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Cover Page Footnote

"The author greatly appreciates her friends and family for their understanding and support throughout this endeavor."

NOTE

Illuminating the Law of Copyright: Holographic Data Storage Takes Intellectual Property to a New Dimension

Patti Burshtyn*

INTRODUCTION

Imagine for a moment a futuristic society in which a vast amount of information is stored on a crystal block no larger than a quarter. In this world, individual "CD's," videocassette tapes, and digitalized computer disks have become obsolete. Instead, they have been consolidated in single data storage systems which allow the user lightening fast access to view any movie, listen to any recording, or use a desktop computer to browse through the amount of data contained in a typical law library. How far into the future have we traveled? The surprising answer may be not far at all.¹

As we are all well aware, the "Information Age" is upon us. Everyone from Big Business to your fifth grade neighbor² is "on-line"³ and able to download data from the global communications

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1. This scenario exaggerates the anticipated recording capacity of the first holographic data storage systems. In light of the ceaseless quest for technological improvement, however, this depiction is not a dramatic departure from the realistic capabilities which improvements upon this recording medium may enable. See Mark Halper, *Putting Mount Everest Into An Anthill*, FORBES, July 7, 1997, at 208.

2. In 1994, a fifth grade class in Grand River, Michigan became the first elementary school with a website on the Internet. See DAVID PEAL, THE OFFICIAL AMERICA ON-LINE INTERNET GUIDE 3 (1997).

3. Approximately sixty million people presently use the Internet. See *id.*, at xvii.

network known as the "Internet."⁴ Today's rush to gather and record information⁵ will inevitably lead to the development of the data storage technologies of tomorrow as digitalized storage mediums become ill equipped to handle the volume and speeds which larger and more complex computing applications will require.⁶ Digitalized storage systems are "'bit-based' in that they have a drive head that scans media to read linear rows of data."⁷ The problem with this medium is that "there are only so many bits that can fit onto a disk before the bits become magnetically unstable."⁸ Experts predict that at the rate at which information is being digitalized, this limit⁹ will be reached within ten years.¹⁰

Some researchers hail the perfection of holographic data storage as the solution to this dilemma.¹¹ This recording medium,¹² which offers an almost inconceivable amount of storage capacity and the ability to access data at incredible speeds may, if refined, present the next great leap in information technology.¹³ Presently, the United States Department of Defense,¹⁴ NASA,¹⁵ a consortium

4. "The Internet today is a worldwide entity whose nature cannot be easily or simply defined. From a technical definition, the Internet is the 'set of all interconnected IP networks'—the collection of several thousand local, regional, and global computer networks interconnected in real time via the TCP/IP Internetworking Protocol suite . . ." Religious Tech. Center v. Netcom On-line Comm. Serv., Inc., 907 F.Supp. 1361, 1365 n.2 (N.D.Cal 1995) (quoting DANIEL P. DERN, THE INTERNET GUIDE FOR NEW USERS 16 (1994)).

5. "The Internet is stimulating the urge to store and retrieve all sorts of information in digital form." Halper, *supra* note 1, at 208.

6. See *Holographs Promise Vast Capacity*, OPTICAL MEMORY NEWS, Aug. 12, 1997.

7. *Id.*

8. Halper, *supra* note 1, at 208.

9. This scientific principle is known as the "superparamagnetic limit." See David M. Stone, *Future Mass Storage*, P.C. MAGAZINE, Mar. 25, 1997, at 182.

10. Today's most densely packed disks hold approximately 2.6 gigabytes to the square inch. Instability will likely occur when disks are asked to hold 50 - 100 gigabytes per square inch; a volume which will probably be reached by the next decade. See Halper, *supra* note 1, at 208.

11. See *Holographs Promise Vast Capacity*, *supra* note 6.

12. Holography was invented by Dennis Gabor in 1947. The Hungarian-born engineer won the 1971 Nobel Prize in physics for this work. See *Holography*, in WORLD BOOK MULTIMEDIA ENCYCLOPEDIA (1997). Recent advancements in this technology have significantly increased its utility. See Drew Winter, *Holography Hits A Roadblock: Automakers Need A Technological Breakthrough From Silicon Valley*, WARDS AUTO WORLD, June 1997, at 3.

13. See Winter, *supra* note 12, at 3.

14. The Defense Department has spent twenty-five million dollars to advance re-

of Universities and at least a dozen corporate researchers including IBM, Kodak, Lucent Technologies, and Japan's NTT,¹⁶ are working on the development of holographic storage.¹⁷

This Note argues that some properties of holographic data storage systems should receive copyright protection while other aspects of this technology are ineligible. Part I examines holographic data storage systems and the history and development of copyright law. Part II discusses the judiciary's treatment of copyright issues in cases which present similar technological advancements. Part III argues that holographic computer programs will be copyrightable, as will other works fixed in this medium. This Note concludes that the copyright laws as they presently exist are broad enough to encompass the advent of holographic technology.

I. HOLOGRAPHIC DATA SYSTEMS AND THE HISTORY AND DEVELOPMENT OF COPYRIGHT LAW

Two hundred years ago, the founding fathers wove intellectual property protection into the fabric of the United States Constitution.¹⁸ The United States was the first country to do so.¹⁹ With the Copyright and Patent Clause as a guide, this country has "grown from a small, agrarian country into an economic powerhouse—the world's leading creator and exporter of scientific know-how and popular culture."²⁰

As new technologies develop, intellectual property²¹ laws must be interpreted or reformatted to incorporate elements not previously considered. This Part explains the holographic data storage process and discusses the evolution of federal copyright law. First,

search in this area. See Halper, *supra* note 1, at 208.

15. See *Light Sensing Technologies Hurdle Barriers*, INTECH, Mar. 1997, at 28.

16. See *Holographics*, FORBES, July 7, 1997, at 210.

17. See *Holograms Promise Vast Storage Capacity*, *supra* note 6.

18. See Ralph Oman, *Copyright And Software: The Emerging International Consensus*, 67-Jun N.Y. ST. B.J. 8 (1995).

19. See *id.*

20. *Id.*

21. "Intellectual property is the legal regime by which authors and inventors protect intellectual creations." Tara Goldsmith, Comment, *What's Wrong With This Picture? When The Lanham Act Clashes With Artistic Expression*, 7 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 821, 826 (1997).

this Part presents the scientific methods used to accomplish holographic storage and the advantages of this technology. Next, the history, objectives, and protections afforded by copyright law are considered. Finally, this Part focuses upon the criteria for establishing copyright infringement claims and defenses to this cause of action.

A. *Holographic Data Systems—The Wave of the Future*

Holographic data storage technology is uniquely qualified to fulfill the constant quest to fit more data into a smaller space²². It uses a process called “multiplexing,”²³ or “overlapping storage”²⁴ to increase volume capacity without increasing the size of the storage container.²⁵ Experts estimate that holographic memory could store “one hundred bits²⁶ per square micro[n] whereas current magnetic disks”²⁷ can only contain approximately three bits in that space.²⁸ The data transfer rate is also significantly increased using this technology.²⁹

Holographic storage is accomplished by using two converging lasers to record data³⁰ within the cubic volume of a crystal.³¹

22. The demand for larger capabilities in a smaller space has long been a theme in the computer industry. In 1956 IBM's first magnetic hard drive computer was so large that it had to be delivered on a flat bed truck. It held only 5 megabytes of memory and used fifty 24 inch disks. By the 1980's personal computers had significantly shrunken in size but held twice as much memory. Today, the average home computer's 2 gigabyte drive uses two, 3.5 inch disks. See Halper, *supra* note 1, at 208.

23. See *Holograms Promise Vast Capacity*, *supra* note 6; see also, discussion of multiplexing *infra* note 34.

24. See *Toshiba Material Becomes High-Density Memory*, COMLINE ELECTRONICS, Aug. 6, 1997.

25. See *id.*

26. A bit is a binary digit, the smallest unit of information that a computer can recognize, represented by a single 0 or 1. A group of eight bits is a byte. See E.D. Hirsch, Jr., ed. *DICTIONARY OF CULTURAL LITERACY* (2d ed. 1993).

27. See *Holographs Promise Vast Capacity*, *supra* note 6. A micron is a unit of length equal to one millionth of a meter. WEBSTER'S II NEW RIVERSIDE UNIVERSITY DICTIONARY, 749 (Riverside Publ'g Co. 1994).

28. Toshiba predicts that its development of new “photo-refractive material” will allow 50 terabytes per square centimeter to be recorded. See *Toshiba Material Becomes High Density Memory*, *supra* note 24.

29. “Holographic devices can transfer data at 1GB/SEC where current devices measure rates in 100's of MB/SEC.” *Holographs Promise Vast Capacity*, *supra* note 6.

30. Holographic storage is achieved by a process whereby electronic bits of data are

Through multiplexing, multiple "pages" of data are recorded in virtually the same area of crystal.³² This process enables a computer to optically read and write data at the same time, thus facilitating "high volume access that would be impossible by [current] electronic means."³³ Multiplexing is actually a simple concept which is illustrated by the typical hologram with which most people are familiar.³⁴ Traditional holographic images of three-dimensional objects are activated by changing the angle of light shining on the image which results in the production of a different view of the object.³⁵ Holographic data storage functions in essen-

downloaded from a computer and assembled in a spatial light modulator, which is basically a liquid crystal display screen, or LCD. A laser is then beamed at this. The light reflecting off the LCD is intersected by a second laser, or reference beam. The intersection of the two beams creates an interference pattern which is recorded within the crystal as a pattern of dark and light patches. The information is recalled by directing the reference beam through the crystal at the same angle at which it was recorded and focusing that beam on a camera which restores the images to electronic bits of data. *See id.*; *see also* technological discussion of holographic data storage *infra* notes 308 and 312.

31. Digital technologies store data within the flat surface of a disk. *See Holographics, supra* note 16, at 210.

32. *See Holograms Promise Vast Capacity, supra* note 6.

33. Chappell Brown, *Ambitious Academics Aim to Integrate Cryogenic Processors, Optical Interconnectors and Holographic Storage—Researchers Pursue the Petaflops Computer*, ELECTRONIC ENGINEERING TIMES, Sept. 8, 1997, at 1.

34. *See Holograms Promise Vast Capacity, supra* note 6; *see also* D.F. Scott, *Light Waves Ahead*, COMPUTER SHOPPER, May 1996, at 562 (discussing holography's potential to be more than "a sparkly 3-d sticker" affixed to the packaging of The Lion King CD). Typical holography employs photographic plates or other light-sensitive material to store and display three dimensional images. A hologram is created when the plate is exposed to light. Most people are familiar with the basic hologram's use as a security device on some credit cards. This type of hologram is also a common sight in advertising, artwork, and jewelry. *See Winter, supra* note 12, at 3.

35. *See Holograms Promise Vast Capacity, supra* note 6. Basic holography involves two steps:

(1) Creating a hologram and (2) Illuminating the hologram to display the image. During the first step a laser light is reflected off a subject and onto a light-sensitive material, such as a photographic plate. Another laser beam, called the reference beam, also shines on the plate. Where these two light beams cross on the plate, they make a complex microscopic pattern of bright and dark stripes. In the second step, a light beam traveling in the same direction as did the reference beam illuminates the hologram. The hologram changes the direction of light waves in this beam so that waves appear to come from the original illuminated subject. The resulting three-dimensional image seems to hover in space. Illuminating the hologram with white light, such as sunlight, produces an image containing rainbow like bands of color. Using a beam of a single color, such as

tially the same manner, "except new angles reveal entirely new pages of data."³⁶ The potential uses for holographic storage are numerous.³⁷ The utilities of such a system could include the creation of high-speed digital libraries³⁸, enhancement of satellite communications³⁹, product design technology⁴⁰, and military capabilities⁴¹, as well as the advancement of new applications such as "telemedicine."⁴²

A hybrid digital/holographic work illustrates the potential public utilities of holographic storage mediums.⁴³ The development of an interactive holographic work which also uses digital technology has enabled a simulation of the human body to be reproduced in three dimensional form.⁴⁴ This representation can be manipulated in mid-air, and has been tested by physicians as a new advance in medicine.⁴⁵ By employing this "telemedical" instrument, doctors are able to learn more about the body without using a live person.⁴⁶ These results have thrilled doctors and clearly depict the substantial enhancements in the quality of life which could be provided by such hybrid mediums, as well as purely holographic mediums.⁴⁷

a laser beam, avoids this effect.

Holographs Promise Vast Capacity, *supra* note 6.

36. *Id.*

37. *See Electronics and Optics*, INDUSTRIES IN TRANSITION, June 1997.

38. *See Holographs Promise Vast Capacity*, *supra* note 6.

39. *Id.*

40. *See* Victor D. Chase, *Using Holography To Design In Thin Air*, APPLIANCE MANUFACTURER, Aug. 1, 1997, at 8.

41. *See id.*; *see also Electronics and Optics*, *supra* note 37.

42. *See Physicians Report That Digital Holography Aids Diagnosis And Treatment Of Complex Spinal and Head and Neck Conditions*, BUSINESS WIRE, May 1997, available in Westlaw, BUSWIRE database.

43. *See* Lambertus Heselink, *Digital Holographic Storage Looks Ahead*, PHOTONICS SPECTRA, Mar. 1, 1996, at 44.

44. *See* Sami Menefee, *Digital Holographic Tool Gives Surgeons Life-size Images*, NEWSBYTES, Sep. 29, 1997.

45. *See id.*

46. *See id.*

47. *See id.*

B. Copyright Law – History and Development

Article I, Section 8 of the United States Constitution grants Congress the power to “promote the Progress of Science and the useful Arts, by securing for limited Times to Authors and Inventors the exclusive right to their respective Writings and Discoveries.”⁴⁸ This Constitutional provision delegates broad authority to Congress to enact legislation to protect creative works. From this enumerated right federal copyright law⁴⁹ has developed.⁵⁰

1. Historical Development

a. Copyright Objectives

Copyright law is grounded in the First Amendment’s basic premise that access to freely disseminated information and ideas is fundamental to the public welfare.⁵¹ The Copyright Clause⁵² in the Constitution endows Congress with vast discretionary power to regulate the law of copyright in furtherance of progress.⁵³ This power derives from an economic theory of societal development.⁵⁴ The theory posits that monetary incentives stimulate the creation of original works which ultimately advance the technological, economic, and artistic development of society.⁵⁵ The establishment of legally protectable rights in original creations secures a fair return for the individual’s labor while inevitably benefiting the masses.⁵⁶

48. U.S. CONST. art. I, § 8, cl. 8.

49. Patent law also traces its origins to this provision of the Constitution. See *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966). “A patent is a grant from the government to the patentee of a right to exclude others from making, using, or selling the claimed invention in the United States for a period of time.” David Bender, *Patents and Software*, N.Y. ST. B.J. May/June 1995.

50. See Julian Velasco, Note, *The Copyrightability of Non-Literal Elements Of Computer Programs*, 94 COLUM. L. REV. 242, 248-249 (1994).

51. See *id.*

52. U.S. CONST. art. I, § 8, cl. 8 is also known as the Copyright Clause.

53. See *Lotus Dev. Corp. v. Paperback Software Int’l*, 740 F.Supp. 37, 41-47 (D. Mass 1990) (holding menu structure of a spreadsheet is copyrightable).

54. See *Mazer v. Stein*, 347 U.S. 201, 202 (1954) (holding that utilitarian nature of statuette lamps did not invalidate copyright as ‘works of art’).

55. See *Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 156 (1975).

56. See *id.*

In a landmark copyright case, the Second Circuit stated, “[t]he interest of the copyright law is not in simply conferring a monopoly on industrious persons, but in advancing the public welfare through rewarding artistic creativity, in a manner that permits the free use and development of non-protectable ideas and processes.”⁵⁷ Congress is charged with the task of maintaining a delicate balance between enacting laws which encourage development, and limiting the extent of those laws to avoid the effects of “monopolistic stagnation.”⁵⁸ The Supreme Court has stated emphatically that “the primary objective of copyright is not to reward the labor of authors.”⁵⁹ Rather, the Court has indicated that one of the most important policies of copyright law is the dissemination of creative material to the public.⁶⁰

b. Technology Compels Change

The law of copyright has, from its beginning, developed in response to significant changes in technology.⁶¹ “Copyright protection became necessary with the invention of the printing press⁶² and had its early beginnings in the British censorship laws.”⁶³ Copy-

57. *Computer Assocs. Int'l, Inc. v. Atlai, Inc.*, 982 F.2d 693, 711 (2d Cir. 1992) (holding that nonliteral elements of a rewritten computer program were not substantially similar to copyrighted work).

58. See *Twentieth Century Music Corp.*, 422 U.S. at 156.

59. *Computer Assocs. Int'l*, 982 F.2d at 711.

60. The Court stated:

The limited scope of the copyright holder's statutory monopoly, like the limited copyright duration required by the Constitution, reflects a balance of competing claims upon the public interest. Creative work is to be encouraged and rewarded, but private motivation must ultimately serve the cause of promoting broad public availability of literature, music and other arts. The immediate effect of our copyright law is to secure a fair return for an “author's” creative labor. But the ultimate aim is, by this incentive, to stimulate artistic creativity for the general public good

Id. (quoting *Twentieth Century Music Corp.*, 422 U.S. at 15.).

61. See *Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417, 429 (1984) (holding that videotaped recordings of public television programming was a fair use).

62. With the invention of the printing press, copies of printed works could easily be disseminated without the author's permission or financial reward. See William C. Warren, *Foreword to BENJAMIN KAPLAN, AN UNHURRIED VIEW OF COPYRIGHT* (1967).

63. *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1479n.14 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991).

right, however, cannot be sustained as a right that existed at common law, but depends wholly on Congressional legislation.⁶⁴ Congress may use its judgment, within Constitutional limits, to determine the scope of the works protected, length of time the copyright holder is afforded rights, and the remedies which may be sought for copyright infringement.⁶⁵ The First Congress, in 1790, used its authority to extend copyright protection to "any map, chart, book, or books already printed."⁶⁶ Subsequent amendments to this legislation delineated other specific mediums which were deemed copyright protected.⁶⁷ Congress attempted to end this type of piecemeal augmentation of the law by creating a broad category of protected works in the Copyright Act of 1909.⁶⁸ Nonetheless, the persistent infusion of new technologies which expand the range of mediums in which an author might express an original "writing"⁶⁹ prompted Congress, in 1976, to enact a major revision of copyright law which was more receptive to technological advances.⁷⁰ This statute and its amendments comprise the current federal copyright laws.⁷¹

64. See *Mazer v. Stein*, 347 U.S. 201, 202 (1954) (finding that no authority exists for obtaining copyright beyond the extent to which Congress has authorized it).

65. See *id.* At common law, authors had some intellectual property rights in unpublished works, but copyright protection as it exists today was created by federal statute.

66. *Lotus Dev. Corp. v. Paperback Software Int'l*, 740 F.Supp. 37, 47 (D. Mass. 1990) (citing Act of May 31, 1790, ch. 15 § 1, 1 stat. 124, 124 (*repealed* 1831)).

67. See *id.* at 52. Designs, prints, etchings, and engravings were added in 1802; musical compositions in 1831; dramatic compositions in 1856; photographs and the negatives thereof in 1865; and statutory and models or designs intended to be perfected as works of the fine arts in 1870. *Id.*

68. The Copyright Act of March 4, 1909 provided: "the works for which copyright may be secured under this title shall include all the writings of an author." Act of Mar. 4, 1909, ch.320 § 4, 35 Stat. 1075, 1076 (*previously codified* at 17 USC § 4, *reprinted in* 17 U.S.C.A. App § 4 (West Supp. 1990); *recodified* 1947; *repealed* 1976.). This act provided a list of examples of copyrighted works but did not limit copyright protection to those works. See *id.* at § 5.

69. The term writing has been broadly interpreted. See *Columbia Broadcasting System, Inc. v. DeCosta*, 377 F.2d 315 (1st Cir. 1967).

70. See *Lotus v. Paperback*, 740 F.Supp. at 47.

71. An important addition to the Copyright Act of 1976 is the incorporation of the Berne Convention in 1988. This amendment provided that the U.S. would adhere to certain international copyright laws which were signed at Berne, Switzerland in 1866. See 17 U.S.C.A. § 101 (West Supp. 1999).

c. Copyrightable Works

The Copyright Act of 1976⁷² provided that: "copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."⁷³ The act included a list of categories⁷⁴ which was intended to be "illustrative and not limitative" of protected works which are copyrightable.⁷⁵ Copyright infringement cases often turn on whether the allegedly copied work is, itself, entitled to legal protection.⁷⁶ Congress explicitly denied copyright protection 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."⁷⁷

Copyright protection is thus afforded only to "those aspects of [a] work termed 'expression' . . . that display the stamp of the author's originality."⁷⁸ Although creativity is required in forming an idea, it is a fundamental principle of copyright law that ideas are not copyrightable.⁷⁹ The Constitutional aim of promoting progress is inherently rebuffed where access to ideas is restricted by laws which permit an idea's originator to prohibit others from its utili-

72. Copyright Act of 1976, Pub. L. No. 94-553, 90 Stat. 2541 (codified as amended at 17 U.S.C.A. §§ 101-1010) (West Supp. 1999).

73. 17 U.S.C. A. § 102(b) (West Supp. 1999).

74. Works of authorship include: (1) literary works, (2) musical works including any accompanying words, (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works, (5) pictorial, graphic, and sculptural works, (6) motion pictures and other audio visual works, and (7) sound recordings. 17 U.S.C.A. § 102(a) (1)-(7) (West Supp. 1999).

75. See H.R. REP. 1476, 94th Cong., 2d Sess. 53 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, 5666.

76. See *Baker v. Selden*, 101 U.S. 99 (1879) (holding that expression of a book-keeping system was not copyrightable); *Apple Computer, Inc. v. Microsoft Corp.*, 821 F. Supp. 616 (N.D. Cal. 1993) (holding that symbols used in Apple's computer icons were unprotectable).

77. 17 U.S.C. A. § 102(b) (West Supp. 1999).

78. *Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 499 U.S. 340, 350 (1991) (quoting *Harper & Row v. Nation*, 471 U.S. 539, 547 (1985)).

79. See *generally Baker*, 101 U.S. at 103 (holding that the copyright of a book on bookkeeping cannot secure the exclusive right to make, sell and use account-books prepared upon the plan set forth in such book).

zation.⁸⁰ Thus, only the creative works which stem from ideas⁸¹ are the proper subjects of copyright law.⁸²

In practice, however, it is often unclear where the boundary line is drawn between an idea and its expression.⁸³ In one case that addressed the issue of copyright law and new technologies, the Court stated that it is very difficult to discern the difference between an idea and an expression.⁸⁴ Judge Learned Hand once noted that “[o]bviously, no principle can be stated as to when an imitator has gone beyond copying the ‘idea,’ and has borrowed its ‘expression’ . . . Decisions must therefore inevitably be ad hoc.”⁸⁵

“As a general matter and to varying degrees, copyright protection extends beyond a literary works’ strictly textual form to its non-literal components.”⁸⁶ Courts have protected non-literal components where “the fundamental essence of one work is duplicated in another.”⁸⁷ Non-literal copying, where sufficiently extensive, constitutes more than the taking of an idea; “it has always been viewed as the copying of elements of an expression of creative originality.”⁸⁸ In a case involving the copyrightability of a computer spreadsheet program the court stated that, “[w]hen faced with

80. See *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*, 797 F.2d 1222, 1235 (3d Cir. 1986).

81. The principle that expressions are copyrightable while ideas are not is known as the “idea-expression dichotomy.” See Ian C. Ballon & Heather D. Rafter, *Computer Software Protection*, 431 PLI/PAT 81, 81 (Mar. 1996).

82. Where ideas cannot be distinguished from their expression copyright is not afforded. Three limiting doctrines of copyright, “merger,” “scenes a faire,” and “useful article” employ this notion. See Velasco, *supra* note 50, at 248-49.

83. See *Nichols v. Universal Pictures Corp.*, 45 F.2d 119 (2d Cir. 1930) (employing “Abstractions Test” to distinguish idea from expression).

84. See *Computer Assocs. Int’l, Inc. v. Altai, Inc.*, 982 F.2d 693, 704 (2d Cir. 1992) (holding that nonliteral elements of compatibility of rewritten computer program were not substantially similar to copyrighted work). The *Altai* court stated: “Drawing the line between idea and expression is a tricky business. Judge Learned Hand noted that “[n]obody has ever been able to fix that boundary, and nobody ever can.” *Id.* at 704 (citing *Nichols v. Universal*, 45 F.2d at 121).

85. *Id.* at 704 (quoting *Peter Pan Fabrics, Inc. v. Martin Weiner Corp.*, 274 F.2d 487, 489 (2d Cir. 1960)).

86. *Id.* at 701.

87. 3 MELVILLE B. NIMMER & DAVID NIMMER, *NIMMER ON COPYRIGHT* § 13.01, at 13-4 (1991).

88. *Lotus Dev. Corp. v. Paperback Software Int’l*, 740 F.Supp. 37, 51-52 (D. Mass 1990).

nonliteral-copying cases, courts must determine whether similarities are due merely to the fact that the two works share the same underlying idea or whether they instead indicate that the second author copied the first author's expression."⁸⁹

Further, copyrightable works often contain uncopyrightable elements within them.⁹⁰ For example, although copyright law affords no protection to facts,⁹¹ compilations of such may sometimes be copyrighted.⁹² "No person can claim original conception of facts,"⁹³ thus facts themselves are not copyrightable no matter how much "sweat of the brow"⁹⁴ one has expended in gathering them.⁹⁵ Nonetheless, where a compilation of facts is arranged in a manner which is sufficient to constitute an original expression, the work as a whole may receive copyright protection.⁹⁶ The same holds true for compilations of preexisting materials that is the work product of others.⁹⁷ A compilation's author receives no rights regarding the preexisting materials and effects no change in copyrights.⁹⁸

d. Legal Rights

The Copyright Act of 1976 provides that certain legal rights are possessed by the holder of a copyright.⁹⁹ A copyright owner is afforded the exclusive right to reproduce the work in copies, prepare derivative works¹⁰⁰, distribute copies of the work to the public¹⁰¹,

89. *Lotus Dev. Corp. v. Borland Int'l, Inc.*, 49 F.3d 807, 814 (1st Cir. 1995) (holding that the menu command hierarchy for computer spreadsheet program was uncopyrightable method of operation).

90. *See National Basketball Assoc. v. Motorola, Inc.*, 105 F.3d 841, 849 (2d Cir. 1997).

91. 17 U.S.C. A. § 101 (West Supp. 1999).

92. *See Publications Int'l Ltd. v. Meredith Corp.*, 88 F.3d 473, 480 (7th Cir. 1996).

93. *Harper & Row v. Nation Enterprises*, 471 U.S. 539, 547 (1985).

94. "Sweat of the brow" is also known as "industrious collection." *See Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1480 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991).

95. *See Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 499 U.S. 340, 350 (1991).

96. *Id.*

97. 17 U.S.C. A. § 103(b) (West Supp. 1999).

98. *Id.*

99. 17 U.S.C. A. § 106 (West Supp. 1999).

100. A derivative work is a work based upon one or more preexisting works. *See* 17 U.S.C. A. § 101 (West Supp. 1999).

and where applicable, to perform and display the work publicly.¹⁰² Congress has legislated that a copyright in a work created on or after January 1, 1978 subsists from its creation and generally endures for the life of the author plus fifty years after the author's death.¹⁰³ The statute also provides that anyone who violates any of the exclusive rights of the copyright owner¹⁰⁴ infringes the copyright.¹⁰⁵

2. Copyright Infringement

a. Criteria

In a suit for copyright infringement the plaintiff must prove two elements.¹⁰⁶ First, the plaintiff must establish ownership of a valid copyright.¹⁰⁷ This is established when the plaintiff demonstrates both the "Copyrightability"¹⁰⁸ of the work and compliance with the statutory requirements in securing the copyright.¹⁰⁹ A registration certificate issued by the Copyright Office¹¹⁰ is prima facie evidence of the validity of the copyright and the information contained in the certificates.¹¹¹ This presumption of copyrightabil-

101. Distribution may occur through sale or other transfer of ownership, rental, lease, or loan. 17 U.S.C. A. § 106 (West Supp. 1999).

102. *See id.*

103. 17 U.S.C. A. § 302(a) (West Supp. 1999). Subsections (b), (c), (d), and (e) are exceptions to the general rule and state their own terms of copyright endurance.

104. These exclusive rights are defined in 17 U.S.C. A. §§ 106-118 (West Supp. 1999).

105. 17 U.S.C. A. § 501(a) (West Supp. 1999).

106. *See Novelty Textile Mills, Inc. v. Joan Fabrics Corp.*, 558 F.2d 1090, 1092 (2d Cir. 1977).

107. *See id.*

108. *See supra* notes 61-82 and accompanying text.

109. *See Central Point Software, Inc. v. Nugent*, 903 F.Supp. 1057, 1059 (E.D. Tex. 1995).

110. "One does not 'obtain' a copyright from the Copyright Office. A claimant merely registers its claim of copyright in a work with the Copyright Office. Copyright itself arises by operation of law when any original work is fixed in a tangible medium of expression from which it can be perceived." *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1480 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991); 17 U.S.C. § 102(a) (1994). "Registration, however, is a prerequisite to initiation of an action for infringement." *Cable News Network*, 940 F.2d at 1480.

111. 17 U.S.C.A. § 410(c) (West Supp. 1999).

ity, however, is refutable by the defendant.¹¹²

Second, the plaintiff must prove that the defendant unlawfully replicated the copyrighted work.¹¹³ Copying may be proven through direct evidence.¹¹⁴ For example, to prove copyright infringement, a copyright holder may present a witness who saw the copyrighted work being copied by the alleged infringer. Many times, however, no such witnesses are available. Therefore, the element of copying is often proven by demonstrating the substantial similarity of the two works and defendant's access to the copyrighted work.¹¹⁵ Copying can also be established when the two works are shown to be so "strikingly similar as to preclude the possibility of independent creation."¹¹⁶

The courts most often employ the ordinary observer test to determine whether two works are substantially similar.¹¹⁷ This test focuses on "whether the accused work is so similar to the plaintiff's work that an ordinary reasonable person would conclude that the defendant unlawfully appropriated the plaintiff's protectible expression by taking material of substance and value."¹¹⁸

The ordinary observer test, however, "which was developed in cases involving novels, plays, and paintings, and which does not permit expert testimony, is of doubtful value in cases involving computer programs on account of the programs' complexity and unfamiliarity to most members of the public."¹¹⁹ In such instances, where "the subjects of the copyright are particularly complex,"

112. See *Playboy Enterprises, Inc. v. Webbworld, Inc.*, 968 F.Supp. 1171, 1174 (N.D. Tex. 1997).

113. See *Novelty Textile Mills, Inc. v. Joan Fabrics Corp.*, 558 F.2d 1090, 1092 (2d Cir. 1977).

114. See *Walker v. Time Life Films, Inc.*, 784 F.2d 44, 48 (2d Cir. 1986).

115. See *id.*

116. *Playboy Enterprises, Inc. v. Webbworld, Inc.*, 968 F.Supp. 1171, 1171 (N.D. Tex. 1997) (quoting *Ferguson v. National Broadcasting Co., Inc.*, 584 F.2d 111, 113 (5th Cir. 1978)).

117. See *Atari, Inc. v. North American Philips Consumer Electronics Corp.*, 672 F.2d 607, 614 (7th Cir. 1982) (granting preliminary injunction to plaintiff who demonstrated substantial similarity of two video game characters).

118. *Id.*

119. *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*, 797 F.2d 1222, 1232 (3d Cir. 1986) (holding that copyright extended past computer programs' literal code to structure, sequence and organization).

most courts employ "a single substantial similarity inquiry according to which both lay and expert testimony . . . [are] admissible."¹²⁰

Substantial similarity cannot be determined through an examination of a set portion of the work.¹²¹ The courts have held that "quantitatively insignificant infringement may be substantial if the material is qualitatively important to plaintiff's work."¹²² In a case holding that copyright protection extended past a computer program's structure, sequence and organization, the court stated that it must make a qualitative, not quantitative assessment of the work as a whole when determining substantial similarity.¹²³

Liability for direct infringement¹²⁴ may be imposed without a finding of intent to copy or knowledge of the infringement.¹²⁵ "It is settled that innocent intent is generally not a defense to copyright infringement."¹²⁶ However, "the issue of the defendant's intent may affect the amount of statutory damages available to the plain-

120. *Id.* at 1233.

121. *See* Apple Computer, Inc. v. Microsoft Corp., 821 F. Supp. 616, 623-24 (N.D. Cal. 1993) (holding that unprotectable elements of computer program were not virtually identical to corresponding elements of allegedly infringing works).

122. *Id.* at 624.

123. *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*, 797 F.2d 1222, 1245 (3d Cir. 1986).. The court stated:

There is no general requirement that most of each of two works be compared before a court can conclude that they are substantially similar. In the cases of literary works (e.g. novels, movies, or plays), it is often impossible to speak of 'most' of the work. Instead, the court must make a qualitative, not quantitative, judgment about the character of the work as a whole and the importance of the substantially similar portions of the work.

Id.

124. Contributory and vicarious infringement have also been addressed by the courts. *See* Religious Technology Center v. Netcom On-Line Comm. Serv., Inc., 907 F.Supp. 1361, 1373 (N.D. Cal. 1995).

125. *See* 17 U.S.C.A. § 504(c) (West Supp. 1999). Prior to the Berne Convention's adoption in 1988, innocent intent was generally not a defense to copyright infringement, as notice of copyright was required to appear on copyrighted works. Notice is not required under the Berne Convention. Therefore, innocent intent may be considered as a mitigating factor in assessing statutory damage awards, while willful intent may result in awarding the statutory maximum of \$100,000 per infringement. *See* 17 U.S.C.A. § 504(c) (2) (West Supp. 1999).

126. *See* Williams Electronics, Inc. v. Artic International, Inc., 685 F.2d 870, 878 (3d Cir. 1982) (holding that video game images were fixed, citing 3 NIMMER ON COPYRIGHTS 13.08 (1981)).

tiff.”¹²⁷ Congress has provided that a copyright infringer is liable for the copyright owner’s actual damages and any additional profits of the infringer, or statutory damages as provided by federal copyright law.¹²⁸

Copyright infringement can be found even where there is no literal¹²⁹ copying if the “total concept and feel” of a copyrighted work is duplicated in another.¹³⁰ “[S]light differences between a protected work and an accused work will not preclude a finding of infringement” where the works are substantially similar in other respects.¹³¹ Exact reproduction or near identity is not necessary to establish infringement. “[A]n infringement . . . includes also the various modes in which the matter of any work may be adopted, imitated, transferred, or reproduced, with more or less colorable alterations to disguise the piracy.”¹³²

3. Defenses

a. Independent Creation

Independent creation is a complete defense to copyright infringement.¹³³ The defendant must show that the plaintiff’s original work was not copied, but rather, it was a separately created original work which bears resemblance to the plaintiff’s.¹³⁴ This defense negates the element of copying and thus, no liability may be imposed.¹³⁵

127. *Id.*

128. *See* 17 U.S.C.A. § 107 (West Supp. 1999).

129. “[Copy]right cannot be limited literally to text, else a plagiarist would escape by immaterial variations.” *See Nichols v. Universal*, 45 F.2d at 121.

130. *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*, 797 F.2d 1222, 1234 (3d Cir. 1986). (citing *Roth Greeting Cards v. United Card Co.*, 429 F.2d 1106, 1110 (9th Cir. 1970)).

131. *Atari v. Philips*, 672 F.2d at 618.

132. *Id.* (quoting *Universal Pictures Co., Inc. v. Harold Lloyd Corp.*, 162 F.2d 354, 360 (9th Cir. 1947)).

133. *See Whelan*, 797 F.2d at 1227 n.7.

134. *See id.* (citing *Fred Fisher, Inc. v. Dillingham*, 298 F. 145, 147 (S.D.N.Y. 1924)).

135. *See id.*

b. Fair Use

Fair Use is another complete defense to copyright infringement.¹³⁶ This policy “permits and requires courts to avoid rigid application of the copyright statute when on occasion, it would stifle the very creativity it was designed to foster.”¹³⁷ Congress has four non-exclusive factors which are relevant to a judicial finding of fair use.¹³⁸ These are: (1) the purpose and character of the use, including whether such is of a commercial nature; (2) the nature of the 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 or value of the copyrighted work.¹³⁹ Generally, this defense applies where a work is used “for purposes such as criticism, comment news reporting, teaching, scholarship or research.”¹⁴⁰

A court, in considering this affirmative defense, must use a case by case analysis of the facts in light of the statutory and other relevant factors.¹⁴¹ The results of this comparison should then be balanced against the objectives¹⁴² of copyright law.¹⁴³ Fair use of a copyrighted work should be found where the interest in the furtherance of progress outweighs the interest in prohibiting the infringing usage.¹⁴⁴

c. Misuse of Copyright

Misuse of copyright is a defense which has its origins in patent law.¹⁴⁵ In that realm, the Supreme Court held that a patent holder could not use the grant of a patent to dictate the products which

136. See 17 U.S.C.A. § 107 (West Supp. 1999).

137. *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 577 (1994) (quoting *Stewart v. Abend*, 495 U.S. 207, 236 (1990)).

138. 17 U.S.C.A. § 107 (West Supp. 1999).

139. *Id.*

140. *Id.*

141. *Campbell*, 510 U.S. at 578.

142. See discussion of copyright objectives *supra* notes 51-60.

143. *Campbell*, 510 U.S. at 577-78.

144. See *id.* at 570-71.

145. See *Morton Salt v. G.S. Suppiger Co.*, 314 U.S. 488 (1942) (holding that scope of patent was exceeded by license agreement which required salt tablets produced by Morton Salt be used in conjunction with its patented salt depositing machine).

could be used in conjunction with a patented invention.¹⁴⁶ To allow a patent holder to do so would in effect create a monopolization of markets outside of the government's limited grant.¹⁴⁷ This theory has been applied to copyright.¹⁴⁸ One court, comparing the common interests of copyright and patent law, espoused the application of the misuse defense in copyright cases.¹⁴⁹ Thus, where an infringer can prove that the copyright holder has exceeded his rights in this manner, the infringing usage will not lead to liability.¹⁵⁰

II. THE IMPACT OF TECHNOLOGY ON THE LAW OF COPYRIGHT

"The fortunes of the law of copyright have always been closely connected with freedom of expression, on the one hand, and with technological improvements in means of dissemination, on the other."¹⁵¹ Each era draws a different balance among the interest of the writer in the control and exploitation of his or her intellectual property, the related interest of the publisher, and the competing interest of society in the "untrammelled dissemination of ideas."¹⁵²

This Part examines the effect technological improvements have had on federal copyright law. Congressional reaction to such advances and the judiciary's application of federal statutes to new

146. *See id.* at 491.

147. *See id.*

148. *See Lasercomb America, Inc. v. Reynolds*, 911 F.2d 970, 972 (4th Cir. 1990) (holding that defendant misused its copyright by including in its standard licensing agreement clauses which prevent the licensee from participating in any manner in the creation of computer assisted die-making software).

149. *See id.* at 976 (citing *Morton Salt*, 314 U.S. at 492). The court stated: Since copyright and patent law serve parallel interests, a "misuse" defense should apply to infringement actions brought to vindicate either right. . . . [T]he similarity of the policies underlying patent and copyright is great and historically has been consistently recognized. Both patent law and copyright law seek to increase the store of human knowledge and arts by rewarding inventors and authors with the exclusive rights to their works for a limited time. At the same time, the granted monopoly power does not extend to property not covered by the patent or copyright.

Id.

150. *See Lasercomb*, 911 F.2d at 972.

151. *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1479n.14 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991) (quoting Benjamin Kaplan, *supra* note 62, at vii-viii).

152. *Id.*

creative mediums are discussed herein. This section focuses upon the court's treatment of copyright law in relation to computer technology.

A. *Legislation and Lawsuits*

Copyright law has been characterized by gradual expansion in the types of works afforded protection as advancements in technology have been realized.¹⁵³ Congress and the courts have been faced with reconciling copyright laws with the emergence of "new techniques for capturing and communicating printed matter, visual images, and recorded sound."¹⁵⁴ The copyright issues presented by the development of information storage and retrieval devices have also sparked much debate.¹⁵⁵

1. Congressional Amendments

The Copyright Act of 1976 was designed to address a scientifically progressive society.¹⁵⁶ The statute's phrasing purposely extends copyright protection to "original works of authorship," rather than to "writings" in anticipation of evolving mediums of expression which could fall under the scope of copyright law.¹⁵⁷ Further, in an attempt to expand the statute's application to mediums not yet in existence,¹⁵⁸ the legislation required that the mode of expression in which a work is fixed be "now known or later developed."¹⁵⁹

Historically, new areas of federal protection were initiated by Congress in response to the expansion of creative means which were not within the scope of the federal copyright statute.¹⁶⁰ Among the mediums specifically provided copyright protection

153. See H.R. REP. 94-1476, 94th Cong. 2d Sess., § 102 (1976), reprinted in 1976 U.S.C.C.A.N. 5659, 5660.

154. *Id.*

155. See *id.*

156. See *Lotus Dev. Corp. v. Paperback Software Int'l*, 740 F.Supp. 37, 48 (D. Mass 1990).

157. See H.R. REP. 94-1476 § 102.

158. See *Lotus v. Paperback*, 740 F.Supp. at 48.

159. H.R. REP. 94-1476 § 102, under heading "Fixation in a Tangible Form."

160. See *Goldstein v. California*, 412 U.S. 546, 562 (1973).

since 1865 are photographs and their negatives, motion pictures, and sound recordings.¹⁶¹ Moreover, the Copyright Act of 1976 sought to include protection for "live" television and radio broadcasts by adding a provision which deemed these works "fixed in a tangible medium of expression"¹⁶² where the fixation of the work is made simultaneously with its live transmission.¹⁶³

Subsequent amendments have also aided the development of the law in response to new technology. One such change involves the protection of copyrighted audio recordings against digital piracy.¹⁶⁴ The amended statute reflects Congressional recognition of the threat posed by high quality reproductions enabled by digital recording devices owned by individuals.¹⁶⁵

The National Commission on New Technological Uses of Copyrighted Works, ("CONTU"), was established by Congress in 1974 to study the impact of scientific advances on copyright law and to make legislative recommendations. CONTU especially focused its attention on computer technology.¹⁶⁶ The 1980 Amendments to the Copyright Act reflect Congressional enactment of CONTU's findings.¹⁶⁷ The amendments were few as CONTU considered copyright law to apply to computer programs without legislative amendment.¹⁶⁸ Congress' most significant modifications were the adding of the definition of computer programs¹⁶⁹, and clarifying the legal rights of use and adaptation extended to rightful possessor's of copies of computer programs.¹⁷⁰ These amendments provide that "[a] 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order

161. *See id.* at 562 n.17.

162. 17 U.S.C.A. § 101 (West Supp. 1999).

163. *See* *NBA v. Motorola*, 105 F.3d 841, 847 (2d Cir. 1997).

164. *See* Digital Performance Right in Sound Recordings Act of 1995, Pub. L. No. 104-39, 109 Stat. 336 (codified as amended in scattered sections of 17 U.S.C.)[hereinafter DPRA]. Section 1 of the DPRA amended sections 101, 106, 111, 114, 115, 119, 801, 802, and 803.

165. *See id.*

166. *See* Velasco, *supra* note 50, at 248-49.

167. *See* H.R. REP. NO. 96-1307, at 5 (1980), *reprinted in* 1980 U.S.C.C.A.N. 6460, 6506.

168. *See* Velasco, *supra* note 50, at 248-49.

169. *See* 17 U.S.C.A. § 101 (West Supp. 1999).

170. *See* 17 U.S.C.A. § 117 (West Supp. 1999).

to bring about a certain result.”¹⁷¹ Further, the amendments clarify the permissible uses of copyrighted computer programs by providing that “it is not an infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program when necessary to “the utilization of the computer program” or “for archival purposes only.”¹⁷²

2. The Role of the Courts

The 1980 Congressional amendments did not resolve many of the difficult copyright issues which stem from the advent of computer technology.¹⁷³ Congress, in response to progress, has often enacted vague statutes which are intended to encompass new modes of creativity.¹⁷⁴ Such legislation has many times failed to definitively settle copyright issues centered around emerging technologies. Moreover, the advent of new technologies has sometimes made unclear the application of otherwise straightforward statutes.¹⁷⁵ In these situations, the courts must interpret outdated statutory language “in . . . light of drastic technological change.”¹⁷⁶

The Supreme Court has noted that “[w]hen technological change has rendered [the] literal terms ambiguous, the Copyright Act must be construed . . . [with regard to its] . . . basic purpose.”¹⁷⁷ The development of television and radio has presented the judiciary with the task of adapting copyright law “to prevent the exploitation of protected works through new electronic technology.”¹⁷⁸ Similarly, the advancement of satellite communications has raised copyright issues which are not squarely addressed by the Copy-

171. 17 U.S.C.A. § 101 (West Supp. 1999).

172. *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1248 (3d Cir. 1983) (quoting 17 U.S.C. § 117 and holding that a computer program, whether in object or source code, or embedded on a ROM chip, can be protected by copyright).

173. See H.R. REP. 94-1476, 94th Cong. 2d Sess., § 102 (1976), reprinted in 1976 U.S.C.C.A.N. 5659, 5660.

174. See *Fortnightly Corp. v. United Artists Television, Inc.*, 392 U.S. 390, 395-96 (1968).

175. See *Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 157 (1975).

176. *Fortnightly*, 392 U.S. at 395.

177. *Twentieth Century Music Corp.*, 422 U.S. at 156; see also discussion of copyright objectives *supra* notes 51-60 and accompanying text.

178. *Id.* at 157.

right Act of 1976.¹⁷⁹ Furthermore, the invention of the photocopier has called the scope of the fair use doctrine into question.¹⁸⁰ These are merely some examples of the copyright questions which technological developments have presented to the courts. Mediums created from the combination of scientific advances have also posed copyright issues.¹⁸¹ Recently, the courts have dealt with definitional issues of digital recordings which also have a video component.¹⁸² The courts are now being called upon to adjudicate copyright law in relation to the Internet.¹⁸³

In many of these cases the courts are asked to rule on copyright issues where "the advent of new communications technology has blurred the distinction between product and process."¹⁸⁴ Traditionally, copyright law focused on the printing of a book and the copyright owner's right to limit access to the work.¹⁸⁵ There was no confusion between the product (the book) and the process (the printing).¹⁸⁶ Such clear delineation, however, is not apparent where technology causes product and process to intertwine.¹⁸⁷ The treatment of the copyright issues surrounding computer technology evinces the judiciary's struggle to resolve this quandary.

179. *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1477 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991) (stating that satellite communications copying involving a significantly different scope).

180. *See Princeton University Press v. Michigan Document Services, Inc.*, 99 F.3d 1381 (1996) (holding that a copy shop's preparation of course packets was not a fair use).

181. *See ABKCO Music, Inc. v. Stellar Records, Inc.*, 96 F.3d 60, 62 (2d Cir. 1996) (finding that digital CD medium with video output capability is not within statutory definition of "phonorecord").

182. *See id.*

183. *See Religious Technology Center v. Netcom On-Line Comm. Serv., Inc.*, 907 F.Supp. 1361, 1361 (N.D. Cal. 1995) (holding that online service provider could not be held liable for direct copyright infringement); *Playboy Enterprises, Inc. v. Webworld, Inc.*, 968 F.Supp. 1171, 1178 (N.D. Tex. 1997) (imposing infringement damages for direct liability on website operator).

184. *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1478 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991).

185. *See id.*; *see also* discussion *supra* Part I.A.

186. *See Cable News Network v. Video Monitoring Services*, 940 F.2d at 1477.

187. *See id.*

B. *Computers and Copyright: The Court's Call*

The courts have assumed the primary responsibility for reconciling copyright law with computer technology, as Congress has not clearly legislated the line between computer product and process.¹⁸⁸ The courts have therefore been charged with establishing, through case law, the elements of computer technology which are subject to copyright.¹⁸⁹

1. Computer Basics

"As scientific knowledge advances, courts endeavor to keep pace, and sometimes, as in the area of computer technology, they are required to venture into less than familiar waters."¹⁹⁰ In such instances, it is essential for the courts to obtain a basic understanding of the technology before adjudicating its relationship to copyright law.¹⁹¹ Likewise, general knowledge of the computer realm is necessary to comprehend the law established by the courts.

A computer is a "sophisticated electronic machine," which employs programs to manipulate data.¹⁹² "A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer to bring about a certain result."¹⁹³ Programs are divided into two main categories;¹⁹⁴ operating systems programs, also known as firmware,¹⁹⁵ and application programs, also known as software.¹⁹⁶ Operating systems programs run the computer's internal functions and facilitate the use of applications programs.¹⁹⁷ "Applications programs usually perform a specific task for the

188. See Velasco, *supra* note 50, at 292 n3.

189. *Id.*

190. Computer Assocs. Int'l, Inc. v. Atlai, Inc., 982 F.2d 693, 696 (2d Cir. 1992).

191. *See id.*

192. See Velasco, *supra* note 50, at 244.

193. 17 U.S.C.A. § 101 (West Supp. 1999).

194. See DICTIONARY OF CULTURAL LITERACY, *supra* note 26.

195. *See id.*

196. *See id.*

197. Apple Computer, Inc. v. Microsoft Corp., 821 F. Supp. 616, 643 (N.D. Cal. 1993).

computer user such as word processing.”¹⁹⁸ The information storage areas of the computer are Read Only Memory (“ROM”) and Random Access Memory (“RAM”).¹⁹⁹ Generally, the information in ROM, as its name implies, can only be read, not erased or re-written.²⁰⁰ In contrast, RAM may be read, re-written, and erased.²⁰¹ The instructions contained on a computer program must be in a “language” which the computer can “understand.”²⁰² This binary language, composed of zeroes and ones, is known as object code.²⁰³ Most programs, however, are initially written in source code and then translated into object code.²⁰⁴ Source code is comprehensible by humans, whereas object code is generally readable only by machines.²⁰⁵

2. The Judicial Nexus

The courts have determined that a computer program is a “literary work” which Congress intended to afford copyright protection.²⁰⁶ Programs that can be deciphered by humans, as well as programs which can only be read by machines, are within the scope of copyright.²⁰⁷ Thus, programs written in either source or object code are protectable modes of expression.²⁰⁸ Moreover, the courts have determined that application programs and operating system programs are copyrightable works.²⁰⁹

Copyright protection extends to programs written onto disk as well as programs imbedded on ROM chips.²¹⁰ Both storage medi-

198. *Id.*

199. *See id.*

200. *See id.*

201. *See id.*

202. *Computer Assocs. Int’l, Inc. v. Atlai, Inc.*, 982 F.2d 693, 698 (2d Cir. 1992).

203. *See id.*

204. *See id.*

205. *See id.*

206. *See Tandy Corp. v. Personal Microcomputers, Inc.*, 524 F. Supp. 171, 173 (D.Cal. 1981).

207. *See Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1247 (3d Cir. 1983); *see also Williams Electronics, Inc. v. Artic International, Inc.*, 685 F.2d 870, 876-77 (3d Cir. 1982).

208. *See id.*

209. *See Apple v. Franklin*, 714 F.2d at 1251-1252.

210. *See Tandy*, 524 F.Supp. at 173.

ums allow the work to be "fixed"²¹¹ in a tangible medium of expression."²¹² Similarly, the courts have held that interactive programs, whose sequence of action is altered by each user, nevertheless, meets the Copyright Act's fixation requirement.²¹³ Furthermore, the loading of a computer program into RAM creates a copyrighted work.²¹⁴ This act creates a copy as the "representation created in RAM is sufficiently permanent or stable to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration."²¹⁵

The judiciary's resolution of these issues established that a computer program's literal elements, or "aspects which can be reduced to written code," are copyrightable.²¹⁶ Most litigated disputes, however, have centered on the copyrightability of the non-literal elements of computer works.²¹⁷ The plaintiffs in these cases allege that "the 'look and feel' of a program (but not necessarily the literal code) have been copied."²¹⁸ The courts, utilizing a variety of tests to determine whether the programs are substantially similar, have held to varying degrees that copyright protection may extend beyond literal elements.²¹⁹ The application of these various

211. The Copyright Act of 1976 defines a work as "'fixed' in a tangible medium of expression when its embodiment in a copy or phonorecord, by or under the authority of the author, is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration." 17 U.S.C.A. § 101.

212. See *Tandy*, 524 F.Supp. at 173.

213. See *Williams Electronics*, 685 F.2d at 874; *Atari Games Corp. v. Oman*, 888 F.2d 878, 884n.6 (D.C. Cir. 1989).

214. See *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 518 (9th Cir. 1993); see also case study, *infra* pp. 29-31.

215. See *id.*; see also definition of "fixed" *supra* note 211.

216. *Ballou*, *supra* note 81, at 89.

217. See *Oman*, *supra* note 20, at 8.

218. *Ballou*, *supra* note 81, at 89. "Judge Learned Hand noted, 'it is of course essential to any protection of literary property . . . that the right cannot be limited literally to the text, else a plagiarist would escape by immaterial variations.'" *Bateman v. Mnemonics, Inc.*, 79 F.3d 1532, 1544 (11th Cir. 1996) (quoting *Nichols v. Universal*, 45 F.2d at 121).

219. The primary tests for substantial similarity applied by the courts are the Whelan test, see generally *Whelan Assoc., Inc. v. Jaslow Dental Laboratory, Inc.* 797 F.2d 1222 (3d Cir. 1986) (discussing test for substantial similarity in computer program cases); *Brown Bag Software v. Symantec Corp.*, 960 F.2d 1465 (9th Cir. 1992) (Extrinsic-Intrinsic test); *Computer Assocs. Int'l v. Altai, Inc.*, 982 F.2d 693, 696 (2d Cir. 1992)

tests have lead to inconsistent results, thus the law in this area remains uncertain.

Both literal and non-literal elements will be denied copyright where they are composed of “[f]unctional or minimally creative portions of programs.”²²⁰ For example, the Tenth Circuit Court of Appeals refused to afford copyright protection to the “constants,”²²¹ which constituted part of a formula used to perform calculations.²²² The Court held that constants are not copyrightable, because as elements which exist in nature they are not created, but rather, they are “merely observed, discovered and recorded.”²²³ The circuit courts, however, are not always in agreement as to what constitutes functional elements.²²⁴ For example, the Fifth Circuit reasoned that an input/output formula, consisting of a series of words and a framework of instructions designed to prompt the entering of data was copyrightable because other formulas existed which achieved the same result.²²⁵ In contrast, the First Circuit held that a menu command’s structure was an unprotectable method of operation regardless of the fact that other structure sequences and words could have been employed to perform the same function.²²⁶ The Fifth Circuit’s ruling that creativity may transform a functional element of a program into protectable expression²²⁷ cannot be reconciled with the First Circuit’s determination that “[t]he fact that there may be many different ways to operate a computer program . . . does not make the actual method of operation chosen copyrightable.”²²⁸

This conflict demonstrates the lack of consensus which persists in regard to the copyrightability of some elements of computer programs. The rulings which have been handed down by specific

(the Abstraction-Filtration test).

220. Ballon *supra* note 81, at 87.

221. “Constants are invariable integers.” *Id.* at 88.

222. *See id.*

223. Gates Rubber Co. v. Bando Chem. Indus., Ltd., 9 F.3d 823, 842-43 (10th Cir. 1993).

224. *See Ballon supra* note 81, at 87.

225. *See Engineering Dynamics, Inc. v. Structural Software, Inc.*, 26 F.3d 1335, 1343-1346 (1994) *modified and reh’g denied*, 46 F.3d 408 (5th Cir. 1995).

226. *See Lotus Dev. Corp. v. Borland Int’l, Inc.*, 49 F.3d 807, 818 (1st Cir. 1995).

227. *See Engineering Dynamics*, 26 F.3d at 1343-1346.

228. *Lotus v. Borland*, 49 F.3d at 818.

Circuits may guide a determination of copyrightability, but until a majority of the courts adopt the holding, the issue cannot be considered settled.

The copyrightability of screen displays and interfaces falls into these murky waters.²²⁹ Some courts have found that the displays which are depicted on a computer screen may be separately protectable as audiovisual works distinct from the copyrightability of the program's underlying code.²³⁰ Such protection, however, will often be denied for lack of originality where the recording of information is a screen's primary function.²³¹

A user interface is the means by which the user interacts with the program.²³² Some courts have held that where a screen display comprises a user interface, it is subject to the same scrutiny as a literary work.²³³ Under this criteria, icons and multiple image displays or "windows" were considered inseparable from their utility and were therefore denied copyright protection.²³⁴

3. *Case Study - MAI Systems Corp. v. Peak Computer, Inc.*

Since copying is an essential element of proving copyright infringement, the definition of "copying" that was applied in *MAI Systems Corp.*,²³⁵ sets an important precedent in computer copyright law.²³⁶

229. See *Computer Assocs. Int'l, Inc. v. Atlai, Inc.*, 982 F.2d 693, 703 (2d Cir. 1992).

230. See *id.*

231. In such instances the screen generally appears to be a form which is blank except perhaps for a list of common words. See Oman, *supra* note 20, at 9.

232. See *DICTIONARY OF CULTURAL LITERACY*, *supra* note 26.

233. See *Apple Computer, Inc. v. Microsoft Corp.*, 35 F.3d 1435, 1445 (9th Cir. 1994).

234. See *id.*

235. See *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 518 (9th Cir. 1993).

236. See discussion of copyright infringement *supra* notes 86-98.

a. Facts

MAI Systems Corp. ("MAI") designed applications²³⁷ and operating system²³⁸ software to run on computers which the corporation manufactured.²³⁹ In addition, MAI serviced the computers and operating system software.²⁴⁰ Peak Computer, Inc. ("Peak") serviced computer systems, performing both routine maintenance and emergency repairs.²⁴¹ Among Peak's clients were over one hundred MAI computer owners.²⁴² In the course of servicing these computers it was sometimes necessary for Peak technicians to operate the computer and its operating systems software.²⁴³ In addition, Peak operated multiple MAI computers from Peak's headquarters while in possession of a license agreement which authorized the use of the program on only one system.²⁴⁴

The MAI software license authorized the use of the software by the licensee for "internal information processing."²⁴⁵ This license permitted the customer to load the software into the computer's RAM,²⁴⁶ creating a working copy of the program.²⁴⁷ The license agreement also afforded the customer the right to make one back-up copy of the program.²⁴⁸ The customer was specifically prohibited from acting in any manner "which might jeopardize MAI's rights or interests in the [s]oftware."²⁴⁹ Any further "copying" of the program was among the acts specifically proscribed by the li-

237. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1243 (3d Cir. 1983) (discussing applications system programs).

238. See *id.*

239. See *MAI Sys. Corp.*, 991 F.2d at 513.

240. See *id.*

241. See *id.*

242. See *id.*

243. See *id.*

244. See *id.* at 519.

245. *Id.* at 517.

246. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1243 (3d Cir. 1983) (explaining RAM).

247. See *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 517 n.3 (9th Cir. 1993) (discussing a representative MAI software license).

248. See *id.*

249. See *id.*

cense agreement.²⁵⁰ The software license did “not allow for the use or copying of MAI software by third parties such as Peak.”²⁵¹

b. Proceedings

MAI sued Peak for various causes of action,²⁵² including copyright infringement.²⁵³ MAI considered Peak’s unauthorized use and maintenance activities to create unlawful copies of MAI’s operating systems program.²⁵⁴ Peak maintained that its activities did not constitute copying²⁵⁵ as no fixed copy was created.²⁵⁶ Following initiation of the suit, a series of preliminary and permanent injunctions were issued and appealed,²⁵⁷ as was a partial grant of summary judgment for MAI.²⁵⁸ The Ninth Circuit Court of Appeals consolidated the appeals and decided the merits of the case.²⁵⁹

c. Decision

The Court determined that the loading of an operating system program from a storage medium into a computer’s RAM constitutes copying.²⁶⁰ The Court found that Peak’s actions had created fixed copies in compliance with the Copyright Act’s definitions of the terms “copies”²⁶¹ and “fixed.”²⁶² MAI had demonstrated that

250. *See id.*

251. MAI Sys. Corp. v. Peak Computer, Inc., 991 F.2d 511, 517 (9th Cir. 1993)

252. In addition to copyright infringement, MAI sued Peak for misappropriation of trade secrets, trademark infringement, false advertising, and unfair competition. These actions were based on Peak’s using, maintaining, and allegedly loaning MAI software, and Peak’s employing a former MAI employee. MAI alleged that because of Peak’s actions, MAI lost customers to Peak. *Id.* at 513.

253. *See id.*

254. *See id.* at 517.

255. *See id.*

256. *See id.* at 518

257. *See id.* at 513-515.

258. *See id.* at 515. (The “district court granted partial summary judgment for MAI and entered a permanent injunction on the issues of copyright infringement and misappropriation of trade secrets”).

259. *Id.* at 516.

260. *See id.* at 518.

261. The Copyright Act of 1976 defines “copies” as “material objects, other than phonorecords, in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.” 17 U.S.C.A. § 101 (West Supp.

Peak created a fixed copy of the work “by showing that Peak load[ed] the software into the RAM and . . . [was] then able to view the system error log and diagnose the problem with the computer”²⁶³ The Court, in making its decision, also looked to case law and CONTU’s recommendations²⁶⁴ for guidance.²⁶⁵ These sources, although not specifically directed at the issue at hand,²⁶⁶ supported the finding that a fixed copy had been made by Peak.²⁶⁷ Thus, summary judgment for MAI was granted on the issue of copyright infringement.²⁶⁸

d. Impact

MAI Systems Corp. v. Peak Computer Inc. expanded the scope of copyright protection afforded to computer programs.²⁶⁹ This case held that the simple act of loading a program from a disk into a computer’s RAM creates a copy.²⁷⁰ No further acts are necessary to copy the work.²⁷¹ Copying does not require the replication of the program onto a disk, stored in permanent memory (ROM), or printed out on paper.²⁷² Therefore, according to this decision, evi-

1999).

262. See definition of “fixed” *supra* note 211.

263. See *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 518 (9th Cir. 1993).

264. See discussion of CONTU *supra* notes 166-168 and accompanying text.

265. See *MAI Sys. Corp.*, 991 F.2d at 519 (citing H.R. REP. No. 1307, 96th Cong., 2d Sess. (1996), pt. 1, at 23 and noting that “the placement of a work into a computer is the preparation of a copy”); *Apple Computer, Inc. v. Formula Int’l, Inc.*, 594 F.Supp 617, 622 (C.D. Cal. 1984) (finding that the loading of a program into RAM creates a temporary fixation); *Vault Corp. v. Quaid Software Ltd.*, 847 F.2d 255, 260 (5th Cir. 1988) (“[T]he act of loading a program from a medium of storage into a computer’s memory creates a copy of the program.”).

266. See *MAI Sys. Corp.*, 991 F.2d at 519. The Court commented that, “[w]e recognize that these authorities are somewhat troubling since they do not specify that a copy is created regardless of whether the software is loaded into RAM, the hard disk, or the read only memory (‘ROM’).” *Id.*

267. See *id.* The Court noted that the language of *Apple Computer, Inc. v. Microsoft Corp.*, 821 F. Supp. 616, 622 (N.D. Cal. 1993), while not dispositive, “supports the view that the copy made in RAM is ‘fixed’ and qualifies as a copy under the Copyright Act.” *Id.*

268. See *id.* at 519.

269. See *id.* at 518.

270. See *id.*

271. See *id.*

272. See *id.*

dence that a program was loaded into a computer without the copyright holder's permission is enough to prove copyright infringement.²⁷³

4. Data Analysis

The copyright issues which stem from the advent of the computer are not easily understood or simply resolved. The sophisticated knowledge required to address this realm has resulted in precise technological arguments which have changed the face of copyright law.²⁷⁴ The courts have endeavored to base decisions about this burgeoning medium upon traditional copyright doctrines and policy.²⁷⁵ Most would agree that their efforts have been successful.²⁷⁶ Certainly, copyright protection of computer programs has "stimulated creativity, competition, and innovation, and has suppressed piracy and predatory commercial practices."²⁷⁷ Thus, it seems that the judiciary has succeeded in furthering the primary goal of copyright policy; progress.²⁷⁸

III. THE COPYRIGHTABILITY OF HOLOGRAPHIC STORAGE MEDIUMS

This Part examines the potential application of copyright information recorded as holographs. This technology is still in a very early stage of development, thus the predictions made herein are fairly speculative. The fundamental properties of this medium,²⁷⁹ however, are known, and when viewed in light of the copyrightability of other aspects of advanced modes of expression,²⁸⁰ it is possible to draw conclusions about the elements of holographic technology.

Comparisons to a court's treatment of technological mediums

273. *See id.* at 517.

274. *See Oman, supra* note 20, at 8, 13.

275. *See Computer Assocs. Int'l, Inc. v. Atlai, Inc.*, 982 F.2d 693, 703 (2d Cir. 1992).

276. *See Oman, supra* note 20, at 8, 13.

277. *Id.*

278. *See* discussion of the objectives of copyright law notes 48-57 and accompanying text.

279. *See* discussion of holographic storage *supra* notes 6-42 and accompanying text.

280. *See* discussion of technological advancements and copyright law *supra* Part II.A. notes 153-187.

created in conjunction with the computer are especially useful. Holographic data storage is likely to be used with already existing computer technology.²⁸¹ Thus, the law in this realm is inclined to offer effective guidance in the assessment of holography's relation to copyright. This is especially true of a medium, presently in existence, which is derived from digital storage and holographic technology.²⁸² "Digital holographic storage" exemplifies both the technological possibilities of the holographic medium as well as the legal implications for works stored by such means.²⁸³

A. *Process is Never Copyrightable*

Holographic data storage is accomplished by using lasers to encode²⁸⁴ a large block of data²⁸⁵ onto a lithium niobate²⁸⁶ crystal.²⁸⁷ Since, copyright law explicitly denies protection to processes or methods of operation, the means by which data is stored as holograms can not be copyrighted.²⁸⁸ However, this scientific advancement is the proper subject of patent law.²⁸⁹

281. See Brett Mendel, *Infrastructure Data Storage*, L.A. TIMES, Apr. 28, 1997, at 84.

282. See *Digital Holographic Data Storage Looks Ahead*, PHOTONICS SPECTRA, Mar. 1, 1996 at 44.

283. *Physicians Report that Digital Holography Aids Diagnosis and Treatment Of Complex Spinal and Head and Neck Conditions*, BUSINESS WIRE, May 19, 1997, available in Westlaw, BUSWIRE database.

284. See Scott *supra* note 34, at 526.

285. See Tom Thompson, *When Silicon Hits Its Limits, What's Next? A Glimpse At Three Technologies That Could Be The Subsystems Of Tomorrow's Desktop Computers*, BYTE, Apr. 1996 at 44.

286. Lithium niobate crystals are inorganic materials used to store holograms. Scientists are also working on developing polymer materials which offer more flexibility in their usage. See *Technology; Exotic Blends Reveals Strong Optical Gain*, ELECTRONIC ENGINEERING TIMES, Aug. 1997 at 35.

287. A crystal is "a clear, transparent mineral that looks like ice, especially the transparent or nearly transparent form of pure quartz." WORLDBOOK MULTIMEDIA ENCYCLOPEDIA (1997).

288. See 17 U.S.C.A. § 102 (West Supp. 1999); see also *Baker v. Selden*, 101 U.S. 99, 103 (1879) (holding that expression of a bookkeeping system was not copyrightable); see also *supra* notes 77-98 and accompanying text.

289. See *supra* note 40 discussing patent law. Holographic storage is a patented invention which is detailed in U.S. Patent 5,665,493. See also *Dopants: Pr+3 Ions Improve Storage Media*, OPTICAL MATERIALS & ENGINEERING NEWS, Oct. 1, 1997, available in 1997 WL 8957143.

Further, the crystal medium currently utilized as storage area is not copyrightable because it is not an original work.²⁹⁰ The crystal is not a new invention, rather it exists in nature.²⁹¹ Therefore, the crystal is not patentable.²⁹² Other, man-made storage mediums are currently being developed which might qualify for patent protection.²⁹³ These substances, however, would be unlikely to be granted copyright protection because, like a computer disk, they are utilitarian in nature, not creative.²⁹⁴

B. *Computer Programs Stored as Holographic Data are Copyrightable*

1. Holographic Works Are Fixed

The Copyright Act of 1976 mandates that copyright may extend only to original works "fixed in a tangible medium of expression."²⁹⁵ Much of the early debate regarding the copyrightability of computer programs centered on the extent to which that medium complied with this fixation requirement.²⁹⁶

Computer programs are classified as literary works²⁹⁷ which the Copyright Act specifically provides may be expressed in disk form.²⁹⁸ This medium stores data in the form of magnetic patterns on its surface.²⁹⁹ The courts have resolved that computer programs are also copyrightable when they are embodied in silicon chips.³⁰⁰ This medium, which is mounted within the computer structure, uses switches which hold data and respond to changes in electric current to communicate the program's directions to the com-

290. See 17 U.S.C.A. § 102 (West Supp. 1999).

291. See *supra* note 287 for a definition of crystal.

292. See *supra* note 49 and accompanying text.

293. See Mendel, *supra* note 281, at 84.

294. See *supra* notes 220-234 and accompanying text for discussion of functional elements of computer programs.

295. 17 U.S.C.A. § 102 (West Supp. 1999); see also *supra* notes 73-77 and accompanying text.

296. See *MAI Sys. Corp. v. Peak Computer, Inc.*, 991 F.2d 511, 518 (9th Cir. 1993); see also *supra* Part II.B.3 for discussion of fixation.

297. See *supra* notes 206-207 and accompanying case.

298. 17 U.S.C.A. § 101 (West Supp. 1999).

299. See *DICTIONARY OF CULTURAL LITERACY*, *supra* note 26.

300. See *supra* notes 210-215 and accompanying text.

puter.³⁰¹ The courts have ruled that so long as the expression of the program may be perceived for a period of more than transitory duration, either by humans or by machine, it meets the fixation requirement.³⁰² One case, discussing the legislative history of the Copyright Act, stated that the definition of "fixed" embodies all "form[s], manner[s] or medium[s] of fixation."³⁰³

Holographic data storage is a creative medium which meets the statutory definition³⁰⁴ of fixation.³⁰⁵ This medium provides many technological advantages over other storage mediums³⁰⁶ while rendering the data as retrievable as any storage medium currently considered copyrightable.³⁰⁷

Computer data which is read and recorded by laser beams³⁰⁸ is

301. See DICTIONARY OF CULTURAL LITERACY, *supra* note 26.

302. See *supra* Part II.B.3; Tandy Corp. v. Personal Microcomputers, Inc., 524 F. Supp. 171, 171 (D.Cal. 1981); Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1248 (3d Cir. 1983).

303. *Tandy*, 524 F.Supp. at 173 (quoting H.R. REP. NO. 1476, 94th Cong., 2d Sess. (1976) at 52). The court stated:

If any doubt is left by the wording of the statute, the legislative history makes clear the all-inclusive nature of the definition of 'fixed' form. Under the bill it makes no difference what the form, manner or medium of fixation may be — whether it is in words, numbers, notes, sounds, pictures, or any other graphic or symbolic indicia, whether embodied in a physical object in written, printed, photographic, sculptural, punched, magnetic, or other stable form, and whether it is capable of perception directly or by means of any machine or device 'now known or later developed.

Id.

304. See *supra* note 211 for definition of "fixed".

305. See *supra* Part II.B.3.

306. See *supra* notes 22-42 and accompanying text for discussion of holographic storage advantages.

307. See discussion of copyrightable mediums *supra* notes 210-234 and accompanying text

308. A ribbon cord connected to a PC board allows data to be downloaded from a computer to a spatial light modulator. Here the data is turned into code which can be used to create an interference pattern within a crystal. As the information enters the spatial light modulator from the computer the PC board translates the data into video rasters. The contents of the computer's memory are then represented by on and off blocks of grouped pixels. The blocks are encoded so that a pair of blocks coded dark/bright represent a "0," while the pairs of blocks encoded bright/dark represent a "1." The on blocks are opaque and thus block or deflect light from passing through. Light easily passes through the transparent off blocks. Interference is created when the signal beam passes through the encoded data and collides with a reference beam inside a crystal. The interference pattern changes the crystal's molecular structure and this results in the recording

distributed and holographically stored throughout the "volume" of a sugar-cube sized medium,³⁰⁹ while digital and magnetic storage use only the surface of the medium to store data.³¹⁰ This enables much more data to be stored as holograms than by other means.³¹¹ Retrieval of data stored in holographic form is basically accomplished by reversing the process by which it was stored.³¹² Recalled data, whether stored by conventional methods or holographically, is perceivable with the aid of a computer for an unlimited duration.³¹³ Experts predict that as holographic technology advances, the stored data will be retrievable at a much faster pace than that of current storage technologies.³¹⁴

The stored information will also be permanently available.³¹⁵ While it will be possible to erase holographically stored data,³¹⁶ it will not be possible to do so accidentally.³¹⁷

"Glitches" that oftentimes wreak havoc upon the data stored with today's computer technology will not negatively impact holographically stored data.³¹⁸ The recordation of data throughout the whole crystal not only dramatically increases the amount of storage area, but also serves to make its retrieval very reliable.³¹⁹

Holographically stored information exists as wave interference

of the data in the form of that pattern. See Scott, *supra* note 34, at 62.

309. See *id.*

310. See *id.*

311. See *supra* notes 23-34 and accompanying text for discussion of multiplexing.

312. To play back recorded data the signal beam is shut off and the reference beam is tilted to the same angle it used to store the data. The crystal naturally refracts the reference beam and the image is captured by a CCD. A CCD is "a charge coupled device . . . [composed of] . . . a light sensitive array of photodiodes linked to capacitors that store charges when its electrical field is disturbed by incoming photons." The data produced here is used to reconstruct the original page of memory from the spatial light modulator. Scott, *supra* note 34, at 62.

313. "Ideally, optical computers should be able to perform as general-purpose machines, substituting directly for electronic counterparts." Eric J. Lerner, *Optical Computing Promises High Speed and Bandwidth*, LASER FOCUS WORLD, Oct. 1, 1997.

314. See Mendel, *supra* note 281, at 84.

315. See Stone, *supra* note 9, at 182.

316. See Scott, *supra* note 34, at 62.

317. See *id.*

318. See *id.*

319. See *Creating Holographic Storage*, BYTE, Apr. 1996, at 48.

patterns³²⁰, which means it exists redundantly throughout the medium.³²¹ “While a defect in the medium for disk or tape storage might garble critical data, a defect in a holographic medium doesn’t wipe out information.”³²² Interruptions will only serve to “dim” the holographic imprint³²³ or split the hologram, creating a duplication of the original hologram.³²⁴ No information will be lost. However, as frustrated users can attest, this may occur when a problem arises with conventional storage techniques.³²⁵

Holographically stored data can be put to the same functions as any other data storage medium.³²⁶ A computer program stored as a hologram would impart the same information to a computer as any medium presently deemed copyrightable.³²⁷ Thus, the results of the program’s direction would be the same as results achieved by conventional mediums upon which programs are currently expressed.³²⁸

The properties of holographic data storage systems plainly permit data to be “fixed in a tangible medium of expression.”³²⁹ The ruling in *MAI Systems Corp.* illustrates that copyrighted computer programs are protected against the making of unlawful copies, no matter what medium those copies embody.³³⁰ Whenever the expression of the program is communicated for a stable period of time, a fixed copy of the work is created.³³¹ Here, the reliable nature of this medium, as well as its fast recall capacity render holographic data “sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of

320. See *supra* notes 308 and 312 and accompanying text discussing the holographic storage process.

321. See Stone, *supra* note 9, at 182.

322. See *supra* note 319.

323. See *id.*

324. See Stone, *supra* note 9, at 182.

325. See *id.*

326. See Lerner, *supra* note 313.

327. See *id.*

328. See *id.*

329. See discussion of statutory copyright criteria *supra* notes 72-93 and accompanying text.

330. See *supra* notes 260-268 and accompanying text.

331. See *id.*

more than transitory duration.³³² Therefore, holographic works meet the statutory requirement of fixation.³³³

2. Holographic Works Are Copyrightable

An original computer program fixed in a holographic medium complies with the statutory criteria for copyrightable works.³³⁴ The copyrightability of a holographically expressed computer program is not precluded by the inability of the human eye, alone, to decipher the data stored within the medium.³³⁵ Federal statute provides that a work may qualify for copyright protection even where it is communicated with the aid of a machine.³³⁶ The courts have ruled that this protection extends to computer programs which are exclusively machine readable.³³⁷ Computer programs stored in holographic form are thus copyrightable, and should be subject to the same rules of copyright which the courts have previously applied to such works.³³⁸

The copyrightability of computer programs, their non-literal elements, screen displays, interfaces, and the like, should not be impacted by their fixation in a holographic medium.³³⁹ The prior rulings of the courts regarding these works are applicable, because the change in medium does not change the properties of the works upon which the decisions rested.³⁴⁰ The underlying works remain the same; they are simply stored differently.

Furthermore, copyrighted works recorded as holograms will not lose their copyright status by being transferred to this medium, nor will the exclusive rights of the copyright holder be effected.³⁴¹

332. See *supra* note 211 and accompanying text.

333. See *id.*

334. See discussion of statutory copyright criteria *supra* notes 72-77 and accompanying text.

335. See *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1248 (3d Cir. 1983); see also *supra* notes 86-89 and accompanying text.

336. See discussion of statutory copyright criteria 17 U.S.C.A. § 102 (b) (West Supp. 1999).

337. See *supra* note 207 and accompanying text.

338. See discussion *supra* Part II.B.2.

339. See *id.*

340. See *supra* discussion Part II.B.2.

341. See *supra* notes 99-105 and accompanying text.

“That a work is transferred into a different medium is not itself a bar to recovery.”³⁴² This transference from one tangible medium of expression to another constitutes the making of a copy.³⁴³ Thus, the holographic recording of a copyrighted work without the copyright holder’s permission, is an act of infringement upon the copyright.³⁴⁴ Moreover, the holographic recording of a copyrighted work, even if permitted by the copyright holder, affords no copyrights to the recorder of the work, or compilation, unless the manner in which the preexisting works are arranged constitutes an original expression.³⁴⁵

3. All Original Holographic Works Qualify

Copyright protection of the holographic medium clearly furthers the promotion of progress in the arts and sciences. The federal copyright statute, as it has been interpreted by the courts, encompasses all holographically stored original works no matter what their categorical classification. The fixation requirement, as previously noted, is clearly met by this medium.³⁴⁶ Therefore, any original work fixed by these means qualifies for protection against copyright infringement.³⁴⁷

The potential uses of holographic storage are numerous.³⁴⁸ Technological innovations in the medium could possibly enable the holographic storage of audio recordings, the creation of 3-D motion pictures and television, as well as the development of interactive board games. Any original work which is fixed in this type of medium, or any other which holographic storage makes possible, is copyrightable.³⁴⁹ This medium’s compliance with statutory requirements mandates its copyrightability.³⁵⁰ Denial of copyright

342. *Atari v. Philips*, 672 F.2d at 618n.12 (holding that a preliminary injunction should issue where substantial similarity of two computer game characters is demonstrated, citing *Universal*, 162 F.2d at 360).

343. See *supra* Part II.B.3.

344. See *id.*

345. See *supra* notes 87-98 and accompanying text.

346. See discussion *supra* Part III.B.1.

347. See discussion of copyright criteria *supra* notes 72-77 and accompanying text.

348. See *supra* notes 37-42 and accompanying text.

349. See discussion *supra* notes 38-47.

350. See discussion *supra* notes 48-60.

protection thus, flouts Constitutional aims and impairs progress.³⁵¹

Copyright law, in furtherance of the public good, ensures that useful knowledge and ideas are disseminated amongst society.³⁵² The basis of copyright law is to encourage authors' creativity while at the same time disseminating vital information to the public.³⁵³ The primary purpose of copyright law is not to benefit the creator of a work.³⁵⁴ Rather, the Supreme Court has determined that the "sole interest of the United States and the primary object in conferring the [copyright] monopoly' . . . 'lie in the general benefits derived by the public from the labors of authors.'"³⁵⁵

The development of holographic storage is inherently beneficial to societal growth. The types of works which can be fixed in this medium are by no means limited to the entertainment field.³⁵⁶ Works which have the capacity to benefit society in the fields of medicine, science, research, etc., may also be made possible by development of this medium.³⁵⁷ However, if the works stored within this medium are not afforded copyright protection it is unlikely that authors will expend their creative energies.³⁵⁸ The courts have the difficult job of balancing the public's access to new innovation while at the same time protecting innovator's rights to their

351. See *supra* notes 53-60 and accompanying text.

352. "The very object of publishing a book . . . is to communicate to the world the useful knowledge which it contains. But this object would be frustrated if the knowledge could not be used without incurring the guilt of piracy of the book." *Cable News Network, Inc. v. Video Monitoring Services of Am., Inc.*, 940 F.2d 1471, 1479n.14 (11th Cir. 1991), *vacated en banc*, 949 F.3d 378 (11th Cir. 1991) (citing *Feist Publications, Inc. v. Rural Telephone Service Co., Inc.*, 499 U.S. 340, 340 (1991) (quoting *Baker v. Selden*, 101 U.S. 99, 103 (1879)).

353. See *Cable News Network v. Video Monitoring Services*, 940 F.2d at 1478; see also L. Ray Patterson, *Free Speech, Copyright, and Fair Use*, 40 VAND. L. REV. 1, 5 (1987). "Copyright's basis as a proprietary concept is that it enables one to protect his or her own creations. Its regulatory basis is that when these creations constitute the expression of ideas presented to the public, they become part of the stream of information whose unimpeded flow is critical to a free society." *Cable News Network v. Video Monitoring Services*, 940 F.2d at 1478.

354. See *Sony v. Universal*, 464 U.S. at 432 (1984).

355. *Id.* at 432 (quoting *Fox Film Corp. v. Doyal*, 286 U.S. 123, 127 (1932)).

356. See *supra* notes 37-42 and accompanying text.

357. See *supra* notes 37-42 and accompanying text.

358. See *supra* notes 352-355 and accompanying text.

labors so that they continue to create new works.³⁵⁹

CONCLUSION

New Strides in technology are important to the continued growth of this nation. The Founding Fathers implicitly recognized this truth, and codified it into our social contract; the United States Constitution. Congress, and the courts have tried to fulfill the goal of forward progression by their treatment of copyright. In the case of holographic data storage, no new amendments to the Copyright Act of 1976 need to be passed to afford this medium copyright protection. Holographic works clearly fit within the scope of copyright. This technology of the near future is likely to have a great impact upon society. Copyright laws have been passed to promote just this type of advancement. Every consideration leads to the conclusion that holographic data storage is a copyrightable medium which will compel society to flourish with the creation of works which have yet to be imagined.

359. *See id. See, e.g., Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 156-57 (1975). The Court stated:

The limited scope of the copyright holder's statutory monopoly . . . reflects a balance of competing claims upon the public interest. Creative work is to be encouraged and rewarded, but private motivation must ultimately serve the cause of promoting broad public availability of literature, music, and the other arts. The immediate effect of our copyright law is to secure a fair return for an 'author's' creative labor. But the ultimate aim is, by this incentive, to stimulate artistic creativity for the general public good.

Id. (Footnotes omitted.). Further, "the line must be a pragmatic one, which also keeps in consideration 'the preservation of the balance between competition and protection reflected in the patent and copyright laws.'" *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1253 (3d Cir. 1983) (quoting *Herbert Rosenthal Jewelry Corp. v. Kulpakian*, 446 F.2d 738, 742 (9th Cir. 1971)).

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PANEL I: THE FIRST AMENDMENT IMPLICATIONS OF CONVERGENCE

Moderator: James Goodale, Esq.

Panelists: Andrew Jay Schwartzman, Esq.
Nicholas Jollymore, Esq.
Janine Jaquet
Jonathan Zittrain, Esq.

PANEL II: THE ECONOMIC AND REGULATORY ISSUES OF CONVERGENCE

Moderator: Mark Patterson, Esq.

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