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Reverse Engineering, Unfair Competition, and Fair Use

Leo J. Raskind*

INTRODUCTION

When Congress introduced the concept of "reverse engineering" as a limitation on the rights of an owner of protected industrial intellectual property in the Semiconductor Chip Protection Act of 1984¹ ("the Chip Act"), it effected an innovation in the law of intellectual property that has ramifications wider and deeper than the Chip Act itself. The statutory framework of the reverse engineering provision is the capstone of the Chip Act. As the principal statutory limitation on the mask work owner's exclusive right to reproduce, it provides for legal sanctions only when the competitive process, which includes copying in the traditional copyright sense, has failed to produce an improved new product. The designation of reverse engineering as noninfringing copying of protected chip products demonstrates Congress's acceptance of the customary industry practice of substantial copying of a competitor's product in the development of a new product.

The chip industry went through its formative stages when there was neither patent nor copyright protection. Consequently it developed a "free-wheeling" attitude toward competi-

* Professor of Law, University of Minnesota Law School. I am pleased to acknowledge the helpful comments of Michael J. Remington and Richard H. Stern in the preparation of this Article.

1. 17 U.S.C. §§ 901-914 (Supp. II 1984). Section 906(a), which permits reverse engineering, 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.

Id. § 906(a).

tion.² Rapid innovation and the large overhead costs of developing new chip products coalesced in an awareness of a common interest in the sharing of research and development information. By 1978, when the specter of Japanese competition was perceived as a threat to their sales and market shares, domestic firms sought congressional assistance in limiting copying of chip products by competitors.³ Initially, protection was proposed within an amended Copyright Act; ultimately extensions of copyright principles were rejected in favor of a *sui generis* mode of protection.⁴

Congress responded by invoking the misappropriation doctrine⁵ to draw the line between the permissible copying of a chip within industry norms and impermissible chip piracy. It wove the concept of the misappropriation doctrine, that a competitor shall not reap that which it has not sown,⁶ into the statutory elements of reverse engineering. Thus, the Chip Act requires that the resultant second chip must meet the statutory standard of an "original mask work,"⁷ that the design of the second chip must not be substantially identical to the first chip,⁸ and that the design of the second chip must be supported by a record of investment and toil.⁹ By using the misappropriation doctrine, Congress placed a traditional doctrine of unfair competition law in a new context. It placed a broad, equitable

2. E. ROGERS & J. LARSEN, SILICON VALLEY FEVER 93-95 (1984).

3. *Copyright Protection for Imprinted Design Patterns on Semiconductor Chips: Hearings on H.R. 1007 Before the Subcomm. on Courts, Civil Liberties and the Administration of Justice of the House Comm. on the Judiciary*, 96th Cong., 1st Sess. 31-33 (1979) (testimony of Andrew Grove, President, Intel Corp.) [hereinafter cited as *1979 House Hearings*]; M. BORRUS, J. MILLSTEIN, & J. ZYSMAN, U.S.-JAPANESE COMPETITION IN THE SEMICONDUCTOR INDUSTRY 35-39 (1982).

4. Samuelson, *Creating a New Kind of Intellectual Property: Applying the Lessons of the Chip Law to Computer Programs*, 70 MINN. L. REV. 471, 481-86 (1985); see also Barker, *Copyright For Integrated Circuit Designs: Will the 1976 Act Protect Against Chip Pirates?*, 24 S. TEX. L. J. 817, 842-45 (1983).

5. Misappropriation has become a catch-all term referring to the obtaining of an unfair competitive advantage by taking another's interest, such as a physical asset, a trade secret, or business goodwill. See *infra* note 96 and accompanying text; see also *Pocket Books, Inc. v. Dell Publishing Co.*, 49 Misc. 2d 252, 255, 267 N.Y.S.2d 269, 272 (1966).

6. See *infra* note 97 and accompanying text.

7. 17 U.S.C. § 902(b) (Supp. II 1984); see *infra* note 64 and accompanying text.

8. 130 CONG. REC. S12,917 (daily ed. Oct. 3, 1984) (Explanatory Memorandum—Mathias-Leahy Amendment to S. 1201) [hereinafter cited as Mathias-Leahy Explanatory Memorandum].

9. *Id.*

principle astride a specific industry with distinctive practices and unique products.¹⁰ This is a marked innovation in the protection of commercial intellectual property, not previously known in either copyright or patent protection.¹¹ In thus departing from the conventional formulation of unfair competition, which has been characterized as an amalgam of "judicial conscience. . . [mixed] with an appreciation of good sportsmanship as well as a sense of justice,"¹² Congress is likely to have provided an innovation in the protection of commercial intellectual property of significance and impact beyond the semiconductor chip industry. Reverse engineering may well be responsible for review and refinement of the doctrines of the law of unfair competition, as well as of its kindred doctrine, fair use in copyright law.

This Article traces the conceptual and legislative history of reverse engineering and considers the impact of its probable interpretation on the existing modes of protection for commercial intellectual property. Part I describes the concept of reverse engineering of the Chip Act and its origins. Part II explores how courts are likely to interpret the concept. Part III explains the relationship of the misappropriation doctrine to reverse engineering and suggests an overall assessment of the significance of the Act. The Article concludes that the misappropriation

10. The origin of this doctrine is the Supreme Court's opinion in *International News Serv. v. Associated Press*, 248 U.S. 215, 237-44 (1918). See Abrams, *Copyright, Misappropriation, and Preemption: Constitutional and Statutory Limits of State Law Protection*, 1983 SUP. CT. REV. 509, 513. It is more precise to characterize the reverse engineering provision as accepting Benjamin Kaplan's presumption that copying is an integral step in advancing knowledge: "[I]f man has any 'natural' rights, not the least must be a right to imitate his fellows Education . . . proceeds from a kind of mimicry and 'progress' . . . depends on generous indulgence of copying." B. KAPLAN, *AN UNHURRIED VIEW OF COPYRIGHT* 2 (1966). Having accepted the validity of the need to copy in the chip industry, Congress then invoked the misappropriation doctrine to help draw the line between lawful copying and plagiarism.

11. When the affirmative defense of reverse engineering is raised in an infringement action under the Chip Act, the court will have to fashion a novel mode of analysis distinct from the traditional misappropriation doctrine, because, in this new formulation within the Chip Act, the traditional misappropriation concept of quasi-ownership rights of competitors is shifted. Reverse engineering has become a concept which concedes at the outset that copying is part of the accepted mode of competition in this industry. Applying misappropriation analysis as the conceptual foundation of reverse engineering now arguably appears to require a calculus of such diverse factors as monetary costs, creative effort, and pricing practices as part of a cause of action for infringement.

12. *Rogers, Unfair Competition*, 17 MICH. L. REV. 490, 492 (1919).

doctrine was originally significant as a conceptual framework for the reverse engineering provision. It is, however, insufficiently precise to serve as a principle of interpretation. In an assessment of the Chip Act, the Article questions whether the Act seeks to protect products in terms of a technology that is already obsolete.

I. REVERSE ENGINEERING UNDER THE CHIP ACT

The Chip Act marks a material innovation both in the law of intellectual property and in the traditional doctrines of unfair competition. The copying and imitation that are permitted under the Chip Act extend far beyond the boundaries of the earlier doctrines of unfair competition and fair use. For the first time in the law of intellectual property, the taking of vast amounts of protected property is expressly sanctioned without limitation as to the amount taken, the degree of similarity in appearance of the second product, or the economic impact of the competition on the revenue of the first owner. The Chip Act is set apart from other laws of intellectual property by Congress's invocation of the misappropriation doctrine as the outer boundary of acceptable industry copying. Under the Chip Act, some copying is a permissible mode of commercial conduct between competitors, as long as the resulting product reflects an acceptable level of investment and innovation by the copyist-competitor. Reverse engineering validates customary research and development practices in the semiconductor chip industry by creating statutory "safe harbors" for copying of chips in certain situations. Under section 905 of the Act, an owner of a protected chip product is granted the exclusive rights of reproduction, importation, and distribution therein.¹³ Under section 906, however, a manufacturer and distributor of a substantially similar chip, made by photographing and analyzing the techniques of the protected chip, is immunized from liability as an infringer, if the resultant second chip embodies an original mask work within the standards of the Act, and the requisite toil and investment can be proven.¹⁴ Finally, the statutory limitations on noninfringing reverse engineering are described in the legislative history in terms of the

13. 17 U.S.C. § 905 (Supp. II 1984).

14. Section 906(a)(2) provides in part that "a person . . . [may analyze a protected mask work and may incorporate the results] in an *original* mask work which is made to be distributed." 17 U.S.C. § 906(a)(2) (Supp. II 1984)(emphasis added).

misappropriation doctrine.¹⁵

Despite its formulation as a safe harbor of commercial rivalry, reverse engineering is properly part of the law of intellectual property. Like the other doctrines of unfair competition, the Chip Act requires a distinction to be made between legitimate competition and piracy.¹⁶ Moreover, because of its reliance on the misappropriation doctrine, reverse engineering incorporates by reference the baggage of the traditional business torts¹⁷ that are lumped under the heading of unfair competition. Finally, reverse engineering is also linked to unfair competition law by its procedural requirements. In both unfair competition law and reverse engineering, one must allocate the burden of proof and determine whether "public benefit" is an element of the defense of reverse engineering.¹⁸ Yet the reverse engineering provision of the Chip Act is also linked functionally and historically to the copyright doctrine of fair use.¹⁹ Just as fair use is a doctrine of limitation in the Copyright Act,²⁰ so reverse engineering is a doctrine of limitation within the Chip Act. In fact, the reverse engineering provision of the Chip Act serves as the principal limitation on the exclusive rights given an owner under section 905.²¹

15. See *infra* note 16.

16. See Stern, *Determining Liability for Infringement of Mask Work Rights Under the Semiconductor Chip Protection Act*, 70 MINN. L. REV. 271, 336-39 (1985). Representative Don Edwards, in introducing H.R. 1028, 98th Cong., 1st Sess., 129 CONG. REC. H643-44 (daily ed. Feb. 24, 1983), referred to the ability to "draw the line between legitimate reverse engineering and the misappropriation forbidden by this bill." 129 CONG. REC. H645 (daily ed. Feb. 24, 1983). The Mathias-Leahy Explanatory Memorandum states that the purpose of section § 906(a)(2) is "to allow protection of new mask works in the creation of which their owners have expended substantial toil and investment." Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917. The earlier Senate Report is in accord. There, section 906 is described as providing a line between "legitimate reverse engineering and the misappropriation forbidden by this bill." S. REP. NO. 425, 98th Cong., 2d Sess. 21 (1984).

17. These torts include trademark infringement, trade libel, and interference with contractual relations or prospective business advantage. See *Tuttle v. Buck*, 107 Minn. 145, 151, 119 N.W. 946, 948 (1909) (listing *prima facie* business torts).

18. See Stern & Hoffman, *Public Injury and the Public Interest: Secondary Meaning In The Law of Unfair Competition*, 110 U. PA. L. REV. 935, 966-71 (1962) (deficiency of misappropriation doctrine is that it dictates the sacrifice of public interests to protect the assertion of private interests).

19. See *infra* notes 24-47 and accompanying text.

20. 17 U.S.C. § 107 (1982); see also *infra* note 26 and accompanying text.

21. See 17 U.S.C. § 906 (Supp. II 1984).

II. INTERPRETING THE REVERSE ENGINEERING PROVISION OF THE CHIP ACT

Speculation about how a court is likely, or ought, to interpret the reverse engineering provision of the Chip Act begins with the statute itself. Despite some similarity in format and structure to the Copyright Act, it is clear from the definitional section of the Chip Act that, for interpretation purposes, the similarity between the two statutes is superficial.²² Section 901 of the Chip Act makes it clear that the exclusive focus of protection is the mask work, the source of the design of a semiconductor chip product.²³

A. COPYRIGHT AND COMPETITION

Like the owner of a work protected under the Copyright Act,²⁴ an owner of a mask work is also given exclusive rights.²⁵ Similar to the Copyright Act, which places limitations on the

22. See *infra* text accompanying notes 24-35.

23. Section 901(a) provides as follows:

(1) a "semiconductor chip product" is the final or intermediate form of any product—

(A) having two or more layers of metallic, insulating, or semiconductor material, deposited or otherwise placed on, or etched away or otherwise removed from, a piece of semiconductor material in accordance with a predetermined pattern; and

(B) intended to perform electronic circuitry functions;

(2) 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 semiconductor 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 chip product;

(3) a mask work is "fixed" in a semiconductor chip product when its embodiment in the product is sufficiently permanent or stable to permit the mask work to be perceived or reproduced from the product for a period of more than transitory duration; . . .

17 U.S.C. § 901(a)(1)-(3) (Supp. II 1984).

24. See 17 U.S.C. § 106 (1982).

25. See 17 U.S.C. § 905 (Supp. II 1984). Section 901(a)(6) defines the owner of a mask work as:

the person who created the mask work and is given the exclusive rights to . . . reproduce the mask work . . . , to import or distribute a semiconductor chip product in which the mask work is embodied, and to induce . . . or . . . cause another person to . . . [reproduce, import, or distribute it].

Id. § 901(a)(6).

exclusive rights of an owner,²⁶ the Chip Act limits the exclusive rights granted a mask work owner. Whereas the Copyright Act qualifies its exclusive ownership rights principally in the broad terms of its fair use provision,²⁷ however, the Chip Act's major limitation on the owner's exclusive rights is in the narrow confines of the reverse engineering provision.²⁸ Unlike the fair use provision, which is couched in terms of specific, mainly noncommercial uses and conditioned upon limited taking of protected property,²⁹ reverse engineering accepts copying as the industry norm of competition. The industry spokespersons, while seeking protection from piracy as they perceived it, were insistent on preserving and encouraging the industry practices of creative copying, a practice known to them as reverse engineering. Competition, as practiced in this industry, includes studying the chip products of competitors as an acceptable

26. Section 107, the fair use provision of the Copyright Act, provides as follows:

Notwithstanding the provisions of section 106 [17 U.S.C. 106], the 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 nonprofit 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 effect of the use upon the potential market for or value of the copyrighted work.

17 U.S.C. § 107 (1982).

27. Section 107 of the Copyright Act codifies the judicially created doctrine of fair use as the principal limitation on ownership rights. Justice Story is generally credited with fashioning the doctrine of fair use in *Folsom v. Marsh*, 9 F. Cas. 342, 343 (C.C.D. Mass. 1841) (No. 4901); see also B. PATRY, *THE FAIR USE PRIVILEGE IN COPYRIGHT LAW* 361-65, 385-408 (1985); Raskind, *A Functional Interpretation of Fair Use*, 31 J. COPYRIGHT SOC'Y 601, 604 (1984); Schulman, *Fair Use and The Revision of the Copyright Act*, 53 IOWA L. REV. 832, 834-38 (1968); Yankwich, *What Is Fair Use?*, 22 U. CHI. L. REV. 203, 212-15 (1954). The Copyright Act also contains other limitations, for example, special reproduction rights for libraries and archives, 17 U.S.C. § 108 (1982), special performance and display rights, *id.* § 110, secondary transmission rights, *id.* § 111, and others.

28. Under the Chip Act, there are two other limitations on the owner's exclusive rights. Section 906(b) contains the first sale doctrine, 17 U.S.C. § 906(b) (Supp. II 1984); section 907 bars liability for innocent infringement. *Id.* § 907.

29. See 17 U.S.C. § 107 (1982).

mode of rivalry in the marketplace.³⁰ Therefore, a court is unlikely to rely on copyright principles in interpreting the reverse engineering provision of the Chip Act.

During the period in which reverse engineering emerged in the legislative process as an independent provision, its marked difference from fair use became clear. Initially, when the industry sought protection from the piracy of very successful chips, it was by an amendment to the Copyright Act.³¹ Thus, an infringement action under the Copyright Act could be met by the fair use defense among others. The legal issue of applying the fair use doctrine of the Copyright Act to the practices of the semiconductor chip industry became moot, however, as a result of three sets of concerns. The first concern, one of the Copyright Office, was that the Copyright Act did not extend to mask works and chip products because they are utilitarian objects.³² The second concern, that of various industry members,

30. An officer of a leading chip manufacturer stated in the Senate hearing on the Chip Act that "there is a marked difference between fair reverse engineering and . . . chip piracy . . ." *The Semiconductor Chip Protection Act of 1983: Hearings Before the Subcomm. on Patents, Copyrights and Trademarks of the Senate Comm. on the Judiciary, 98th Cong., 1st Sess. 75 (1983)* (statement of F. Thomas Dunlap, Jr., Corporate Counsel and Secretary, Intel Corp.) [hereinafter cited as *1983 Senate Hearings*]. The difference was explained more precisely by an intellectual property attorney as follows:

In both piracy and in reverse engineering, you take the chip apart, you peel off the plastic, you photograph it, you etch away the layers in order to take more photographs. But the question then is what do you do with those photographs? . . . The legitimate reverse engineer . . . takes those photographs and . . . studies them and . . . takes the concepts out of them, and he makes his own . . . stencils or photographic plates with which to make chips.

The pirate just rephotographs those pictures, . . . measuring them and . . . turn[ing] them into stencils. He does not make his own stencils; he does not use [just] the ideas.

Id. at 84 (statement of Richard H. Stern).

31. Samuelson, *supra* note 4, at 476-78.

32. "The Copyright Office historically has refused, and presently does refuse, to register claims to copyright in the design or layout of . . . and the . . . chips themselves. . . . Courts have consistently refused to extend copyright protection to useful articles as such." *Copyright Protection for Semiconductor Chips: Hearings on H.R. 1028 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the House Comm. on the Judiciary, 98th Cong., 1st Sess. 88 (1983)* (statement of Dorothy Schrader, Associate Register of Copyrights for Legal Affairs) [hereinafter cited as *1983 House Hearings*]; see also *id.* at 11 (statement of Jon Baumgarten, Copyright Counsel for the Association of American Publishers, Inc.) (urging that the Committee approach chip protection as a severable, unitary measure and not as a series of piecemeal amendments to the basic Copyright Act).

In 1976, Intel Corporation, a leading manufacturer in the chip industry, sought to deposit a chip as a copy of a mask work with the Copyright Office,

was that protection under the Copyright Act would be ineffective because of the inadequacy of the fair use doctrine to accommodate the industry practice of reverse engineering.³³ The final concern about granting copyright protection to chip products came from a major constituency of the Copyright Act, the organized publishers. Unlike the members of the chip industry, who were concerned that an extension of the fair use doctrine would be insufficient, the publishers feared such extension as a "distortion of the fair use doctrine to accommodate reverse engineering."³⁴ Thus, when section 906 of the Chip Act emerged as an independent provision, it was as a rejection of the fair use principles of the Copyright Act.³⁵

but the submission was refused. Subsequently, Intel brought an action against the Register of Copyrights seeking to compel the acceptance of the mask work by the Copyright Office. See Barker, *supra* note 4, at 842 (citing Intel Corp. v. Ringer, No. C-77-2848-RHS (N.D. Cal. 1978)). After an unsatisfactory compromise of that action, Representative Don Edwards introduced H.R. 1007, which sought to amend the definitional section of the Copyright Act to cover mask works and chip products. See H.R. 1007, 96th Cong., 1st Sess., 125 CONG. REC. 461 (1979). H.R. 1007 was not enacted.

33. One firm's representative stated that, "the twin goals of certainty and encouragement of innovation can be achieved only if legitimate reverse engineering is permitted. *We feel that existing 'fair use' provisions of Section 107 of the Copyright Law may not be sufficient, however, as they tend to emphasize non-commercial purposes.*" 1983 House Hearings, *supra* note 32, at 201 (statement of NEC Electronics U.S.A., Inc.) (emphasis added).

34. *Id.* at 12 (statement of Jon Baumgarten, Copyright Counsel for the Association of American Publishers, Inc.). Baumgarten explained his concern in terms of publisher self-interest:

It must be emphasized that our concern is not born out of mere desire for ideologically "pure" copyright law, nor . . . aversion to innovative legislation. It lies, instead, with the blurring or distortion of principles and the establishment of precedents that may have untoward or unintended consequences for copyright protection of *our* works, and those of other copyright proprietors.

Id. (emphasis added).

35. In a sentence that is likely to become famous, footnote 45 of the House Report on H.R. 5525, the final House measure, states that "the provisions of Section 107 do not apply to this Chapter, . . . and thus there is no right of fair use under the Act." H.R. REP. NO. 781, 98th Cong., 2d Sess. 23 n.45, *reprinted in* 1984 U.S. CODE CONG. & AD. NEWS 5750, 5772 n.45 [hereinafter cited as HOUSE REPORT]. (All citations to the House Report are to the star print. *United States Code Congressional and Administrative News* contains the initial version of the House Report. The star print corrected typographical errors in the initial version and contains three additional pages.). This footnote, however, cannot stand as the full statement of legislative intent because the measure as finally enacted differed by the addition of section 906(a)(2). Because there was only an informal conference to reconcile the House and Senate versions of the Chip Act, the final piece of legislative history is not a conference report but instead is the Mathias-Leahy Explanatory Memorandum. See Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,918. The Ma-

Nonetheless, it is possible that some interpretations of the Chip Act may allow a court to apply certain fair use principles. Support for such application may be found in the initial version of the House measure which did not include a separate reverse engineering provision. The sponsors of the House bill, Representatives Don Edwards and Norman Y. Mineta, stated that the Chip Act would rely on the existing fair use provisions of the Copyright Act.³⁶ Similarly, the initial Senate bill³⁷ was introduced without a separate reverse engineering provision. The Senate Report states that the original bill was amended in response to the concerns described above to include a separate provision legitimizing reverse engineering.³⁸ Subsequently, the final House bill³⁹ adopted the same reverse engineering provision.⁴⁰ The text of the separate reverse engineering provision, as incorporated in these measures, was taken from the statement of Representative Edwards in his introduction to H.R. 1028.⁴¹ Like the first reverse engineering provision, it con-

thias-Leahy Explanatory Memorandum contains no reference to fair use, see *id.* at S12,917-18, nor does the House counterpart, see 130 CONG. REC. E432-33 (daily ed. Oct. 10, 1984) (Explanatory Memorandum of the Senate Amendment to H.R. 6163, Title III, as considered by the House of Representatives) [hereinafter cited as Kastenmeier Explanatory Memorandum].

One commentator has suggested that fair use principles might still be applicable to chip products eligible for protection under the Act in nonproduction situations. See Stern, *supra* note 16, at 339-42.

For a detailed chronology of the steps in the enactment of the Chip Act, see Kastenmeier & Remington, *The Semiconductor Chip Protection Act of 1984: A Swamp Or Firm Ground?*, 70 MINN. L. REV. 417, 424-30 (1985).

36. [T]he existing fair use provisions of section 107 of the present Copyright Act apply to the exclusive rights of a chip innovator. Accordingly, in the case of masks and chips, it is not an infringement of copyright to reproduce the pattern on the mask solely for the purpose of teaching, analysis, or evaluation, or to use the concepts or techniques embodied in the mask or chip, such as the circuit schematic or organization of components. *That means that legitimate reverse engineering is not prohibited by the bill.*

129 CONG. REC. H645 (daily ed. Feb. 24, 1983) (statement of Rep. Edwards introducing H.R. 1028 in the 98th Congress) (emphasis added).

37. S. 1201, 98th Cong., 2d Sess., 130 CONG. REC. S5837-38 (daily ed. May 16, 1984).

38. The inclusion of the express provision is described as follows: "To respond to these concerns [see *supra* text accompanying notes 32-34], the version reported by the Subcommittee and the Committee includes an express provision guaranteeing the right to use a chip or mask for reverse engineering purposes." S. REP. NO. 425, 98th Cong., 2d Sess. 22 (1984).

39. H.R. 5525, 98th Cong., 2d Sess., 130 CONG. REC. H5489-91 (daily ed. June 11, 1984).

40. HOUSE REPORT, *supra* note 35, at 21 n.40, 1984 U.S. CODE CONG. & AD. NEWS at 5770 n.40.

41. See *supra* text accompanying note 36.

tained only the language that became section 906(a)(1) in the final version as enacted.⁴² Although the reference in this section to "teaching, analyzing, or evaluating" seems to reflect the exceptions of the fair use provision of the Copyright Act,⁴³ this interpretation is likely foreclosed by section 906(a)(2).

In the end, in choosing how to interpret the reverse engineering provision of the Chip Act, a court is likely to recognize that the fair use doctrine is functionally inarticulate for the protection of chip products. This is a reasonable finding because the Chip Act limits the scope of protection to mask works and chip products.⁴⁴ Narrowing the scope of protection to one product strips the general categories of use and the conditions of taking that are set out in section 107 of the Copyright Act⁴⁵ of functional significance. When chip products are the sole object of protection, the method and practices of their production and distribution are controlling. The traditional fair use concern over the substantiality of the amount copied, for example, has no application in the context of the established industry practice of reverse engineering.

Since section 906(a)(2) of the Chip Act expressly permits the complete reproduction of a protected mask work to be copied and incorporated into a second chip being marketed in competition with the copied product, the limiting condition of section 107(4) of the Copyright Act on "the effect of the use upon the potential market"⁴⁶ for the protected work has little meaning. This is due to the Chip Act's acceptance of copying as a necessary element of competition. The Copyright Act, by comparison, does not directly address the competitive uses of

42. Section 906 (a)(1) provides as follows:

(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

17 U.S.C. § 906 (a)(1) (Supp. II 1984).

43. See 17 U.S.C. § 107 (1982).

44. The focus of the Chip Act is established by its definitional section, 17 U.S.C. § 901 (Supp II. 1984), and by section 902, *id.* § 902, in which the subject matter of protection is limited to a single product, mask works fixed in semiconductor chip products. Section 906 (a)(2) provides that it is not an infringement of the exclusive rights of a mask work owner for "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." *Id.* § 906 (a)(2). For the text of section 906(a)(1), see *supra* note 42.

45. See 17 U.S.C. § 107 (1982).

46. *Id.* § 107(4).

protected property. Its fair use provision qualifies the exclusive rights of reproduction primarily for noncommercial and non-profit uses.⁴⁷ The Chip Act's codification of the industry conception of competition under the industry's terminology, i.e. reverse engineering, is thus a marked departure from traditional copyright protection, requiring an equally new interpretation by the judiciary.

B. REVERSE ENGINEERING AND CONSTRAINTS ON COMPETITION

By adopting the concept of reverse engineering instead of the fair use provision of the copyright statute, Congress did not prescribe uncontrolled competition in the production of chip products. In section 906 itself, as well as in the legislative history, there are clear indications that Congress also attempted to adopt the industry's distinction between "legitimate" reverse engineering and "piracy." The House Report on the final House measure,⁴⁸ which was merged with the Senate bill⁴⁹ in informal conference, clearly acknowledges that reverse engineering is an acceptable ingredient of effective competition and product innovation.⁵⁰ The Mathias-Leahy Explanatory Memo-

47. Section 107(1) of the Copyright Act states that one of the factors to be considered in determining whether a use is a fair use is, "the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes . . ." *Id.* § 107(1). The Supreme Court has recently interpreted Section 107 as meaning that "every commercial use of copyrighted material is presumptively an unfair exploitation . . . of the copyright." *Sony Corp. of Am. v. Universal City Studios*, 464 U.S. 417, 451 (1984); *cf.* *Harper & Row Publishers, Inc. v. Nation Enters.*, 105 S. Ct. 2218, 2228-31 (1985) (doctrine of fair use will not be expanded to create what would amount to a public figure exception to copyright).

48. H.R. 5525, 98th Cong., 2d Sess., 130 CONG. REC. H5489-91 (daily ed. June 11, 1984).

49. S. 1201, 98th Cong., 2d Sess., 130 CONG. REC. S5837-38 (daily ed. May 16, 1984).

50. The House Report states:

Based on testimony of industry representatives that it is an established industry practice to . . . make photo-reproductions of the mask work in order to analyze the existing chip so as to design a second chip with the same electrical and physical performance characteristics as the existing chip (so-called "form, fit, and function" compatability), and that this practice fosters *fair competition* and provides a frequently needed "second source" for chip products, *it is the intent of the Committee to permit such reproduction by competitors . . .* [and to bar] mere wholesale appropriation of the work and investment in the creation of the first chip.

It is the intent of the Committee to permit, under the reverse engineering limitation, the . . . creation of a second mask work whose layout, in substantial part, is similar to the layout of the protected mask work — if the second mask work was the product of substantial

randum, the final piece of legislative history, similarly identifies the intention to permit reverse engineering as understood by the industry.⁵¹

Although the legislative history clearly states the intent of both Houses to codify the practice of reverse engineering, the reflection of that intent in statutory language is sparse. Section 906 bears the heading "reverse engineering."⁵² Section 906(a) states that reproduction for the purposes stated in section 906(a)(1) is not an infringement of a mask work owner's exclusive rights;⁵³ section 906(a)(2) grants the competitor who has performed the copying permitted by section 906(a)(1) the right to incorporate the results of such conduct in a second chip.⁵⁴ The only statutory language of constraint on copying in the entire reverse engineering provision is in the phrase, "original mask work," in section 906(a)(2).⁵⁵ That the legislative history contains virtually all of the explanation of the distinction between "legitimate" reverse engineering and "piracy" reflects the legislative decision to place the guidance for interpretation of this distinction almost entirely in the legislative history, rather than to undertake the monumental task of drafting a statutory definition of fair competition. Thus, the Mathias-Leahy Memorandum explains the meaning of an "original

study and analysis, and not the mere result of plagiarism accomplished without such study or analysis.

HOUSE REPORT, *supra* note 35, at 22, 1984 U.S. CODE CONG. & AD. NEWS at 5771 (emphasis added).

51. The memorandum states:

Although the reverse engineering provisions of S. 1201 and H.R. 5525 were almost identical, this amendment includes a provision (section 906(a)(2)) to clarify the *intent of both chambers that competitors are permitted not only to study protected mask works, but also to use the results of that study to design, distribute, and import semiconductor chip products embodying their own original mask works.* While this intent appears indisputable from the legislative history in both Houses, it seems prudent to spell it out in the bill itself.

Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917 (emphasis added). Representative Robert Kastenmeier introduced the Kastenmeier Explanatory Memorandum, which essentially follows the format of the Mathias-Leahy Memorandum, in the House. The Kastenmeier Memorandum notes the significance of these memoranda. "[S]ince the House and Senate worked together and agreed in advance on the amendment to the semiconductor legislation [Section 906(a)(2)], . . . this memorandum coupled with the Senate's document represent an informal 'conference report.'" Kastenmeier Explanatory Memorandum, *supra* note 35, at E432.

52. 17 U.S.C. § 906 (Supp. II 1984).

53. *Id.* § 906(a).

54. *Id.* § 906(a)(2).

55. *Id.*

mask work" under section 906(a)(2) by contrasting it with a "substantial copy."⁵⁶ The memorandum also identifies the word, "original," in section 906(a)(2) as the final arbiter in that section between permissible copying and actionable infringement.⁵⁷

C. PROCEDURAL REQUIREMENTS FOR REVERSE ENGINEERING

In distinguishing between legitimate reverse engineering and chip piracy, the legislative history requires that a two-pronged test be applied to the section 906(a)(1) copied mask work when the results are incorporated in a section 906(a)(2) second chip.⁵⁸ The first part of the test requires that the resultant chip be compared with the initial protected chip to determine whether the second chip is "substantially similar" as opposed to "substantially identical" to the first chip.⁵⁹ If the second chip is entirely or substantially identical, there is a conclusive presumption of infringement. When the comparison of the two chips shades away from identity to similarity, the second prong of the test comes into play. To establish noninfringing similarity in these circumstances, it must be established by competent documentary evidence that the copying competitor had expended substantial energy and resources in the development of the second chip, *in addition* to copying some aspects of the original.⁶⁰

Because section 906 is an affirmative defense, a plaintiff alleging infringement may prevail by establishing that the resultant second chip is identical or substantially identical to the first chip. If, however, the comparison between the two chip products reveals similarity, the defendant may prevail by sustaining the burdens of the risk of nonpersuasion and of going forward with the production of probative evidence. For the de-

56. The Mathias-Leahy Explanatory Memorandum states:

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 product 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.

Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917 (emphasis added).

57. *Id.*

58. *Id.*

59. *Id.*

60. *Id.*

fense of reverse engineering to be successful, a defendant must dispel the conclusion of mere copying by showing business records, time sheets of labor expended, actual designs, and mask works produced that led to the similar design of the second chip. The defendant will prevail if it makes this showing, subject to establishing the final statutory requirement of producing an "original mask work."⁶¹

In addition, because section 906(a)(2) permits the person who studies and analyzes an existing chip, as permitted by section 906(a)(1), to incorporate those results into a second chip to be distributed in competition with the first chip,⁶² the copyist must also meet the statutory condition of producing a second chip which is an "original mask work" within the meaning of section 906(a)(2). Thus, according to the legislative history, the affirmative defense of reverse engineering requires the defendant to show substantial expenditures for labor and materials in development *and* to establish that the resultant second chip is "original" in the section 906(a)(2) sense.⁶³

1. Interpretation of Originality Under Section 906(a)(2)

Because the word "original" appears in section 902(b) as well as in section 906(a)(2), the question becomes whether the word "original" in section 906(a)(2) has the same meaning as the term in section 902(b), which provides that there cannot be protection under the Chip Act for a mask work that "(1) is not *original*; or (2) consists of designs that are staple, commonplace, or familiar in the semiconductor industry, or variations of such designs, combined in a way that, considered as a whole, is not *original*."⁶⁴

Some of the uncertainty about the interpretation of "original" in sections 902 and 906 may be attributed to the absence of any reference to the term in the definitional section of the Chip Act. However, H.R. 5525, the penultimate House measure,⁶⁵ did provide the following definition in section 901(4): "a mask work is 'original' if it is the independent creation of an author who did not copy it from another source."⁶⁶ Since this definition did not carry over into the final measure as enacted, it is

61. See Stern, *supra* note 16, at 333.

62. 17 U.S.C. § 906(a)(2) (Supp. II 1984).

63. Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917.

64. 17 U.S.C. § 902(b) (Supp. II 1984) (emphasis added).

65. H.R. 5525, 98th Cong., 2d Sess., 130 CONG. REC. H5489-91 (daily ed. June 11, 1984).

66. *Id.* § 901(4), 130 CONG. REC., at H5489.

unclear whether the provision was deleted because this definition would have been inconsistent with section 906(a), or whether it was deleted as surplusage, in light of section 902 as enacted. There is no explanation in the legislative history for the deletion of section 901(4).

The most likely explanation of the deletion of the House bill's definition of "original" is its potential inconsistency with the grant of the right to copy, subject to the conditions imposed by section 906. The House Report on H.R. 5525 describes section 901(4) as stating the "essence of the customary copyright law concept of originality and [applying] it to mask works, to the extent it is appropriate and feasible to do so."⁶⁷ This reference is consistent with the intent to carry over the copyright definition, but only to the extent congruent with the Chip Act. Thus, it is likely that Congress intended the term "original" in section 902(b)(1) of the Chip Act to incorporate the copyright definition, and intended the addition of section 902(b)(2) to incorporate the Chip Act modification. Under section 902(b)(2), therefore, a mask work is not original if it "consists of designs that are staple, commonplace, or familiar in the semiconductor industry, or variations of such designs, combined in a way that, considered as a whole, is not original."⁶⁸ Further examination of the legislative history of the Chip Act supports the notion that section 902(b)(2) incorporates the copyright standard of originality in semiconductor industry terms. This inference is consistent with the statement in the Mathias-Leahy Explanatory Memorandum on the Chip Act. The section of the memorandum headed "Originality" states that "the purpose of section 902(b)(2) is to weed out mere insubstantial or trivial variations on prior mask works and to allow the protection of new mask works in the creation of which their owners have expended substantial toil and investment . . ."⁶⁹ Therefore, the designs that are in the public domain of the semiconductor chip industry at the time of the claim are ineligible for protection.

67. HOUSE REPORT, *supra* note 35, at 17, 1984 U.S. CODE CONG. & AD. NEWS at 5766.

68. 17 U.S.C. § 902(b)(2) (Supp. II 1984). The phrase "as a whole" also appears in the patent statute. *See* 35 U.S.C. § 103 (1982). The purpose there is to bar the dissection of an invention into its otherwise obvious parts. *See id.*

69. Mathias-Leahy Explanatory Memorandum, *supra* note 27, at S12,917. The legislative history is not entirely dispositive on this point, however, because the traditional copyright standard of originality is extended in the concluding phrases of that same paragraph by incorporating the reference usually associated with the misappropriation doctrine, which in turn is said in other parts of the legislative history to be the doctrinal basis of section 906.

2. Originality Under Section 902(b)

This review of the history of the term "original" in section 902 of the Chip Act suggests that the standard of originality in section 906(a)(2) is separate and distinct from that of section 902. Given its background, the term "original" in section 902(b)(1) is intended to perform the function of barring protection under the Chip Act for matter plagiarized from another innovation. This is the traditional copyright concern, assuring a modicum of independent creation on the part of an author. A work is original in the copyright sense if it contains a distinguishable variation from matter in the public domain and was not produced by actual copying.⁷⁰

Meeting the standard of originality in section 902(b)(2) would not satisfy the originality requirement of section 906(a)(2) because each section requires a different order of comparison. For example, the section 902 inquiry ordinarily arises when one is seeking statutory protection prior to marketing. Absent any allegation of infringement at that time, the proffered chip is compared with the existing state of the art in the industry. Section 906, however, provides an affirmative defense against an action for infringement. For section 906(a)(2) purposes, originality is a standard of difference to be shown by competent business records of toil and investment and by expert testimony. In the infringement situation, the comparison is between the alleged infringing chip and the one from which it was purportedly pirated.

3. Standard of Proof for Originality Under Section 906(a)(2)

There are further grounds for distinguishing the phrase, an "original mask work" in section 906(a)(2) of the Chip Act from the interpretation associated with section 902(b). In the latter provision, "original" connotes independent creation and production and implies the absence of producing the commonplace and the familiar. This interpretation is not meaningful in section 906(a)(2), which legitimizes reverse engineering and, therefore, accepts some copying as part of the creative process.⁷¹

70. See *Bell & Co. v. Catalda Fine Arts*, 191 F.2d 99, 102 (2d Cir. 1951); see also *E.H. Tate Co. v. Jiffy Enters.*, 16 F.R.D. 571, 573 (E.D. Pa. 1954) (holding that simple, functional directions are not writings and therefore not entitled to copyright protection).

71. Section 906 accepts copying in the sense associated with the copyright standard. See *Mathais-Leahy Explanatory Memorandum*, *supra* note 27, at S12,917.

Hence, the interpretation of "original" in section 906(a)(2), which is consistent with the whole of that provision as described in the legislative history, requires a comparison of the layout and design conduct of the plaintiff and the defendant. More likely than not, for a defendant to prevail under section 906, its resultant "original mask work" under section 906(a)(2) must be one that is functionally superior to the protected work, as measured by the relevant technological criteria.⁷² At least this is the standard to which Congress aspired. Whether courts will apply this standard, however, remains to be seen.

The legislative history reflects the extensive testimony of industry representatives who described the process of improvement through reverse engineering. It is apparent that legitimate reverse engineering is an industry custom in which the duplication of a successful chip is the first step in reviewing and improving the process of producing a better resultant chip. Decreasing the size of a chip, improving its thermal stability, and reducing the number of mask and wafer fabrication steps are some of the current objectives of reverse engineering.⁷³

The legislative history makes clear that an original mask work within the meaning of section 906(a)(2) cannot infringe a protected work. The requirement of originality in section 906(a)(2) is, according to the legislative history, to be met by a showing of nonsimilarity, corroborated by the objective evidence of toil and investment;⁷⁴ the proof of improvement, therefore, becomes the ultimate issue in establishing the defense of reverse engineering.

D. INNOCENT INFRINGEMENT

The extent to which the Chip Act is grounded in validating copying as an integral part of product innovation is underscored by the innocent infringement provision.⁷⁵ This section provides that there is no liability for infringement if a purchaser imports

72. The legislative history supports this interpretation. The Senate Report characterizes reverse engineering as spurring "innovation and technological progress, as competitors seek to develop ever faster or more efficient chips to perform similar or related functions." S. REP. NO. 425, 98th Cong., 2d Sess. 21 (1984).

73. The House Report mentions one form of product improvement as using less "silicon real estate." HOUSE REPORT, *supra* note 35, at 12, 1984 U.S. CODE CONG. & AD. NEWS at 5761. This is a reference to developing a smaller chip by using more compact circuits and thus using less silicon.

74. *See supra* note 56.

75. *See* 17 U.S.C. § 907 (Supp. II 1984).

or distributes an infringing chip product without notice of protection.⁷⁶ An innocent purchaser is then liable for a reasonable royalty while disposing of his infringing inventory, after having notice of protection.

The legislative history makes clear that investment in new products using chips, i.e., computers, recorders, etc., is the basis of this favored treatment of an infringing use.⁷⁷ The Mathias-Leahy Explanatory Memorandum further emphasizes the limited scope of protection under the Chip Act and the great weight which is accorded the development of competing products using chips. The memorandum, in characterizing section 907, states that "[i]t should be understood that . . . the first payment of a reasonable royalty under Section 907 liberates the semiconductor chip product unit from the intellectual property monopoly, for the benefit of all downstream purchasers"⁷⁸

III. MISAPPROPRIATION AND SECTION 906

By providing a statutory framework that favors product innovation through competition, Congress has imposed on courts presented with infringement actions under the Chip Act a duty to fashion a new analysis. *Sui generis* protection for chip products requires striking a balance between exclusive ownership rights and the particular mode of competition in this industry—reverse engineering. Within the reverse engineering provision, a court is required to distinguish "legitimate" copying by a competitor from "piracy." To accomplish these tasks, Congress has provided only a context in the Chip Act, rather than specific statutory standards.⁷⁹ The analysis required to make the statutory distinctions is to be derived, as the legislative history indi-

76. *Id.*

77. The Senate Report states:

[E]ven after an innocent purchaser acquires notice of . . . infringement, the innocent purchaser's subsequent conduct may also deserve a privileged status. If the innocent purchaser had already committed substantial funds to the development of a product built around the infringing chip before learning of the . . . [claim of protection], to compel the innocent purchaser to abandon manufacture . . . could work an undue hardship. S. REP. NO. 425, 98th Cong., 2d Sess. 23 (1984).

78. Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917.

79. For a recognition of the significance of the context in the interpretation of legal concepts in another area of the law, see Vincent-Daviss, *Human Rights Law: A Research Guide to the Literature—Part I*, 14 N.Y.U. J. INT'L L. & POL. 209, 213-14 (1980).

cates,⁸⁰ largely from the misappropriation doctrine.

A. THE MISAPPROPRIATION DOCTRINE AND SECTION 906

The doctrine of misappropriation was not the first choice of protection for chip products. Initially, protection was conceived in terms of extending traditional copyright principles.⁸¹ The testimony of various industry representatives at the hearings developed an appreciation among the legislators of the importance of reverse engineering to the semiconductor industry, sharpening the perception that the copyright doctrine of fair use would be unable to accommodate reverse engineering.⁸² The rejection of copyright principles, including fair use, as a framework of protection left a void for the legislators. Without an organizing principle, the practice of reverse engineering—the centerpiece of industry concern—would be vulnerable to attack as infringement.

In the course of the hearings, two factors coalesced in making the misappropriation doctrine the foundation of section 906. First came the suggestions in the course of the hearings that the misappropriation doctrine could be adapted to distinguish chip piracy from innovative copying, consistent with industry standards. The earliest reference to misappropriation analysis appears to have been made by Richard H. Stern,⁸³ who, after noting the high, front-end costs of chip product manufacturing, stated that "it is unfair . . . for the second comer to help himself to the product of the first comer's labor and investment."⁸⁴ Professor L. Ray Patterson appears to have made an early express reference to the misappropriation doctrine in the hearings, urging *sui generis* protection as a form of "statutory

80. See *infra* notes 87-95 and accompanying text.

81. Samuelson, *supra* note 4, at 476-78.

82. See *supra* note 33 and accompanying text; see also 1983 Senate Hearings, *supra* note 30, at 100-01 (statement of A.G.W. Biddle, President, Computer and Communications Industry Association); *id.* at 102 (statement of Ronald Potenski, Associate General Counsel, Association of Data Processing Service Organizations); *id.* at 103 (statement of Jon Baumgarten, Copyright Counsel, Association of American Publishers, Inc.); *id.* at 114-15 (statement of Robert Hinckley, General Counsel, NEC Electronics U.S.A., Inc.).

83. Mr. Stern practices in the area of computer-related law in Washington, D.C..

84. *Copyright and Technological Change: Hearings Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the House Comm. on the Judiciary*, 98th Cong., 1st Sess. 136-37 (1983) (statement of Richard H. Stern) [hereinafter cited as *House Hearings on Copyright and Technological Change*].

unfair competition based on the misappropriation rationale."⁸⁵

The second factor that led to the acceptance of the misappropriation doctrine was its ready compatibility with the stated needs of the industry. The several descriptions of the practice of reverse engineering that emerged from the hearings served to emphasize the transparent nature of the practice. Several witnesses commented on the relative ease with which knowledgeable persons could distinguish legitimate reverse engineering from piracy.⁸⁶ The legislative history is unequivocal in the acceptance of the premise that courts will not face an especially difficult task in distinguishing chip piracy from reverse engineering. Thus, the Senate Report states "cases will rarely arise that are in a gray zone between clear copying and clearly legitimate reverse engineering, since most actual fact situations in this field are either at one end or the other of the spectrum."⁸⁷ The Mathias-Leahy Explanatory Memorandum echoes this perception of the limited scope of the judicial inquiry in a section 906 case. As the memorandum states, "the courts are not likely, as a practical matter, to find it unduly difficult to draw the line between reverse engineering and infringement . . ."⁸⁸ This statement is more likely a reflection of congressional acceptance of industry assurances than an accurate prediction of judicial responses. Therefore, it remains to be seen whether the courts will share this optimistic view of Chip Act infringement cases.

Congress agreed with the industry characterization of reverse engineering as a practice that would produce its own evidence, or lack thereof, of wrongdoing. The idea that legitimate reverse engineering would leave a "paper trail" of probative evidence of conduct within acceptable industry norms captivated the legislators.⁸⁹ The Senate Report also reflects the complete acceptance of the belief that reverse engineering as practiced by the industry would provide the evidentiary basis for identifying

85. *House Hearings on Copyright and Technological Change, supra* note 84, at 56 (statement of Professor L. Ray Patterson).

86. *1983 Senate Hearings, supra* note 30, at 146 (statement of Leslie L. Vadaz, Senior Vice President, Intel Corp.).

87. S. REP. NO. 425, 98th Cong., 2d Sess. 22 (1984).

88. Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917.

89. The House Report states: "A number of witnesses testified as to the practice . . . of reverse engineering . . . and how to distinguish between chip piracy and legitimate reverse engineering. They emphasized the evidentiary importance of the 'paper trail' of legitimate reverse engineering that helps to distinguish it from mere piracy." HOUSE REPORT, *supra* note 35, at 21, 1984 U.S. CODE CONG. & AD. NEWS at 5770.

chip product piracy. The Report states that "reverse engineering leaves a 'paper trail' not found in the files of pirates"90 The Senate Report gives special emphasis to its acceptance of the usefulness of reverse engineering as providing a bright evidentiary line between permissible copying and piracy, by commenting on the above statement as follows: "The Committee agrees with and adopts that view as a guide to its intent."⁹¹ The final piece of legislative history, the Mathias-Leahy Explanatory Memorandum, makes complete the legislative reliance upon the "paper trail" of reverse engineering.⁹²

The legislative history is equally clear that the misappropriation doctrine is the legal principle which codifies the practice of reverse engineering in section 906 of the Chip Act.⁹³ The pervasive characterization in the hearings of reverse engineering as a settled industry practice tended to diminish the stated reliance of Congress on the underlying rationale. Yet, the misappropriation doctrine is clearly linked to section 906. The Senate Report refers to this section as drawing the line "between legitimate reverse engineering and the misappropriation forbidden by this bill."⁹⁴ The Mathias-Leahy Explanatory Memorandum makes no express reference to the misappropriation doctrine, but refers instead to the dictum associated with it by noting that a copied chip "does not infringe the original chip" if "its design involved significant toil and investment, so that it is not mere plagiarism."⁹⁵

This formulation of the misappropriation doctrine is drawn from Justice Pitney's famous dictum in *International News Ser-*

90. S. REP. NO. 425, 98th Cong., 2d Sess. 22 (1984); see also Note, *Semiconductor Chip Protection: Changing Roles for Copyright and Competition*, 71 VA. L. REV. 249, 258 (1985).

91. S. REP. NO. 425, 98th Cong., 2d Sess. 22 (1984).

92. The memorandum states:

As noted in the Senate Report, the courts are not likely, as a practical matter, to find it unduly difficult to draw the line between reverse engineering and infringement because the additional work required to come within the privilege established by section 906(a) will ordinarily leave a "paper trail."

Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917.

93. See *infra* notes 94-95 and accompanying text.

94. S. REP. NO. 425, 98th Cong., 2d Sess. 21 (1984). The term "misappropriation" is used generically in intellectual property law, including the law of trade secrets, to mean the taking and using of another's property for the sole purpose of capitalizing unfairly on the goodwill and reputation of the property owner. See *supra* note 5.

95. Mathias-Leahy Explanatory Memorandum, *supra* note 8, at S12,917.

vice v. Associated Press.⁹⁶ There, International News Service, a news service unable to send cable reports from England to the United States during the World War One, took the news reports of its competitor, the Associated Press, from the Associated Press's early East Coast editions in the United States and used those news stories as its own in its West Coast newspapers. Justice Pitney, writing for the majority, found that International News Service had engaged in unfair competition by "taking material that has been acquired by [a competitor] as the result of organization and the expenditure of labor, skill, and money, and which is salable for money, and that [the copying competitor] in appropriating it and selling it as his own is endeavoring to reap where it has not sown" ⁹⁷ This case therefore treated the misappropriation doctrine as a cost-based rationale for barring unfair competitive practices.

B. THE SIGNIFICANCE OF THE MISAPPROPRIATION DOCTRINE FOR SECTION 906

If the misappropriation doctrine is the conceptual basis of section 906, it is necessary to assess the scope and content of that doctrine in order to speculate about its impact on shaping the interpretation of that provision. A review of the origin and application of the misappropriation doctrine suggests that the immediate significance for a court faced with the interpretation of the affirmative defense of section 906 will be minimal.⁹⁸ The principal reason for the relative insignificance of the misappro-

96. 248 U.S. 215 (1918). One commentator notes: "The misappropriation doctrine was first developed in *International News Service v. Associated Press* by the Supreme Court." Baird, *Common Law Intellectual Property and the Legacy of International News Service v. Associated Press*, 50 U. CHI. L. REV. 411, 412 (1983).

97. 248 U.S. at 239-40.

98. The immediate, or short-run, impact might be distinguished from the longer-term significance of the misappropriation doctrine. The enactment of the Chip Act occurred at a time when industry representatives were in agreement on the need for and the manner of protection. That is, the industry at the time the Act was developed had a given structure. The number of firms in the industry and the leadership position of the firms with large market shares were fixed in relation to the smaller firms in the semiconductor chip industry. See M. Borrus, *Reversing Attrition: A Strategic Response to the Erosion of U.S. Leadership in Microelectronics* (1985) (Working Paper, Berkeley Roundtable on the International Economy).

If the structure of the industry should change, so that the behavior of the firms in relation to each other changes, say within the next five years, then the practice of reverse engineering and the meaning of misappropriation might also be altered. For further discussion of this issue, see *infra* notes 112-128 and accompanying text.

priation doctrine in the interpretation of section 906 is that it is "a somewhat hazily defined business tort."⁹⁹ Its vagueness limits its usefulness. From its initial formulation, the misappropriation doctrine has been a legal principle of uncertain content. In his vigorous dissent in the *International News Service* case, Justice Brandeis considered the doctrine inconsistent with the concept of lawful, commercial competition. He stated:

competition is not unfair in a legal sense, merely because the profits gained are unearned, even if made at the expense of a rival *He who follows the pioneer into a new market, or who engages in the manufacture of an article newly introduced by another, seeks profits due largely to the labor and expense of the first adventurer; but the law sanctions, indeed encourages the pursuit.*¹⁰⁰

In light of Justice Brandeis's characterization of lawful competition, it is ironic that Congress invoked the misappropriation doctrine to articulate the concept of reverse engineering in the semiconductor chip industry.

Another factor responsible for limiting the significance of the misappropriation doctrine is the restrictive reading of the misappropriation doctrine imposed by courts in subsequent cases. The Supreme Court itself has cast doubt upon the usefulness of the doctrine. In companion cases examining the extent to which state unfair competition statutes could impose liability for copying an article unprotected either by federal patent or copyright laws, the Supreme Court held that federal law necessarily preempted state unfair competition laws.¹⁰¹ In expressing the clear federal policy favoring competition in terms of the broad language of preemption, the Court undercut the very basis of the misappropriation doctrine of the *International News Service* opinion.¹⁰²

99. *Abrams*, *supra* note 10, at 513; *see also Stern & Hoffman*, *supra* note 18, at 969.

100. *International News Serv. v. Associated Press*, 248 U.S. 215, 259 (1918) (Brandeis, J., dissenting) (emphasis added).

101. *See Sears, Roebuck & Co. v. Stiffel Co.*, 376 U.S. 225, 228-31 (1964); *Compco Corp. v. Day-Brite Lighting, Inc.*, 376 U.S. 234, 237-38 (1964). The extent of the implied limitation imposed by these cases on the *International News Service* case remains uncertain, because of subsequent Supreme Court opinions giving some scope to state trade secret and record piracy statutes. *See Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 478-79 (1974); *Goldstein v. California*, 412 U.S. 546, 552-58 (1973).

102. Some courts view *Stiffel* and *Compco* as having implicitly overruled *International News Service*. *See Columbia Broadcasting Sys. v. DeCosta*, 377 F.2d 315, 318-19 (1st Cir.), *cert. denied*, 389 U.S. 1007 (1967). Judge Learned Hand declined to extend the *International News Service* doctrine to bar copying of an unprotected dress design by a competitor in *Cheney Bros. v. Doris Silk Corp.*, 35 F.2d 279, 280 (2d Cir. 1929). Judge Hand's treatment of the mis-

Finally, the misappropriation doctrine has been criticized as a legal principle in search of a rationale.¹⁰³ This viewpoint finds the doctrine suspect because it cannot be reconciled with the concept of competition. The doctrine fails to articulate the interest or interests which it seeks to protect, and absent such statement and analysis, it has no predictive content. It remains a vague "theory of unfair competition law . . . a carte blanche to the courts to write their own code of business morality."¹⁰⁴

Given these criticisms of the misappropriation doctrine, it is unlikely to serve the analytical function which its proponents ascribed to it during the legislative process. A court faced with an infringement action under the Chip Act would not find helpful a doctrine circumscribed in case law and criticized in the literature.

C. INTERPRETING SECTION 906

The relative clarity and precision of the industry description of the "paper trail" of legitimate reverse engineering will ultimately preempt the application of the misappropriation doctrine. A court could properly find an identifiable standard of acceptable commercial copying of semiconductor chip products by reference to the exposition of legitimate reverse engineering in the hearings.

The exposition of the "paper trail" associated with "legitimate" reverse engineering could satisfy the test required by section 906. For example, the initial issue of determining whether the allegedly infringing chip is itself an original mask work would invoke the standard of "substantial similarity."¹⁰⁵ Surely a court would permit expert testimony to illuminate this issue. At that point, the court would review the complete history of the design of the allegedly infringing chip. Moreover, the very evidence which an expert might rely upon to give an opinion as to the similarity or lack thereof would also be relevant and probative of "legitimate" toil and investment. The many schematic and layout diagrams in which transistors are connected to perform specific electronic functions, and the computer simulations of their operations, are the basis of the design

appropriation doctrine is analyzed in Goldstein, *Federal System Ordering of the Copyright Interest*, 69 COLUM. L. REV. 49, 51-62 (1969). Judge Hand wrote privately that the misappropriation doctrine and its broad grant of quasi-property rights were mistaken. See Baird, *supra* note 96, at 419.

103. Stern & Hoffman, *supra* note 18, at 966-71.

104. *Id.* at 969.

105. See *supra* text accompanying notes 64-74.

process. They would serve both to illustrate the differences between the earlier and later chips, and to reflect the cost of the layout designer's time.¹⁰⁶

Given the weight accorded the "paper trail" in the legislative history and the clarity of the description of the present technology which produces it, a court could resolve the infringement issue without further analysis. The broad formulation of the misappropriation doctrine would add little to the precise specification of costs, including investigative marketing expenses, which the reverse engineering "paper trail" identifies.

A derivative benefit of the reverse engineering model is the clarity and precision with which the design process was described in cost terms. Witnesses reiterated the high costs of the design process. From the initial marketing survey defining a marketable product to the conclusion of the engineering and layout design phases, millions of dollars are expended.¹⁰⁷ One witness estimated a front-end development cost of \$50 million to design and develop a new semiconductor chip product.¹⁰⁸ Another witness estimated a \$40 million cost of developing and marketing a sophisticated chip, which could be copied at a cost of \$60,000.¹⁰⁹ The House Report stated that "development costs for a single new chip can reach \$100 million."¹¹⁰ While the

106. Layout designers were described in the 1979 hearings as "[c]reative persons and not just draftsman Layout design is a skill that has successfully resisted . . . attempts at computerization, it requires a level of human ingenuity that will not be computerized . . ." *1979 House Hearings, supra* note 3, at 26 (testimony of L.J. Sevin, President, Mostek Corp.).

Since the hearings, software improvements have permitted complete customization of chips entirely by computers. This change reflects the rapidity of technological change and the resultant pressure on the Chip Act, e.g., is a chip customized by a computer program an "original" under section 902(b)?

107. *1983 House Hearings, supra* note 32, at 205, 209-11 (testimony of Christopher K. Layton, Vice-President, Intersil, Inc.). Layton stated that the design of a new chip required a period of two or three months of marketing studies by two persons at a cost of \$50,000. The subsequent engineering effort of two man-years would involve a cost of about \$200,000. Another year would be required for the layout design to be prepared at a cost of some \$75,000. To translate the composite drawing into interactive graphics would require an added investment of \$1 million. The copier, however, could replicate the originator's chip in three to six months with an investment of \$30,000 to \$50,000. *Id.*

108. *House Hearings on Copyright and Technological Change, supra* note 84, at 129, 135 (statement of Richard H. Stern).

109. Cohodas, *Special Report: Technology and the Law—New Technology Puts Strain on Old Laws*, 42 CONG. Q. 135, 135 (1984), reprinted in *House Hearings on Copyright and Technological Change, supra* note 84, at 355.

110. HOUSE REPORT, *supra* note 35, at 2, 1984 U.S. CODE CONG. & AD. NEWS at 5751.

originating firm might take years to complete its work, the House Report notes that a competitor could copy the original chip in only a few months at a meager cost of \$50,000.¹¹¹

With a legislative history replete with the explicit details of development and marketing for this industry, including the relative magnitudes of the costs of the originator as distinguished from the copier, it is most likely that infringement actions would be resolved around the reverse engineering model. Courts would be required only to assess the credibility and probative weight to be accorded the business records of the competitors. To accomplish this task, courts would rely on the testimony of experts.

D. THE DEMISE OF THE MISAPPROPRIATION DOCTRINE

The full effect of the misappropriation doctrine was exhausted in the legislative process. There is a certain irony in the demise of the misappropriation doctrine as a viable doctrine under the Chip Act. In the formative stages of the designing of statutory protection for semiconductor chip products, the misappropriation doctrine was the conceptual catalyst of *sui generis* protection. That doctrine, as a branch of unfair competition law, energized the customary industry practice of reverse engineering into a legal standard expressed in the text of section 906.¹¹² As it turned out, the nature and description of the underlying customary practice will better serve courts as a normative standard of permissible competition than would the misappropriation doctrine. It is more likely that judicial opinions in Chip Act infringement actions will be expressed in terms of industry norms and costs than in the agrarian metaphor associated with the misappropriation doctrine.¹¹³ The ultimate conclusion of law will probably be stated as either legitimate reverse engineering or improper piracy. The distinction between the two is likely to be illuminated by the "paper trail" of reverse engineering.

CONCLUSION

As an innovative statute providing protection for commercial intellectual property of a single industry, the Chip Act will continue to be an object of study and analysis. It is appropriate

111. *Id.*

112. *See* 17 U.S.C. § 906 (Supp. II 1984).

113. *See supra* text accompanying note 97.

to conclude this review of the development and interpretation of this statute by speculating about its long-range significance. Recent studies of this colorful industry portray the enormous dynamism of its technology and the vulnerability of its firms to these changes.¹¹⁴

Viewing the Chip Act as legislation sought by this industry of fewer than thirty major domestic producers suggests doubts as to its durability.¹¹⁵ Throughout its history, intellectual property law has demonstrated only a limited capability to accommodate to new technology. Computer programs remained an uncertain subject matter of copyright protection for four years after the 1976 Copyright Act revision.¹¹⁶ The complete absence of copyright protection for semiconductor chip products ultimately generated the quest for protection which culminated in the passage of the Chip Act. In light of this pattern of intellectual property law of not always being in step with technology, it is unlikely that the Chip Act will entirely avoid this hazard. The rapid pace of technological change, coupled with the sensitivity of the domestic firms to the resultant changes in costs and revenues, reinforces this concern.

From this perspective, the industry adherence to the practice of reverse engineering, as reflected in the hearings on the Chip Act, has produced a statutory scheme of protection which may be inextricably linked to the state of the art in the industry at that point in time and technology. Congress showed some awareness of the problem in its expanded definition of a mask work as "a series of related images, *however fixed or encoded*."¹¹⁷ The legislative history corroborates this sensitivity to the effect of changing technology on statutory definitions.¹¹⁸

114. Recent studies of this dynamic industry have produced a basis for such speculation. See, e.g., T. MAHON, CHARGED BODIES 279-303 (1985); J. K. PAUL, HIGH TECHNOLOGY, INTERNATIONAL TRADE, AND COMPETITION 218-45 (1984).

115. M. Borrus, *supra* note 98, at Table I.

116. 17 U.S.C. § 102(a) (1982) does not expressly list computer programs, but the legislative history suggests that they can be protected as literary works. See H.R. REP. NO. 1476, 94th Cong., 2d Sess. 54, *reprinted in* 1976 U.S. CODE CONG. & AD. NEWS 5659, 5667. Congress then provided a status quo provision, pending a report on the matter by the National Commission on New Technological Uses (CONTU). Congress adopted that report by amending section 117 of the Copyright Act in 1980. See Pub. L. No. 94-553, 90 Stat. 2565 (codified at 17 U.S.C. § 117 (1982)). This provision implies that computer programs are copyrightable. See also Rosen, *A Common Law for the Ages of Intellectual Property*, 38 U. MIAMI L. REV. 769, 793-804 (1984).

117. 17 U.S.C. § 901(a)(2) (Supp II 1984) (emphasis added).

118. See HOUSE REPORT, *supra* note 35, at 20, 1984 U.S. CODE CONG. & AD. NEWS at 5769.

But even as the Chip Act was being signed into law, competition and technology were working major changes in the structure and behavior of the domestic semiconductor chip industry. These forces are proceeding apace, and the results are becoming visible.

One recent study of the international semiconductor chip industry shows that in 1978, United States firms occupied five of the top ten industry rankings by volume of sales. In that year, the Japanese firms ranked third, seventh, and eighth respectively. By 1984, the Japanese firms had moved into the second, fourth, fifth, and seventh places.¹¹⁹ These statistics do not adequately depict the intense marketing rivalry that produced these changes. For example, the domestic industry had pioneered the standard random access memory (RAM) chip, which became a staple product of the industry by serving as the operating basis for a variety of consumer products from personal computers to video cassette recorders. By copying this chip product, the Japanese competitors were able to enter the United States market without incurring the design and marketing costs. Given the superior quality control of the Japanese firms, they were able to offer a better product at a lower price. An increased market share and a higher ranking in the industry statistics followed.¹²⁰

The fate of the RAM chip, once the staple product of the domestic industry, is an example of the rapid rate of change in the industry. In the early 1980's, this chip both underwent improvement due to intense research and development efforts and served as a significant revenue producer. By the third quarter of 1985, however, the major domestic producers had abandoned production of the RAM chip to their Japanese competitors.¹²¹ At the end of October 1985, Intel Corporation, an industry leader, announced it was ending its production of the RAM chip after a third quarter loss of \$4 million.¹²² Mostek Corporation ceased production after a third quarter loss of \$45.6 million;¹²³ Motorola is no longer manufacturing the 64k RAM, having sustained a third quarter loss of \$39 million; National Semiconductor, after a reported loss for the period of \$53.5 mil-

119. M. Borrus, *supra* note 98.

120. 1983 Senate Hearings, *supra* note 30, at 82 (testimony of F. Thomas Dunlap, Jr., Corporate Counsel and Secretary, Intel Corp).

121. See N.Y. Times, Oct. 29, 1985, at 33, col. 4.

122. See *id.*

123. See *id.*

lion,¹²⁴ has also suspended RAM manufacture. The largest firm in the industry, Texas Instruments, has announced significant reductions in personnel and manufacturing, while reporting a loss of \$82.8 million.¹²⁵

These changes may well diminish the role of the Chip Act. It may be that the enactment of the statute came too late to blunt the impact of Japanese competition on domestic producers. Moreover, the consensus and acceptance of reverse engineering as the norm of industry research and development may evaporate under the force of technology. In a recent report, LSI Logic Corporation, a smaller domestic firm, is described as successfully pioneering the manufacture of small batches of chips customized to the needs of each user.¹²⁶ This process of producing application specific integrated circuits is seen by industry analysts as causing a major shift in the semiconductor business. The techniques of producing customized chips permit the basic logic elements of the chip to be manufactured subject to being specially crafted to the needs of a particular customer in the later stages of production. Technological advances since the passage of the Chip Act allow some chips to be completely customized by a computer.¹²⁷ As part of this process of customizing chips, LSI has established its own design centers in major cities of the world. Customer and manufacturer participate in the design process.¹²⁸

If the present trend in marketing and design changes continues, reverse engineering may well become obsolete. As competitive forces drive the various firms to adopt diverging and

124. *See id.*

125. *See id.*

126. At a time when most semiconductor companies are suffering from losses, layoffs and plant closings, the LSI Logic Corporation . . . has passed \$100 million in sales this year and remains one of the few profitable chip makers in Silicon Valley.

LSI accomplished this feat by surging to the lead in a still small but rapidly growing segment of the semiconductor business —the production of relatively small batches of microelectronic chips that are customized for each user.

N.Y. Times, Nov. 5, 1985, at 25, col. 4.

127. LSI specialized in one technique of producing customized chips. In this technique, known as gate arrays, the basic logic elements, or "gates," are laid out on a chip and then customized by connecting them in a certain order in the last stages of production.

Analysts say a key to LSI's success is that it provides excellent software allowing customers to do their own chip designs or go to LSI design centers around the world.

N.Y. Times, Nov. 5, 1985, at 45, col. 2.

128. *Id.*

complex technologies in the quest for market shares, reverse engineering becomes more expensive. The custom products of one manufacturer may be very difficult and costly to analyze. Moreover, as firms develop different chips for different users, the chip of one manufacturer may have no appeal to the clientele of a competitor.

As the domestic industry shifts away from standardized products made under a relatively uniform technology, reverse engineering, which served as the arbiter of protection under the earlier technology, declines in significance. If this perception is valid, there are at least two foreseeable results. One is that the Chip Act, perhaps developed too late to shield the domestic producers from the Japanese capture of the RAM market, may serve in a diminished role in the market that remains. The second result is that infringement actions will arise between domestic firms employing widely divergent technologies. In these cases, courts will face difficult tasks of interpretation. As its contribution to the law of intellectual property, the Chip Act may have allowed for the acceptance of some copying, in the copyright sense, as a legitimate ingredient of competition. The fact of its enactment as a *sui generis* statute for this dynamic industry will surely have enriched this sometimes musty area of the law.

