original chip. A senate explanatory memorandum, known as the Mathias- Leahy Amendment, provides a good explanation of the test for an infringing computer chip:

The end product of the reverse engineering process is not an infringement, and itself qualifies for protection under the Act, if it is an original mask work, as contrasted with a substantial copy. If the resulting semiconductor chip is not substantially identical to the original, and its design involved significant *toil and investment* so that it is not mere plagiarism, it does not infringe the original chip, even if the layout of the two chips is, in substantial part, similar.²⁹

To conclude, reverse engineering under the SCPA reverse engineering exception allows copying that results in a compatible computer chip that is not substantially similar to the original chip and is supported by documented evidence of "toil and investment."

IV. ATARI V. NINTENDO AS A FACTUAL BASIS FOR ANALYSIS OF THE REVERSE ENGINEERING EXCEPTION

Atari v. Nintendo involves two home video entertainment system competitors. Although the case is still in litigation, the facts are relevant in assessing the adequacy of the SCPA reverse engineering exception.

A. FACTS OF ATARI V. NINTENDO³⁰

Nintendo's NES game system is manufactured to be played exclusively with Nintendo video game cartridges. Nintendo created a lock-out system (contained on the computer chip) to prevent any other competitor's cartridge from being played on the NES system. The *copyrighted* code allows the NES game

29. 130 CONG. REC. S12,917 (daily ed., Oct. 3, 1984) (statement of Sen. Mathias).

30. See *Atari*, *supra* note 10.

system and the cartridge to communicate with each other so that the game can be played. Atari, in an effort to replicate the lock-out code and ultimately create NES-compatible game cartridges, reverse engineered the Nintendo chips, but was unable to break the lock-out code.

In the following year, Atari entered into a licensing agreement with Nintendo which enabled Atari to sell NES-compatible game cartridges. Atari, however, still could not break the lock-out code. Undaunted, Atari filed an application with the Copyright Office, stating they were the defendants in an infringement action brought by Nintendo, and needed a copy of the program to "be used only in connection with the specified litigation."³¹ Atari was able to break the lock-out code with this information. Atari broke its licensing agreement with Nintendo and commenced the present litigation.

Atari *admitted* lying to the Copyright Office, but stated that its goal in copying the program was to create an Atari chip which was functionally indistinguishable from the Nintendo chip. The Atari chip would have prevented Nintendo from altering its future base units in a manner that could selectively exclude Atari (or any other competitor's) game cartridges.³² In defending the conduct at the Copyright Office, Atari argued that the "functional elements of the lock-out system were not copyrightable; that the purpose of breaking the lock could not be prohibited; and that if Atari is allowed to break the lock as it exists now, then it is also allowed to preempt all future variations in the lock."³³

Atari argued that the "idea" of the lock-out code was to restrict NES play to game cartridges containing the specific program or any future variation on it, and the idea and expression in this instance had merged. When an idea has merged with its expression, the idea is not copyrightable.³⁴ Therefore, Atari, in its legitimate reverse engineering efforts, could rightfully obtain and use the copyrighted information.

31. *Id.* at 3.

32. *Id.* at 8.

33. *Id.*

34. *Herbert Rosenthal Jewelry Corp. v. Kalpakian*, 446 F.2d 738, 742 (9th Cir. 1971). Now infamous, this case represents the copyright doctrine of merger. A jewel encrusted bee pin was found to be uncopyrightable because the idea of the pin is uncopyrightable and the expression of it is copyrightable were found to be indistinguishable. The idea and its expression had merged. *Id.*

The court rejected Atari's merger argument, emphatically stating:

In essence, Atari would have the court give the would- be infringer the right to determine what is important in a copyrighted work, and thereby bestow the right to copy whatever the infringer thinks is worth having.

Atari is free to develop a lockout program for its own video game machines. Nintendo cannot copyright the idea. By contrast, Atari is not free to appropriate Nintendo's specific technique for "locking" its own game console. More important, *Atari cannot identify changes that it fears could make its copyrighted program; then redefine those feature as functional and unprotected.* (emphasis added)³⁵

Judge Smith granted the preliminary injunction against Atari, and ordered the manufacture and sale of all Atari game cartridges that could be played on the NES system stopped.³⁶

B. ANALYSIS OF *ATARI V. NINTENDO* UNDER COPYRIGHT LAW

Atari's conduct at the Copyright Office should have been the *only* factor in granting the preliminary injunction. Whatever Atari may have believed about the copyrightability of the lockout code, Atari misappropriated confidential information in order to become totally compatible with Nintendo's NES game system. Nevertheless, the case was argued under the copyright doctrine of merger.

The result of the *Atari v. Nintendo* injunction controverts the goals of both copyright law and the SCPA by stagnating innovation in favor of a monopoly. The decision unknowingly represents a narrow interpretation of reverse engineering: Atari was free to reverse engineer Nintendo's game system in an effort to create its *own* game system, but Atari could not preempt Nintendo's efforts to lock them out of the NES game system.³⁷ The outcome appears to be that Atari cannot create

35. *Atari*, *supra* note 10 at 12.

36. *Id.* at 17.

37. *Id.* at 12.

a game cartridge that is compatible with the NES system. Nintendo successfully argued copyright infringement of the lock-out even though the code was a part of the mask work protected under the SCPA. This result emphasizes why the SCPA reverse engineering exception was enacted. Under Judge Smith's interpretation of reverse engineering, compatible computer chips could never be created and the purpose of the SCPA is entirely controverted.

Atari cannot create NES compatible game cartridges that are in every way identical to Nintendo video game cartridges. But under Judge Smith's interpretation, the consumer would be restricted to purchasing systems and matching game cartridges. If a consumer owning a Nintendo game system wanted to try the Atari game cartridges, the consumer would be forced to buy another, separate game system. *Atari v. Nintendo* should have never reached this point. The copyright issues involved were unnecessary: Atari misappropriated confidential information for use in its reverse engineering project. Whether the confidential information was copyrightable was an issue to be tried *before* Atari used the information.

C. ATARI V. NINTENDO ANALYZED UNDER THE SCPA REVERSE ENGINEERING EXCEPTION

Atari v. Nintendo is relevant to defining the scope of the reverse engineering exception. Atari began the entire process by legitimately reverse engineering Nintendo's computer chip. At this point in the litigation, Nintendo's ability to copyright a code contained on the uncopyrightable mask work will prevent any competitor from obtaining compatibility with the NES game system. The injunction leaves Nintendo with a virtual monopoly on the NES game system, and Atari with fewer ways to compete with Nintendo.³⁸

If Atari's merger arguments were correct, and Nintendo could not copyright the lock-out code, the action for an infringement would involve the SCPA reverse engineering exception. In this instance, the Judge Smith's decision would have been quite simple. Under the two-prong test of § 906, Atari's chip would have been examined to determine its substantial similarity to Nintendo's computer chip. If the Atari chip was not

38. Consider the implications if the parties were manufacturing home VCR's and VCR-compatible tapes. An Atari-type outcome would severely restrict a consumer's choices.

substantially similar³⁹ to the Nintendo chip, Atari's conduct while reverse engineering (as discerned through discovered documentation) would be examined. If the discovery process uncovered documentation reflecting Atari's misconduct at the Copyright Office (or if Atari had little or no documentation), the reverse engineering defense would not stand because Atari misappropriated confidential information.

While the SCPA approach excludes confusing applications of copyright principles to portions of uncopyrightable works it, creates other problems. The first prong of the reverse engineering defense requires that the second chip not be substantially similar. This is problematic because almost every compatible computer chip will be substantially similar to the original chip. The second prong of the reverse engineering defense might allow clever reverse engineers to disguise or create documentation. Further, the examination of the reverse engineer's documentation creates a real potential for expensive and lengthy litigation.

V. A WORKABLE ALTERNATIVE TO THE SCPA: THE VALUE-ADDED APPROACH

One commentator has noted that the SCPA *should* provide legal sanctions *only* when the competitive processes, which includes copying in the traditional copyright sense, has failed to produce an improved new product.⁴⁰ A product like Atari's NES-compatible cartridges is in fact improved because the consumer is given another brand of game cartridges (and presumably more variety of games) to play on a system which previously could only play one type. This approach could significantly change the focus of an infringement action under the SCPA reverse engineering exception. Atari, under this interpretation, would meet the affirmative defense of reverse engineering, and Nintendo would have to seek protection against Atari's misconduct under trade secret law or unfair competition.

A proposed alternative to the SCPA reverse engineering exception embraces the above, value-added approach. It provides immunity to reverse engineered products which copy the design of the first work and produce a second product which improves upon the original in some significant way:

39. If the chips were quite different, it seems there would be no infringement under copyright law or the SCPA.

40. Raskind, *supra* note 1 at 386.

[C]onstruing the originality standard for reverse engineering in a manner which provided immunity only for those works which fall within the concerns that prompted Congress to create the exception in the first place—that is, compatible works which copy only the design of the first work, and works that improve the design of the first work in some significant way. Works designed primarily for compatibility that copied only the ideas of the first work, would not, even apart from the reverse engineering exception, infringe the first work. Thus, the relevant inquiry would be a judicial examination of the value of the improvements made in the second work.

Limiting the reverse engineering exception to works that improve a predecessor mask work would likely reduce the ability of second comers to utilize the reverse engineering exception. [P]erhaps the most that can be said about the scope of the reverse engineering exception is that rather than striking that appropriate balance between the rights of the creator and the needs of the public, the Act opens the door for lengthy and expensive technical litigation to determine where that balance should be struck.⁴¹

Litigation would be less expensive and time consuming under the value-added approach since the court would not have to go through the exhaustive process of scrutinizing extensive documentation. Instead, it would only look at the resulting competitive product and whether it actually improved upon the first product. Other remedies are available when a reverse-engineering competitor is guilty of misconduct. Companies like Nintendo would have to seek greater protection under the appropriate legal remedies (such as unfair competition or trade secret violation).

The value-added approach would also follow the constitutional mandate of making the interests of the author secondary to the needs of the public without completely abrogating

41. Ladd, Leibowitz & Joseph, *Protection for Semiconductor Chip Products in the United States*, 8 IIC STUDIES 40 (1986) reprinted in Hart, *supra* note 15 at 240-241.

the author's rights. This is because it leaves the SCPA reverse engineering exception as originally intended, but also ensures that competitors are doing more than pirating. As the SCPA now stands, a competitor can create a near identical product if that competitor makes sufficient changes and takes good notes. This result seems artificial. The value-added approach, on the other hand, allows to the competitor to legitimately copy without making meaningless changes, so long as the compatible product is an improvement upon the original product.

IV. CONCLUSION

The SCPA reverse engineering exception is useful to the computer chip industry since it attempts to protect computer chips from outright piracy. The protection, however, also creates a potential for fraudulent documentation and lengthy and expensive litigation.

When and if *Atari v. Nintendo* goes to trial, the ultimate decision will have an important impact upon reverse engineering both under the SCPA and federal copyright law. As the SCPA now stands, it appears that Congress' intentions of accommodating a rapidly changing industry go half way. Reverse engineers should not have to create a mountain of documentation solely to validate the copying which is already an accepted industry norm. Instead, a reverse engineer should be concerned primarily with creating a genuinely improved product which promotes competition, and acting within the law to meet that end. These concerns are the essence of intellectual property law under the Constitution.

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