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Chapter 2: Copyright of Computer Programs

I. The History Of Software Copyright

Although today it is uncontroversial that computer programs can be protected by copyright, in the early days of computer programs that was far less clear. It is largely through convenient timing and creative decisions that computer programs enjoy copyright protection today.

I.A. Early “Software”: The Piano Roll

Before the advent of digital computers controlled by computer programs, there was another device whose particular function was controlled by an encoded sequence of instructions – the player piano. In 1908, the Supreme Court looked at the copyrightability of piano rolls in the case of *White-Smith Music v. Apollo*.¹ In a unanimous decision finding that piano rolls were not copies of the musical work under the copyright law as it existed at that time, and therefore not an infringement, the Supreme Court stated:

These perforated rolls are parts of a machine which, when duly applied and properly operated in connection with the mechanism to which they are adapted, produce musical tones in harmonious combination. But we cannot think that they are copies within the meaning of the copyright act.²

The Court concluded that if piano rolls and similar things were to be copies under the Copyright Act, it was the responsibility of Congress to amend the copyright law to cover them.

Congress made such a revision in the Copyright Act of 1909, but not by directly stating that works that can be perceived only through the use of a machine are protected by copyright. That would have to wait for the Copyright Act of 1976, whose Section 102³ makes it clear that “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” are copyrightable.

Instead, Congress implicitly recognized the copyrightability of piano rolls and other musical recordings by giving the copyright owner for a musical work the

¹ 209 U.S. 1 (1908).

² 209 U.S. at 18.

³ 17 U.S.C. §102(a).

exclusive right “to make any arrangement or record in which the thought of an author may be recorded and from which it may be read or reproduced.”⁴ To balance this new exclusive right, Congress provided a compulsory license for anyone wishing to make his or her own recording of a musical work, provided that the composer had permitted at least one recording of the work. This compulsory license was carried over to the Copyright Act of 1976 as Section 115.⁵

I.B. The First Software Copyrights

There was little need for copyright (or patent) protection for early computer programs. There were few computers, and most software was custom-developed for in-house applications. It wasn’t until the early 1960s that computer programs were being actively marketed by a software industry besides the computer manufacturers. Before widely-marketed software, it was easy to protect by a contract or license agreement any computer program that was being marketed.

While a contract restricted what people receiving the software could do with it, particularly limiting their further distribution of the software, it could not bind people who were not parties to the contract. A person finding a computer program on the street could do anything he or she wanted with it. Copyright law, on the other hand, provides protection for a computer program even when no contract exists.

Under the Copyright Act of 1909, copyright protection required registration of the copyright at the time of first publication. That caused a problem for early computer programs because they weren’t generally published like books or other copyrightable works. (The problem went away when the publishing requirement was eliminated by the Copyright Act of 1976.) According to the Copyright Office, the first deposit of a computer program for registration was on November 30, 1961. North American Aviation submitted a tape containing a computer program. While the Copyright Office was trying to determine whether such a deposit could be registered, two short computer programs were submitted by a Columbia University law student to determine how a computer program might be registered. One computer program was submitted as a printout published in the *Columbia Law School News* on April 20, 1964, while the other was on magnetic tape. The copyrights for both student computer programs were registered in May 1964, and North American Aviation’s computer program was registered in June 1964.

Surprisingly, the Copyright Office did not seem to think that the Supreme Court’s *White-Smith v. Apollo* decision prevented the copyrighting of computer programs. It believed that punched cards, a primary medium for computer programs at the time, could be read by somebody familiar with the code used to represent characters on the cards, or could be printed to get a computer program listing intelligible to a person. Magnetic tapes, presumably, were just like a whole bunch of punch cards on a more convenient medium.

The Copyright Office concluded that a computer program was like a “how to” book, and therefore protectable by copyright just like that book, if:

⁴ 35 Stat. 1, §1(e).

⁵ 17 U.S.C. §115.

(1) The elements of assembling, selecting, arranging, editing, and literary expression that went into the compilation of the program [meaning the creation of the program, not converting it from source code to object code] are sufficient to constitute original authorship. This is essentially a threshold question whether the “de minimis” maxim [that there has to be a minimum amount of originality for copyright protection] applies.

(2) The program has been published, with the required notice [which was a requirement for copyright at the time]; that is, “copies” (*i.e.* reproductions of the program in a form perceptible or capable of being made perceptible to the human eye) bearing the notice have been distributed or made available to the public.

(3) The copies deposited for registration consist of or include reproductions in a language intelligible to human beings [source code, rather than object code]. If the only publication was in a form that cannot be perceived visually or read [say, on magnetic tape], something more (*e.g.* a print-out of the entire program) would also have to be deposited.⁶

Since then, the copyright of computer programs has been generally accepted, and it became common for computer programs to contain a copyright notice, even if they were not formally registered. This happened more because software developers copied what others had previously done rather than because of a great understanding of copyright law and its relationship to computer software.

I.C. Software Under the 1976 Act

The Copyright Act of 1976, which became effective on January 1, 1978, made it clear that Congress intended software to be copyrightable. The definition of literary works in Section 101 states that they are:

works, other than audiovisual works, expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the nature of the material objects, such as books, periodicals, manuscripts, phonorecords, film, tapes, disks, or cards, in which they are embodied.⁷

Furthermore, the House Report discussing the Act states:

The term “literary works” does not connote any criterion of literary merit or qualitative value: it includes catalogs, directories, and similar factual, reference, or instructional works and compilations of data. It also includes computer data bases, and computer programs to the extent that they incorporate authorship in the programmer’s expression of original ideas, as distinguished from the ideas themselves.⁸

Yet what was not clear was how much protection Congress intended to give computer programs, and whether there should be special exceptions to the exclusive rights of the copyright owners, as was the case for some other types of works. Because

⁶ Copyright Office Circular No. 61, 1964 version.

⁷ 17 U.S.C. §101.

⁸ H.R. Rep. No. 94-1476 at 54.

Congress didn't want to further delay the passage of the Act (which had been in the works for about two decades), it appointed the National Commission on New Technological Uses of Copyrighted Works (referred to as CONTU) to report back about computer programs and other new technologies and put a placeholder provision in the Act:

§117. Scope of exclusive rights: use in conjunction with computers and similar information systems. Notwithstanding the provisions of sections 106 through 116 and 118, this title does not afford the owner of copyright in a work any greater or lesser rights with respect to the use of the work in conjunction with automatic systems capable of storing, processing, retrieving, or transferring information, or in conjunction with any similar device, machine, or process, than those afforded to works under the law, whether title 17 or the common law or statutes of a State, in effect on December 31, 1977, as held applicable and construed by a court in an action brought under this title.⁹

I.D. The CONTU Recommendations

CONTU held extensive hearings not only on protection of computer software but also photocopying and computer databases. On July 31, 1978, it transmitted its final report to the President and Congress. Along with other recommendations, CONTU recommended making two changes to the copyright laws to address computer programs.

First, it recommended a new definition be added to Section 101:

A "computer program" is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.¹⁰

It also recommended that Section 117 be replaced with:

Notwithstanding the provisions of section 106, it is not an infringement for the rightful possessor of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program provided:

(1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or

(2) that such new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful.

Any exact copies prepared in accordance with the provisions of this section may be leased, sold, or otherwise transferred, along with the copy from which such copies were prepared, only as part of the lease, sale, or other transfer of all rights in the program. Adaptations so

⁹ Pub. L. No. 94-553, 90 Stat. 2541, §117.

¹⁰ Final Report of the National Commission on the New Technological Uses of Copyrighted Works (CONTU Rep.), ISBN 0-8444-0312-1 (1978) at 12.

prepared may be transferred only with the authorization of the copyright owner.¹¹

CONTU explained its recommendations:

Because the placement of a work into a computer is the preparation of a copy, the law should provide that persons in rightful possession of copies of programs be able to use them freely without fear of exposure to copyright liability. Obviously, creators, lessors, licensors, and vendors of copies of programs intend that they be used by their customers, so that rightful users would but rarely need a legal shield against potential copyright problems. It is easy to imagine, however, a situation in which the copyright owner might desire, for good reason or none at all, to force a lawful owner or possessor of a copy to stop using a particular program. One who rightfully possesses a copy of a program, therefore, should be provided with a legal right to copy it to that extent which will permit its use by that possessor. This would include the right to load it into a computer and to prepare archival copies of it to guard against destruction or damage by mechanical or electrical failure. But this permission would not extend to other copies of the program. Thus, one could not, for example, make archival copies of a program and later sell some while retaining some for use. The sale of a copy of a program by a rightful possessor to another must be of all rights in the program, thus creating a new rightful possessor and destroying that status as regards the seller. This is in accord with the intent of that portion of the law which provides that owners of authorized copies of a copyrighted work may sell those copies without leave of the copyright proprietor.

Because of a lack of complete standardization among programming languages and hardware in the computer industry, one who rightfully acquires a copy of a program frequently cannot use it without adapting it to that limited extent which will allow its use in the possessor's computer. The copyright law, which grants to copyright proprietors the exclusive right to prepare translations, transformations, and adaptations of their work, should no more prevent such use than it should prevent rightful possessors from loading programs into their computers. Thus, a right to make those changes necessary to enable the use for which it was both sold and purchased should be provided. The conversion of a program from one higher-level language to another to facilitate use would fall within this right, as would the right to add features to the program that were not present at the time of rightful acquisition. These rights would necessarily be more private in nature than the right to load a program by copying it and could only be exercised so long as they did not harm the interests of the copyright proprietor. Unlike the exact copies authorized as described above, this right of adaptation could not be conveyed to others along with the licensed or owned program without the express authorization of the owner of the copyright in the original work. Preparation of adaptations

¹¹ CONTU Rep. at 12.

could not, of course, deprive the original proprietor of copyright in the underlying work. The adaptor could not vend the adapted program, under the proposed revision of the new law, nor could it be sold as the original without the author's permission. Again, it is likely that many transactions involving copies of programs are entered into with full awareness that users will modify their copies to suit their own needs, and this should be reflected in the law. The comparison of this practice to extensive marginal note-taking in a book is appropriate: note-taking is arguably the creation of a derivative work, but unless the note-taker tries to copy and vend that work, the copyright owner is unlikely to be very concerned. Should proprietors feel strongly that they do not want rightful possessors of copies of their programs to prepare such adaptations, they of course, make such desires a contractual matter.¹²

I.E. Congressional Action

I.E.1. Adoption of the CONTU Recommendations, with an Unexplained Change

Congress adopted these recommendations as part of a bill "to amend the patent and trademark laws" that became Public Law 96-517 on December 12, 1980. However, there was one change made to CONTU's proposed Section 117 – the term "rightful possessor of a copy" was replaced by "owner of a copy." There is nothing in the legislative history of the bill that indicates why this change was made. Perhaps the best explanation is that Congress was concerned that people would make copies of software they had rented or borrowed from a public library, where they were rightful possessors during the time they had the software, and then not delete the copies when they return the software to the rental place or library. It would be strange if somebody were not a copyright infringer when he or she made the copy but became one when he or she didn't take an action – deleting the copy after returning the rental software.

I.E.2. The 1990 Software Rental Prohibition

In any case, such concerns were unnecessary because Congress later passed the Computer Software Rental Amendments Act of 1990, which limited the "first sale" provisions of Section 109 for computer software:

Unless authorized by the owners of copyright in the sound recording or the owner of copyright in a computer program (including any tape, disk, or other medium embodying such program), and in the case of a sound recording in the musical works embodied therein, neither the owner of a particular phonorecord nor any person in possession of a particular copy of a computer program (including any tape, disk, or other medium embodying such program), may, for the purposes of direct or indirect commercial advantage, dispose of, or authorize the disposal of, the possession of that phonorecord or computer program (including any tape, disk, or other medium embodying such program) by rental, lease, or lending, or by any other act or practice in the nature of rental, lease, or lending. Nothing in the preceding sentence shall apply to the rental,

¹² CONTU Rep. at 13.

lease, or lending of a phonorecord for nonprofit purposes by a nonprofit library or nonprofit educational institution. The transfer of possession of a lawfully made copy of a computer program by a nonprofit educational institution to another nonprofit educational institution or to faculty, staff, and students does not constitute rental, lease, or lending for direct or indirect commercial purposes under this subsection.¹³

Although there are few cases that discuss the implications of Congress's adopting "owner of a copy" rather than "rightful possessor of a copy," in *MAI Systems Corp. v. Peak Computer*,¹⁴ the Ninth Circuit Court of Appeals noted that licensees of software "do not qualify as 'owners' of the software and are not eligible for protection under §117."¹⁵ Peak was an independent service company that had used MAI's diagnostic programs when it serviced customers' computers. While the software licenses permitted the customers to run the diagnostic programs and the operating system, they did not permit third parties like Peak to load the software.

It is questionable whether a license should be allowed to preempt the rights granted to software users under Section 117. In general, Section 301 of the Copyright Act preempts any state law that "come[s] within the subject matter of copyright,"¹⁶ which the copying of a computer program to use it clearly does. (Other terms of a license, such as a limit on the warranties provided, are separate from copyright considerations and clearly not preempted by Section 301.) But in *ProCD v. Zeidenberg*,¹⁷ the Seventh Circuit found that a license injects an additional element (the license itself) into the relationship between the copyright owner and the user, and so isn't equivalent to copyright and is not preempted. This view is not universally held; it allows a copyright owner to "double-dip" by using copyright protection when it is desirable which negates the balances in the copyright act by claiming that the software is licensed.

I.E.3. The 1998 Addition to Section 117

In 1998, as part of the Digital Millennium Copyright Act, Congress reacted to the concerns raised by this decision by amending Section 117 to address third-party maintenance of computers

(c) Machine Maintenance or Repair.— Notwithstanding the provisions of section 106, it is not an infringement for the owner or lessee of a machine to make or authorize the making of a copy of a computer program if such copy is made solely by virtue of the activation of a machine that lawfully contains an authorized copy of the computer program, for purposes only of maintenance or repair of that machine, if—

(1) such new copy is used in no other manner and is destroyed immediately after the maintenance or repair is completed; and

¹³ 17 U.S.C. §109(b)(1)(A).

¹⁴ 991 F.2d 511, 26 USPQ2d 1458 (9th Cir. 1993).

¹⁵ 991 F.2d at 518 n. 5, 26 USPQ2d at 1464 n. 5.

¹⁶ 17 U.S.C. §301(a).

¹⁷ 86 F.3d 1447, 39 USPQ2d 1161 (7th Cir. 1996).

(2) with respect to any computer program or part thereof that is not necessary for that machine to be activated, such program or part thereof is not accessed or used other than to make such new copy by virtue of the activation of the machine.

(d) Definitions.– For purposes of this section:

(1) the “maintenance” of a machine is the servicing of the machine in order to make it work in accordance with its original specifications and any changes to those specifications authorized for that machine; and

(2) the “repair” of a machine is the restoring of the machine to the state of working in accordance with its original specifications and any changes to those specifications authorized for that machine.¹⁸

It is not clear whether these added provisions really solve the problem or are just a Band-Aid. It would have been far better if Congress had recognized that most software is distributed under a license – generally a non-negotiable shrink-wrap license – that arguably makes Section 117 a nullity if consumers are really just licensees and not owners of their copies of a computer program. Also, Section 117 addresses only “computer programs,” which are “set[s] of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.” It does not provide special treatment for computer data, even though configuration files or sample computer programs or clip art regularly accompany computer programs and are often necessary for their operation.

Finally, Section 117 still does not recognize the reality of how backups of computer data are done, particularly on machines shared by a number of users. Archival copies of particular programs are not made. Instead, a copy of the entire file system, or those files that have changed since the last backup was made, is written with little regard for what is being copied. (Most backup procedures make a copy of everything on the disk being archived, not just computer programs as permitted by Section 117, but also computer data not addressed by Section 117.) But more problematic is the requirement of Section 117 that “all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful.” It is difficult, if not impossible, to go to all the backup tapes and delete the specific files associated with a computer program when the license for that computer program expires.

II. The Scope Of Software Copyright

II.A. Copyrights or Patents?

Although it is now clear that software can be protected by copyright, the real question is what does that copyright protect? This question is complicated by the inherently-functional nature of computer software, something that has traditionally been protected by patents. Section 102(b) of the Copyright Act of 1976 restates this principle:

In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation,

¹⁸ 17 U.S.C. §117(c).

concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.¹⁹

This recognizes the complementary nature of copyright, which protects expression, and patents, which protect useful procedures or machines. The Supreme Court, in the 1879 case *Baker v. Selden*,²⁰ stated:

The difference between the two things, letters-patent and copyright, may be illustrated by reference to the subjects just enumerated. Take the case of medicines. Certain mixtures are found to be of great value in the healing art. If the discoverer writes and publishes a book on the subject (as regular physicians generally do), he gains no exclusive right to the manufacture and sale of the medicine; he gives that to the public. If he desires to acquire such exclusive right, he must obtain a patent for the mixture as a new art, manufacture, or composition of matter. He may copyright his book, if he pleases; but that only secures to him the exclusive right of printing and publishing his book. So of all other inventions or discoveries.

The copyright of a book on perspective, no matter how many drawings and illustrations it may contain, gives no exclusive right to the modes of drawing described, though they may never have been known or used before. By publishing the book, without getting a patent for the art, the latter is given to the public. The fact that the art described in the book by illustrations of lines and figures which are reproduced in practice in the application of the art, makes no difference. Those illustrations are the mere language employed by the author to convey his ideas more clearly. Had he used words of description instead of diagrams (which merely stand in the place of words), there could not be the slightest doubt that others, applying the art to practical use, might lawfully draw the lines and diagrams which were in the author's mind, and which he thus described by words in his book.

The copyright of a work on mathematical science cannot give to the author an exclusive right to the methods of operation which he propounds, or to the diagrams which he employs to explain them, so as to prevent an engineer from using them whenever occasion requires. The very object of publishing a book on science or the useful arts 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. And where the art it teaches cannot be used without employing the methods and diagrams used to illustrate the book, or such as are similar to them, such methods and diagrams are to be considered as necessary incidents to the art, and given therewith to the public; not given for the purpose of publication in other works explanatory of the art, but for the purpose of practical application.²¹

¹⁹ 17 U.S.C. §102(b).

²⁰ 101 U.S. 99 (1879).

²¹ 101 U.S. at 102-103.

Furthermore, the Court noted that the criteria for copyright and patent protection are quite different:

A treatise on the composition and use of medicines, be they old or new; on the construction and use of ploughs, or watches, or churns; or on the mixture and application of colors for painting or dyeing; or on the mode of drawing lines to produce the effect of perspective,—would be the subject of copyright; but no one would contend that the copyright of the treatise would give the exclusive right to the art or manufacture described therein. The copyright of the book, if not pirated from other works, would be valid without regard to the novelty, or want of novelty, of its subject-matter. The novelty of the art or thing described or explained has nothing to do with the validity of the copyright. To give to the author of the book an exclusive property in the art described therein, when no examination of its novelty has ever been officially made, would be a surprise and a fraud upon the public. That is the province of letters-patent, not of copyright. The claim to an invention or discovery of an art or manufacture must be subjected to the examination of the Patent Office before an exclusive right therein can be obtained; and it can only be secured by a patent from the government.²²

The House Committee on the Judiciary, in its report accompanying the Copyright Act of 1976, commented on the provision in Section 102(b):

Copyright does not preclude others from using the ideas or information revealed by the author's work. It pertains to the literary, musical, graphic, or artistic form in which the author expressed intellectual concepts. Section 102(b) makes clear that copyright protection does not extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.

Some concern has been expressed lest copyright in computer programs should extend protection to the methodology or processes adopted by the programmer, rather than merely to the "writing" expressing his ideas. Section 102(b) is intended, among other things, to make clear that the expression adopted by the programmer is the copyrightable element in a computer program, and that the actual processes or methods embodied in the program are not within the scope of the copyright law.²³

II.B. Object Code

II.C. RAM Copies

One remaining question is whether the copying of a program from a disk drive into RAM for its execution is the making of a reproduction of that work, the first of the

²² 101 U.S. at 102.

²³ H.R. Rep. No. 94-1476 at 56.

exclusive rights in copyright. Although the answer seems obvious, it is complicated by the fact that the exclusive right is to “reproduce the copyrighted work in copies” and copies require that the work be fixed. Section 101 states:

A work is “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.³¹

II.C.1. *MAI v. Peak*: Fixed Reproductions

But if the contents of a RAM disappear when power is removed from the RAM, is the work fixed in the RAM so that it can be considered a copy? The Ninth Circuit considered this question in *MAI v. Peak*.³²

Peak argues that this loading of copyrighted software does not constitute a copyright violation because the “copy” created in RAM is not “fixed.” However, by showing that Peak loads the software into the RAM and is then able to view the system error log and diagnose the problem with the computer, MAI has adequately shown that the representation created in the RAM is “sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration.”

After reviewing the record, we find no specific facts (and Peak points to none) which indicate that the copy created in the RAM is not fixed. . . .

The law also supports the conclusion that Peak’s loading of copyrighted software into RAM creates a “copy” of that software in violation of the Copyright Act. In *Apple Computer, Inc. v. Formula Int’l, Inc.*, the district court held that the copying of copyrighted software onto silicon chips and subsequent sale of those chips is not protected by Section 117 of the Copyright Act. Section 117 allows “the ‘owner’ of a copy of a computer program to make or authorize the making of another copy” without infringing copyright law, if it “is an essential step in the utilization of the computer program” or if the new copy is “for archival purposes only.” One of the grounds for finding that 117 did not apply was the court’s conclusion that the permanent copying of the software onto the silicon chips was not an “essential step” in the utilization of the software because the software could be used through RAM without making a permanent copy. The court stated:

RAM can be simply defined as a computer component in which data and computer programs can be temporarily recorded. Thus, the purchaser of software desiring to utilize all of the programs on the diskette could arrange to copy the software into RAM. This would only be a temporary fixation. It is a property of RAM that

³¹ 17 U.S.C. §101.

³² 991 F.2d 511, 26 USPQ2d 1458 (9th Cir. 1993).

when the computer is turned off, the copy of the program recorded in RAM is lost.

While we recognize that this language is not dispositive, it supports the view that the copy made in RAM is “fixed” and qualifies as a copy under the Copyright Act.

We have found no case which specifically holds that the copying of software into RAM creates a “copy” under the Copyright Act. However, it is generally accepted that the loading of software into a computer constitutes the creation of a copy under the Copyright Act. We 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 the RAM, the hard disk or the read only memory (“ROM”). However, since we find that the copy created in the RAM can be “perceived, reproduced, or otherwise communicated,” we hold that the loading of software into the RAM creates a copy under the Copyright Act. We affirm the district court’s grant of summary judgment as well as the permanent injunction as it relates to this issue.³³

II.C.2. A Better Way to Look at RAM Copies

Perhaps a better way of looking at whether something is fixed is whether it can be read or copied at some arbitrary later time, absent some external event that destroys the work. In the case of RAM, it is possible to read the work as long as it hasn’t been overwritten or the power hasn’t been removed. In the case of a videotape, it can be viewed unless it is erased or otherwise destroyed. In contrast, the image of a movie on a screen or a television show on a cathode ray tube or bits being transmitted on a wire fade away “automatically” at a predictable time, so that the image can no longer be perceived, and therefore is not fixed. (Although in a dynamic RAM the individual bits also fade away, the memory system has a refreshing component that extends their life, so when the entire memory system is considered, the bits are fixed unless there is some external event such as the removal of power that causes the refreshing to stop.)

But when one considers the loading of a program into RAM from the disk making of a copy, there is a problem. The criminal infringement provision, Section 506,³⁴ was amended in 1997 by the No Electronic Theft (NET) Act³⁵ so that criminal infringement occurs not only when the infringement was willful and for purposes of commercial advantage or private financial gain, but also if there has been the reproduction or distribution during any 180-day period of copies having a total retail value of more than \$1,000. So if you have a program with a retail value of \$100, and you run it 11 times, you have made 11 copies of the program, with a total value of \$1,100, by reproducing the disk copy to RAM.

Clearly, this was not the intent of Congress, although it is the logical consequence of combining the NET Act’s language with the decision in *MAI v. Peak*. Concerned about this problem, the chairman of the Senate Committee on the

³³ 991 F.2d at 518-519, 26 USPQ2d at 1463-1464 (citations omitted).

³⁴ 17 U.S.C. §506.

³⁵ Pub. L. No. 105-147, 111 Stat. 2678.

Judiciary, Senator Orrin Hatch, made the following floor statement when the Senate was considering the NET Act:

Congress has long recognized that it is necessary to make incidental copies of digital works in order to use them on computers. Programs or data must be transferred from a floppy disk to a hard disk or from a hard disk into RAM as a necessary step in their use. Modern operating systems swap data between RAM and hard disk to use the computer memory more efficiently. Given its purpose, it is not the intent of this bill to have the incidental copies made by the user of digital work be counted more than once in computing the total retail value of the infringing reproductions.³⁶

He was also concerned about the effect of the bill on making archival copies of computer programs:

Because most shrink-wrap licenses purport to make the purchaser of computer software a licensee and not an owner of his or her copy of the software, the ordinary purchaser of software may not be able to take advantage of the exemption provided by sec. 117, allowing the “owner” of a copy to reproduce the work in order to use it in his or her computer.

Many shrink-wrap licenses limit the purchaser to making only a single backup copy of his or her software. Thus, under a literal reading of the bill, the ordinary purchaser of computer software who loaded the software enough times in the 180-day period to reach the more-than-\$1,000 threshold may be a criminal! This is, of course, not the intent of the bill. Clearly, this kind of copying was not intended to be criminalized.³⁷

II.D. Summary

It is now well-accepted that copyright protects computer programs and other digital information, whether they are in readable source code form or are an executable program that is intended to be understood only by a computer. Copies are made whenever the program is transferred from floppy disk to hard disk or is read into the computer’s memory for execution, and those copies will infringe the copyright of the computer program if they are not permitted by the copyright owner or by copyright law.

As computer programs have become more complicated, that may be sufficient in most instances. Most, if not virtually all, copyright infringement of today’s operating systems or applications programs consists of the complete copying of that program onto a compact disc or other distribution medium, the preloading of the program onto the hard disk of a computer being sold, or the distributing of the program over the Internet without authorization. These acts are obviously wrong, and so there is little difficulty in finding that they are copyright infringement.

³⁶ 143 Cong. Rec. at S12690.

³⁷ 143 Cong. Rec. at S12690.

III. Beyond Mere Copying of a Computer Program

Generally, when we think of copyright infringement, we think of somebody duplicating a work, either all of it or at least enough of it as to appropriate much of its value. Sometimes we even remember that a copyright can be infringed by publicly performing or displaying a work without permission, or by translating the work into another language or another form.

But it is possible to infringe a copyright without copying all, or even a major part, of a work. Sometimes a play or movie takes too much of the plot or characterization of a copyrighted work, without copying the actual dialogue. The Second Circuit, in its decision in *Computer Associates v. Altai*,³⁸ has noted that:

as a general matter, and to varying degrees, copyright protection extends beyond a literary work's strictly textual form to its non-literal components. As we have said, "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."³⁹

Such cases are very fact-intensive, so it is difficult to draw bright lines on what is infringement and what isn't. For example, whether something is a fair use depends on many factors and how they are weighted. Judge Learned Hand, who wrote many copyright decisions during his time on the Second Circuit, noted that "nobody has ever been able to fix that boundary, and nobody ever can."⁴⁰ Thirty years later he concluded, "Obviously, 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*."⁴¹

III.A. Structure, Sequence, and Organization

III.B. Abstraction, Filtration, Comparison

III.B.1. The Second Circuit's *Altai* Decision

III.B.2. The Tenth Circuit's Elaboration On *Altai*

III.B.3. Filtration

There are a number of reasons why something might be filtered, and whether something is filtered may depend on the particular level of abstraction being considered.

³⁸ 982 F.2d 693, 23 USPQ2d 1241 (2d Cir. 1992).

³⁹ 982 F.2d at 701, 23 USPQ2d at 1248.

⁴⁰ *Nichols v. Universal Pictures*, 45 F.2d 119, 121, 7 USPQ 84, 86 (2d Cir. 1930).

⁴¹ *Peter Pan Fabrics v. Martin Werner*, 274 F.2d 487, 489, 124 USPQ 154, 155 (2d Cir. 1960)

III.B.3.a. Efficiency

III.B.3.b. External Factors

III.B.3.c. Material in the Public Domain

III.B.3.d. Facts

III.B.4. Comparison

III.C. Methods of Operation

IV. Applying The AFC Test

While it seems simple to describe the abstraction-filtration-comparison analysis, the devil is in the details. The abstraction can result in the comparing of hundreds or thousands of different aspects of a computer program if one is not careful. Elements are filtered out of consideration on the basis of broad criteria, including:

- The element's expression was dictated by reasons of efficiency, such as when it is the best way of performing a particular function.
- The element's expression was dictated by external factors, such as using an existing file format or interoperating with another program.
- The element's expression is a conventional way of writing something in the particular programming language or machine running the program.
- The element, at the particular level of abstraction, is an unprotectable process and not protectable expression.
- The element is taken from the public domain or is an unprotectable fact.

Any protection for elements dictated by efficiency or external factors or processes must come from patents or trade secrets, if at all, and not from copyright.

For most alleged copyright infringements, this filtering makes little difference. It is important to recognize that, with today's large, complex programs, most copyright infringement consists of the verbatim copying or unauthorized distribution of a computer program, and no question over whether any similarities are protected expression or unprotected function need be considered.

But sometimes a program is based on another program, or takes features from another program, and at those times the abstraction-filtration-comparison test must be used to determine whether too much was taken and a copying of the non-literal elements has resulted in a copyright infringement.

IV.A. A Suggested Approach

IV.B. A Judge's Comments on the Suggested Approach

V. Reverse Engineering Of Software

In *Whelan v. Jaslow*⁸⁵ and *Computer Associates v. Altai*,⁸⁶ both of the alleged infringers had access to the original source code through a prior business relationship, and used that as the basis of a competing product. But the holdings in those cases also provide guidance on what can be copied from an existing computer program without infringing its copyright, something very important when you are trying to write a program similar to one already in the market.

In most instances, the creators of a competing product have not had access to the source code for the original product. Instead, they have studied how the original product operates in order to develop their product. This is particularly true when the competing product must duplicate the file formats or other external features of the original product, and information about those file formats or features is not provided by the developer of the original product.

The key decisions on the legality of reverse engineering have dealt with disassembly: taking the publicly-available object code and attempting to reconstruct the original source code to learn how the program works. They also involved the interface between a video game console and the game cartridges that run on it. This is not surprising, since video game console manufacturers attempt to lock out games from suppliers not paying them licensee fees.

V.A. The Federal Circuit's Atari Decision

V.B. The Ninth Circuit's Sega Decision

V.C. Revising Sega in Sony v. Connectix

VI. Other Software Copyright Issues

There are a number of aspects of software copyright that have not been considered by the courts but may play a role in future litigation.

VI.A. Source Code and Derivative Works

Copyright for a computer program, under the Copyright Act of 1976, comes into being as the source code for the computer program is being written by the programmer. As Section 102(a) states, "Copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression,"¹⁰⁰ such as keypunch cards, magnetic tape, hard or floppy disks, or even the RAM of the computer. The program does not need to be complete or even functional for copyright protection to come into being.

⁸⁵ 797 F.2d 1222, 230 USPQ 481 (3d Cir. 1986).

⁸⁶ 982 F.2d 693, 23 USPQ2d 1241 (2d Cir. 1992).

¹⁰⁰ 17 U.S.C. §102(a).

When additional source statements are added to the computer program, or corrections are made to the computer program, those additions or corrections are a “derivative work” based on the original computer program. Section 101¹⁰¹ defines a derivative work as “a work based upon one or more preexisting works” and states that “editorial revisions, annotations, elaborations, or other modifications which, as a whole, represent an original work of authorship” are derivative works.

Just as a copyright came into being when the original lines of source code were written by the programmer, so another copyright comes into being for each addition or modification to the source code that shows sufficient originality. Because of this, a computer program generally is protected not by a single copyright but by a series of copyrights starting when it is first written and continuing through the last modification.

However, there is little practical significance in viewing the source code copyrights as a series of separate copyrights rather than a single copyright. If the computer program is not a work made for hire, then all the copyrights will expire at the same time – 70 years after the death of the last surviving author. For works made for hire, the copyrights will expire in the order in which they came into being. The copyright on the original program will expire first, allowing it (but not its later modifications) to enter the public domain, where it can be copied freely. The copyright on each modification will expire at some later time, until all the copyrights have expired and the complete computer program enters the public domain. However, because the copyright for the original source code will not expire for 95 years after it is first published (and 120 years after it is first written, if it remains unpublished), it is unlikely that the fact that part of an outdated, 95-year-old computer program has entered the public domain while a part remains copyrighted will be of any significance.

One situation in which this series of copyrights may be significant when the copyright in the computer program is registered. It is common to register the copyright whenever a major release of the computer program occurs, but not when there has been only a minor change. While the copyright owner can sue for infringement of the copyright only on the material that has been registered, if there have been only minor changes since registration, the copied version will be substantially similar to the registered one – sufficient for a finding of copyright infringement.

It may also be important to look at a computer program as a series of derivative works is when the original author has not written the modifications. For a program written by company employees, it makes no difference because the author under the law for such a work made for hire is the employer. But if there are different authors, then the copyright owner in any work has to authorize the making of any further derivative works and must approve of any distribution of the work that contains his material. Unless ownership and distribution rules are resolved at the time the work is being developed, there could be problems at a later time.

VI.B. Source Code and Object Code

Although copyright comes into being with the writing of the source code, it is the object code – the actual instructions that control the computer when the program is being executed – that copyright generally protects. In most instances, the source code

¹⁰¹ 17 U.S.C. §101.

is never revealed to the public, and thus remains protected as a trade secret even though millions and millions of copies of the program are distributed as object code.

Every computer program copyright case treats the copyright in the source code and the object code as equivalent. That is likely because they were decided at a time when there was essentially a one-to-one correspondence between the source code and the object code. The source code was written in assembly language, with each line of the source code corresponding to a single machine instruction (or, if a macro facility existed as part of the assembler, a small predefined series of machine instructions). The source code contained information that made it easier for a programmer to write or understand the program – mnemonics like “ADD” instead of a bit pattern of “01000011” for the addition instruction, the use of symbolic labels for storage or program locations, and the inclusion of comments to annotate the program – which the assembly process removed or replaced as it produced the object code.

With the advent of higher-level programming languages, that is less the case. The compiler for the higher-level language performs a much more complicated translation than was the case for an assembler. It not only produces complex series of object code instructions for each source line but may actually rearrange the statements of the program to produce a more efficient program. There is no longer the one-to-one correspondence between the source code and the object code. This, along with their size, makes it more difficult to reverse engineer (for example, to learn how the program works either by testing or by trying to convert the object code back to source code) a modern computer program, which in turn makes it more likely that any copying will be a literal copying of the entire program.

Even though source code and object code are distinct, it is still useful to maintain the concept that the source code and the object code are just different forms of the same copyrighted work. The Copyright Office regards the source code and object code as equivalent for purposes of registration. In fact, it generally requires a deposit of at least a portion of the source code (generally the first and last 25 pages – see their Circular 61) and questions any registration that includes only object code.

Where an applicant is unable or unwilling to deposit source code, he/she must state in writing that the work as deposited in object code contains copyrightable authorship. The Office will send a letter stating that registration has been made under its rule of doubt and warning that it has not determined the existence of copyrightable authorship.¹⁰²

VI.C. Source Code and Displays

The source code copyright that protects the object code may also cover any screen displays produced by the computer program. These would be considered “audiovisual works” under the Copyright Act, defined in Section 101 as

works that consist of a series of related images which are intrinsically intended to be shown by the use of machines or devices such as projectors, viewers, or electronic equipment, together with accompanying sounds, if any, regardless of the nature of the material objects, such as films or tapes, in which the works are embodied.¹⁰³

¹⁰² Copyright Office Circular 61: “Copyright Registration for Computer Programs,” at 2.

¹⁰³ 17 U.S.C. §101.

Video games, consisting of a series of displays controlled by the computer program, are particularly suitable to regard as audiovisual works. But because Section 106 grants no exclusive right to copyright owners of audiovisual works that it does not also grant to copyright owners of literary works like computer programs and audiovisual works, there is little reason to treat the two aspects of some programs separately. The Copyright Office has recognized that computer programs may be both literary works and audiovisual works, and it requires only a single registration for both aspects.

Copyright protection for computer screen displays, including videogames, has been an issue in the courts for some time. Courts have differed in their opinions regarding whether screen displays may be registered separately.

The Copyright Office has consistently believed that a single registration is sufficient to protect the copyright in a computer program and related screen displays, including videogames, without a separate registration for the screen displays or a specific reference to them on the application for the computer program. An application may give a general description in the “nature of authorship” space, such as “entire work” or “computer program.” This description will cover any copyrightable authorship contained in the computer program and screen displays, regardless of whether identifying material for the screen is deposited.¹⁰⁴

VI.D. New Software from Old

Most computer programs are based to some degree on other computer programs. They could be new implementations of existing programs (for instance, Linux reimplementing Unix) or new programs influenced by an existing program (the first spreadsheet program, VisiCalc, influenced Lotus 1-2-3, which influenced Microsoft Excel), or they could use a preexisting library as part of the final computer program.

Obviously, there are a number of copyright considerations when creating a new computer program based on an existing one.

VI.D.1. Using a Clean Room

It is not necessary to be looking at an existing program while writing a new program for the new program to infringe the reproduction right in the existing program. The copying could be unconscious. In *ABKCO Music v. Harrisongs Music*,¹⁰⁵ George Harrison was found to have infringed the copyright of “He’s So Fine,” a song that he had heard years before, when he wrote “My Sweet Lord.” If you have had access to the source of a computer program, you need to be particularly concerned that you aren’t unconsciously copying the original program when you write a similar program.

One way to avoid infringement when writing a program that is similar to another program is through the use of a “clean room” procedure. This is what was done when companies cloned the BIOS of the IBM personal computer to produce compatible

¹⁰⁴ Copyright Office Circular 61 at 3.

¹⁰⁵ 722 F.2d 988, 221 USPQ 490 (2d Cir. 1983).

systems. In a clean room procedure, there are two separate teams working on the development of the new program.

The first team determines how the original program works, by examining its source code if it is available (IBM published the source code for its BIOS in a technical manual), by reverse engineering the program (by converting its object code back to source code and attempting to understand it or by testing it to see how it behaves), or by studying available user manuals and other descriptions of the program's function. This first team puts together a complete technical specification that describes the functioning of the original program. Such a specification is not an infringement, since the copyright in the original program doesn't protect its functionality, only the expression in the program that creates that functionality. Generally, an intellectual property attorney will review the functional specification to assure that it does not contain any protected expression from the original program.

Given the functional specification, a second team of programmers, metaphorically in a "clean room" uncontaminated by the original program, implements the new program. These programmers have not seen the source code of the original program. In fact, it is best if they have never seen any aspect of the original program, getting all their knowledge of it from the functional specification. Because they haven't seen the original program, they cannot be copying it, even unconsciously.

A limited clean room was used by programmers at Altai when they discovered that one of their employees had written a program that included portions of a program he had worked on at a competitor. Although *Computer Associates v. Altai*¹⁰⁶ does not spend much time on the clean room aspects of Altai's new implementation, it does suggest that such a procedure results in a program that does not infringe as long as the portions that are similar are dictated by function.

VI.D.2. Piecewise Reimplementation

Many people have reimplemented computer programs by rewriting them to replace the source code with code of their own writing. There is no reason to believe that this would not be a copyright infringement, particularly if the reimplementer had access to the source code of the original program, even if none of the original source code remains.

When the first segment of code is rewritten, the new code will be an infringing work if it is substantially similar to the original code, or may be an infringing derivative work if it is a reimplementation in a different programming language. That reimplemented first segment is combined with the remaining parts of the original program to form an intermediate version. Subsequent modifications produce another work. So when you have completed the piecewise reimplementation, you have a set of works, each of whose creation infringes the exclusive rights of the owner of the copyright of the original program.

As an analogy, consider the translation of a novel to a different language, something that would clearly be a derivative work. It makes little difference that none of the original words remain, or that the translation was done a little at a time. The resulting translation is still an infringing derivative work.

¹⁰⁶ 982 F.2d 693, 23 USPQ2d 1241 (2d Cir. 1992).

Even if you completely replace the program with new code, nonliteral elements also protected by the original program's copyright are likely to remain and infringe – elements like the overall program structure or architecture and data structures that are not dictated by external or efficiency considerations. Although there is no case law on this point, it would seem that the only way to break the chain of infringing works is by some extraordinary act, such as a clean room implementation.

VI.D.3. Section 117 Adaptations

Most computer programs are covered by a series of copyrights, each coming into being when a portion of the program is written or modified. The copyright on each nontrivial modification is as a derivative work of some preexistent program. One of the exclusive rights of a copyright owner is the right to control the preparation of any derivative works, so generally only somebody with the permission of the copyright owner can modify a computer program.

There is a special exception in Section 117 that permits the owner of a copy of a computer program “to make or authorize the making of another copy or adaptation of that computer program provided that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner.”¹⁰⁷ This exception recognizes that it is sometimes necessary to configure or otherwise modify a computer program as part of its installation or to run it. While in theory this adaptation exception would allow somebody to redo Microsoft Access to run on a Macintosh, in reality such an adaptation even with access to the source code would be impractical for an individual user.

Note that Section 117 also requires the permission of the computer program's copyright owner to transfer the adaptations you have made. So Section 117's adaptation right is personal to each owner of a copy of a computer program and does not allow the sharing of such adaptations.

VI.D.4. Derivative Works and Compilations

Until now, we have been discussing computer programs as if they were a single work, or an original program and a series of derivative works comprising each modification to that program. While that was the case for early computer programs, now it is more common for a program to include preexisting libraries, themselves copyrighted computer programs, and similar components.

When two or more preexisting works are combined to form a new work, in copyright law that work is called a “compilation” – “a work formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship.” The copyright in the resulting overall computer program comprises the copyrights in the preexisting component computer programs and a new copyright in the compilation. But that compilation copyright is very limited.

The copyright in a compilation or derivative work extends only to the material contributed by the author of such work, as distinguished from the preexisting material employed in the work, and does not imply any

¹⁰⁷ 17 U.S.C. §117.

exclusive right in the preexisting material. The copyright in such work is independent of, and does not affect or enlarge the scope, duration, ownership, or subsistence of, any copyright protection in the preexisting material.¹⁰⁸

This means that to distribute the overall computer program, there must be permission from the copyright owners of all the component computer programs. It is important before distributing a program using a library that the license that accompanied that library allow the redistribution of the library in the way intended, or else the distribution right for that library will be infringed.

An interesting situation arises when an application program is distributed without the libraries it needs, and those libraries are supplied at a later time by the user of the application program. While this may initially seem like a strange procedure, it actually is common for today's software. Most programs do not run stand-alone on a machine but use the services of an operating system – a special type of preexisting library. Most operating systems also provide dynamic linking to a library, so that the library can be shared by all the programs that are using it.

In this discussion, “library” indicates a preexisting program used by a new “applications program,” because that is one of the most common instances of what is being discussed. However, the discussion is just as applicable to libraries that work with a preexisting operating system, or plug-ins that work with a preexisting browser.

With dynamically-linked libraries, the application program being distributed is no longer a compilation that includes the library. Because the library is not being distributed with the application program, no permission is needed from the copyright owner of the library for the distribution to users. Users must, of course, be authorized to use the library, but if they are owners of a copy of the library, under Section 117 they can make any adaptations of the library necessary to use it with the application program.

Some have claimed that an application program that needs a library for its operation is a derivative work of that library. They take that position because the application program is “based on” the library because it was written to use the subroutines and other aspects of the library.

Such a position is misplaced. Even though the definition of a derivative work contained in Section 101 seems to support such a reading when it talks about a derivative work's being “based upon one or more preexisting works,” the examples all illustrate derivative works where the original work is somehow incorporated or recast in the derivative work:

A “derivative work” is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted. A work consisting of editorial revisions, annotations, elaborations, or other modifications

¹⁰⁸ 17 U.S.C. §103(b).

which, as a whole, represent an original work of authorship, is a “derivative work”.¹⁰⁹

This need to use a portion of the original work in the derivative work is stated in the legislative history of the Copyright Act of 1976, where the drafters discussed when the derivative work exclusive right is infringed:

To be an infringement the “derivative work” must be “based upon the copyrighted work,” and the definition in section 101 refers to “a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, transformed, or adapted.” Thus, to constitute a violation of section 106(2), the infringing work must incorporate a portion of the copyrighted work in some form; for example, a detailed commentary on a work or a programmatic musical composition inspired by a novel would not normally constitute infringements under this clause.¹¹⁰

It could be argued that the component program really does include portions of the library that it uses – data structures that are passed as parameters, or even the parameter lists themselves. But elements dictated by external considerations are filtered out when trying to determine whether there is copyright infringement.

No other conclusion makes sense. If it were not the case, then any program using the applications program interfaces (APIs) of an operating system could be considered a derivative work of that operating system. And, under the exclusive right to prepare derivative works, the copyright owner of an operating system such as Microsoft Windows could control who was allowed to write programs for that operating system.

VII. Summary

It is now well-accepted that copyright protects computer programs and other digital information, whether they are in human-readable source code or are an executable program that is intended to be understood only by a computer. Copyright provides protection for computer programs that is both easy to obtain (it occurs automatically as the computer program is written) and effective against someone who is making or distributing copies of the program, as would be the case with bootleg copies of commercial software packages such as Microsoft Windows or WordPerfect.

Beyond the verbatim copying of a computer program, the scope of copyright protection is quite limited. It does not protect the functional aspects of the program, just its expression. But as computer programs have become more complicated, that protection may be sufficient in most instances. Most, if not virtually all, copyright infringement of today’s operating systems or applications programs consists of the complete copying of that program onto a compact disc or other distribution medium, the preloading of the program onto the hard disk of a computer being sold, or the distributing of the program over the Internet without authorization. There is little difficulty in finding that such acts are copyright infringements.

¹⁰⁹ 17 U.S.C. §101.

¹¹⁰ H.R. Rep. No. 94-1476 at 62.

It also does not protect the functional aspects of the program, just its expression. But it is much easier to state that rule than determine how to apply it, since a computer program combines expression and functionality much, much more than any other copyrighted work. The most-accepted way of determining whether something is unprotectable function or protectable expression is the abstraction-filtration-comparison test, which, after determining a number of parts of the program to consider (abstraction), filters out elements not protectable by copyright, and then compares the remaining elements to determine if they are similar.

Elements are filtered because:

- The element's expression was dictated by reasons of efficiency, such as when it is the best way of performing a particular function.
- The element's expression was dictated by external factors, such as using an existing file format or interoperating with another program.
- The element's expression is a conventional way of writing something in the particular programming language or machine running the program.
- The element, at the particular level of abstraction, is an unprotectable process and not protectable expression.
- The element is taken from the public domain, or is an unprotectable fact.

When writing a program similar to an existing program, you can copy any element of that program that would be filtered without infringing the copyright of the existing program. But you have to worry if you are using too many of the filtered elements. It could be that the selection or arrangement of a large number of filtered elements could itself have sufficient originality to warrant copyright protection. Remember, in the abstraction-filtration-comparison test, abstraction is done before any filtration of elements at a particular level of abstraction, and elements that may be filtered out at one level may be of primary importance at another.

And you must always remember that if you have had access to the source code of the existing program under a confidentiality agreement, such copying would likely be trade secret misappropriation even if it is not copyright infringement. Because it may be difficult to determine whether something should be filtered or not, and because unconscious copying can constitute infringement just as if you were looking at the program when you wrote yours, the more exposure you have to an existing computer program, the more care you need to take when writing a similar program.

In the three major cases that have considered reverse engineering of computer programs, *Atari v. Nintendo*,¹¹¹ *Sega v. Accolade*,¹¹² and *Sony v. Connectix*,¹¹³ the appellate courts found that the intermediate copies produced during reverse engineering were a fair use and therefore did not infringe the copyright of the computer program being disassembled. The intermediate copies were necessary to see and understand the unprotected functional aspects of the computer program, and even though the entire program was copied, that was necessary to locate those unprotected expressions.

¹¹¹ 975 F.2d 832, 24 USPQ2d 1015 (Fed. Cir. 1992).

¹¹² 977 F.2d 1510, 24 USPQ2d 1561 (9th Cir. 1992).

¹¹³ 203 F.3d 596, 53 USPQ2d 1705 (9th Cir. 2000).

However, the fact that it is not copyright infringement to produce the intermediate copies necessary in reverse engineering doesn't mean that it will not be a copyright infringement to use protected expression that was learned through reverse engineering in the final computer program.