MIDI Files: Copyright Protection for Computer-Generated Works

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NOTES

MIDI FILES: COPYRIGHT PROTECTION FOR COMPUTER-GENERATED WORKS

Professor Lydian escorts you to his music composition class at the prestigious university you are visiting. You expect a small meeting room with a stereo and a chalkboard, but as you enter the classroom your eyes reveal surprise that you desperately attempt to hide from your colleague. He clearly has entered the modern world while you are left composing on an outdated and cumbersome tool. Your piano will never look the same again.

Students sit at twelve workstations in front of you. Each student wears a set of headphones. Every station has a computer, a keyboard, a drum machine, two sound generators (synthesizers without keyboards), a digital reverb unit, an amplifier, and wires, many wires. The wires run from the keyboard through a little box to the computer and other components of the system. The box has some writing on it: MIDI interface. Two cables connect each station to the speakers in the front of the room. The room is silent except for the light patter of keys striking plastic casings. Some students appear to be virtuosos, with fingers moving rapidly and skillfully over the keyboard. Others hunt and peck at the keyboard with one finger. Can even they compose? At least the familiar chalkboard is still in the front of the room, separating the loud speakers.

Professor Lydian points out that many of the students do not have a music theory background although some are theory majors. As the professor moves to the front of the class, the students remove their headphones. Professor Lydian asks Aaron, one of the virtuosos you had spotted, to play his piece. You hear strings playing a beautiful melody reminiscent of an old folk tune. Woodwinds take over the melody while the strings supply the underlying harmony. The intonation is amazing, almost too perfect. The room fills with a brass entrance and the timpani.
provides a slow rumble into the coda which ends the piece. Where did he find the musicians to record his composition?

Professor Lydian has a second student play his composition. Bob explains that he cannot read music but hopes his piece is enjoyable. A heavy bass drum punctuated by a sharp high-hat bursts from the speakers. Soon the pounding beat is joined by a slap bass and syncopated rhythm guitar. Your foot develops a mind of its own. A horn section accentuates the beat with precision pops. Funkadelic never sounded so good.

"Professor Lydian, not only were these compositions excellent, but the musicianship was unparalleled. Where did you record these compositions?"

"The sounds you heard were produced by synthesizers controlled by information stored in a floppy disk on the computer. The computer and synthesizers communicate by using the MIDI language." Your short visit leaves you yearning for a MIDI studio of your own and pondering the use of such a studio.

Musical Instrument Digital Interface, or MIDI, has had a profound impact on the way music is created, heard, and related to in our society. At least one commentator regards MIDI as "the most important composer's tool since the piano, because you have an entire orchestra at your fingertips."¹ Students experiment with composition at young ages and are able to compose by ear with little instruction in music theory.² MIDI is used not only as a tool for composing, but also to teach harmony and composition.³

Most important, however, a MIDI workstation can rival professional recording studios.⁴ Multitrack recording, unlimited instrumentation, and extensive error correction capabilities permit a musician "of modest means, and limited talent, to

2. Thomas Rudolph, MIDI Goes to School, DOWN BEAT, June 1990, at 59 (noting that in some schools 12- and 13-year-old students are writing original compositions).
3. Alexander Offers Unique College Method, MUSIC TRADES, June 1991, at 105. This author's first music composition class was conducted in a computer music lab using MIDI workstations.
achieve remarkable results." Using a sequencer program, a musician can play a composition, "record" it, and then play it back. The commercial music industry has recognized the value of MIDI to such an extent that there is "hardly a record on the pop charts that has not been shaped and refined through the use of MIDI."

MIDI is not limited to professional use. The availability to the public of "[t]his ability to fine-tune musical data has democratized, if not revolutionized, music-making today." The widespread use of MIDI consequently presents a unique challenge to copyright law because "while the mind strains to think of what Beethoven or Mozart would have made of all of this, one thing is for sure: there will be more music made by more people than ever before," and it will all be stored in a MIDI file on computer disk.

"Above all else, technology now dictates the content of copyright laws and plots its course into the future." More than any event in recent history, MIDI "has changed the face of the music industry." A MIDI file stores data that direct synthesizers to produce sound. When synthesizers execute these directions, a musical composition results. The use of MIDI files, however, raises complex questions: whether the files fall within the subject matter of the Copyright Act of 1976, and if so, what scope of protection copyright law extends to materials subsisting in a MIDI file.

This Note first provides a detailed description of MIDI and focuses on whether a copyright in a computer program protects the original work of authorship the program is designed to generate. In determining whether a MIDI file is within the subject

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5. Events That Shaped the Decade: MIDI & the Microprocessors, Technological Revolution, MUSIC TRADES, Jan. 1990, at 113; see also di Perna, supra note 4, at 167 ("Even the most ham-fisted player can attain perfection after the fact.").


7. Id. at E15.
8. Id. at E16.


matter of the Copyright Act of 1976, this Note provides a brief history of copyright protection and proceeds to examine the legislative history of sections 101 and 102 of the Act. After concluding that a MIDI file is copyrightable as a computer program, this Note examines a split between the federal circuit courts of appeals involving the scope of copyright protection for video games and audiovisual works generated by computer programs. This Note concludes that, in general, a copyright in a computer program does not protect an original work of authorship generated by a computer program, but that a copyright on a MIDI file protects the underlying musical composition. Finally, this Note suggests that Congress amend the Copyright Act of 1976 to include computer-generated original works of authorship.

**WHAT IS MIDI?**

*Industry Protocol*

MIDI, or Musical Instrument Digital Interface, is an industry protocol governing how electronic instruments communicate with each other. Communication occurs in the form of a serial computer language carried between computers and synthesizers by cables. Understanding the nature of the data communicated by MIDI requires a short description of how synthesizers work.

Synthesizers house a microprocessor that contains information required to make a sound. Pressing down on one of the keys in a keyboard creates an electrical impulse of certain voltage. That voltage causes the microprocessor to instruct sound-generating equipment to play a certain pitch. The microprocessor does not differentiate between voltages from different origins; as

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14. *Id.* at E14; *see also* WEINBERG, *supra* note 10, at 4 (describing the MIDI language).
16. *Id.*
17. *Id.*
long as the correct voltage is received, the desired pitch will sound. These electronic impulses can be encoded digitally through a digital-to-analog converter.

MIDI is the computer language that equates digital signals with electronic signals from musical instruments. The music industry created MIDI so that every synthesizer company’s microprocessor would respond to instructions written in MIDI. These instructions include pitch, pitch bend, velocity of the key, patch number (indicating the particular sound or instrument), and any number of specialized effects contained in the synthesizer. Although MIDI instructions eventually cause a synthesizer to generate sound, MIDI does not instruct synthesizers to reproduce a specific sound. A MIDI file is not an audio recording. One music reporter described the MIDI file as follows: “The gestures made on a keyboard are translated into the serial computer language that is MIDI, sent out of the MIDI Out port, are received at the MIDI In port of a second (and third, and fourth, ad infinitum) instrument, and that instrument faithfully reproduces those gestures.”

All computer languages function this way. The language interprets the instructions entered by a human being so that a microprocessor will perform the needed result. MIDI is thus similar to other computer languages in that it provides a formalized method for the composer or programmer to instruct the microprocessor to perform certain actions. MIDI differs from tradition-

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18. Id. at 2-3.
19. Id.
20. See Wyman, supra note 6, at E15; see also WEINBERG, supra note 10, at 4. The language is written in binary code divided into bytes. Id. Each byte has a specific meaning and instructs the microprocessor which function to perform. In the computer world, a language written in binary code is called object code. Id.
21. WEINBERG, supra note 10, at 3. The instruction to play the note Middle C is a good example. All notes on a keyboard have been numbered from zero to 127. Note 60 on the keyboard is Middle C. In binary code note 60 is written as 0011 1100. When the computer receives this binary code, Middle C sounds regardless of the instrument to which the code is directed.
23. Wyman, supra note 6, at E15.
24. Id. The MIDI protocol also includes a segment that permits the composer to select which instrument will sound Middle C.
25. See id.
al computer languages in that the program is created by playing an instrument. That program can find expression in many different ways, depending upon how the synthesizer has been programmed to respond to the instructions.

**MIDI Files**

A MIDI file is created by using a sequencing program. A sequencer makes MIDI especially useful because it is similar to having a multitrack recording studio on a computer. The sequencer “records” digital data, which can then be “played back.” Because MIDI data is recorded on a computer, the composer can display it on the screen and manipulate the data, much as a writer manipulates written text with a word processor. Each track can be recorded or overdubbed in perfect synchronization. The composer can transpose sequences in pitch, velocity, or duration, shift them in time, or invert sequences after recording. A composer can edit note by note, rearrange passages using cut and paste functions, and easily fix any mistakes that occurred while recording. The particular patch (sound) also can be changed, either entirely or by just one parameter, such as “decay.”

The ability to create a MIDI file therefore presents many advantages for a composer. The composition is immediately realizable without acoustic instruments. The composer easily can change key and tempo, and effortlessly experiment with tone color. In addition, because sequences are called up and reiterated easily, the composer can explore the formal dimensions of music. The composer can restructure an entire work

26. Id.
27. See supra text accompanying notes 20-24. Although patch number may be indicated, the correlation between patch number and the sound produced may be varied at the synthesizer itself.
29. Playing back causes a synthesizer to sound the notes that were just recorded.
32. Id.
33. Wyman, *supra* note 6, at E15. Decay indicates how quickly a note will stop sounding, or fade out.
with little difficulty. In all of these cases, the data being manipulated is a set of ordered instructions written in the MIDI language.

A MIDI file is in essence a computer program stored in object code that can instruct synthesizers to reproduce a musical composition. Principles governing the ability to copyright computer programs have developed out of the Copyright Act, its legislative history, and judicial decisions. Some of these principles are settled law, but others have split the courts and leave in question the extent of copyright protection available to a MIDI file.

HISTORY OF COPYRIGHTABLE SUBJECT MATTER

Specific Enumeration of Copyrightable Works

The Constitution grants Congress the "Power ... To promote the Progress of Science ... by securing for limited Times to Authors ... the exclusive Rights to their Writings." The most significant limitation in the Copyright Clause is that only works qualifying as "writings" may claim protection of federal copyright legislation.

Initially, Congress specifically enumerated which works qualified as writings. The first Congress protected "any map, chart, book or books already printed." Congress expanded the protectable subject matter of copyright during the nineteenth century by adding designs, prints, etchings and engravings, musical compositions, photographs and the negatives thereof, and "statuary [and] models or designs intended to be perfected as works of the fine arts." In 1908, the congressional effort to extend copyright protection to improvements in technology hit a roadblock. In *White-Smith Music Publishing Co. v. Apollo Co.*, the Supreme Court determined that the piano roll used in a player piano was not a copy of the musical composi-

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34. U.S. Const. art. I, § 8, cl. 8.
35. 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 1.08[A] (1992).
36. Act of May 31, 1790, ch. 15, § 1, 1 Stat. 124, 124 (repealed 1831).
38. 209 U.S. 1 (1908).
In declining to extend copyright protection to piano rolls, the Court held that the form in which a work is fixed must be intelligible to human beings to warrant such protection, and further that an interchangeable part of a machine is not a copy. In other words, no copyright existed in mechanical reproductions of musical works.

General Description of Subject Matter

Works Intelligible to Human Beings

Congress abandoned its attempt to list copyrightable works in 1909 and provided instead a generalized description of copyrightable subject matter. Copyright protection under the Act may be obtained for all "writings" of an author. The Copyright Act of 1909 entitled the author to a copyright protecting the composition embodied in mechanical reproductions, but not with respect to the mechanical reproductions themselves. Such reproductions included piano rolls, records, and tapes. Congress extended copyright protection to sound recordings in 1971, thereby overruling part of White-Smith by making interchangeable parts of a machine copyrightable. The sound recording copyright was limited to the actual sounds recorded (the specific expression) and not the underlying musical work. For a copyright to subsist in the musical work itself, the work still had to be intelligible to human beings.

39. Id. at 18.
40. Id.
41. Id.
44. See id., see also Ernest S. Meyers, Sound Recordings and the New Copyright Act, 22 N.Y.L. SCH. L. REV. 573, 573-76 (1977) (providing the historical developments leading to the Sound Recording Act of 1971).
46. Id.
47. Id.
Works Not Intelligible to Human Beings

The Court in Goldstein v. California\textsuperscript{48} recognized Congress' constitutional authority to redefine "writings" to include works not intelligible to human beings.\textsuperscript{49} Goldstein concerned a challenge to a California statute that made record pirating a crime, on the grounds that the Copyright Act preempted the subject matter of the state criminal statute.\textsuperscript{50} In upholding the statute, the Court held that Congress could have acted in the area, but had refrained from doing so.\textsuperscript{51} Congress has the discretion to determine what constitutes a "writing" for the purpose of protection under the federal copyright law.\textsuperscript{52} The congressional determination concerning what constitutes a "writing" "is dependent, not only on the character of the writing, but also on the commercial importance of the product to the national economy."\textsuperscript{53} Congress, therefore, has the authority to redefine "writings" to include sound recordings and other works not intelligible to human beings.

The Copyright Act of 1976

The Copyright Act of 1976\textsuperscript{54} finally overruled White-Smith by providing that a writing need not be intelligible to human beings to be eligible for copyright protection. A work is within the subject matter of the Copyright Act if it is an "original work[] of authorship fixed in a tangible medium of expression from which [the work] can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or

\textsuperscript{48} 412 U.S. 546 (1973).
\textsuperscript{49} See id. at 561-62.
\textsuperscript{50} See id. at 548-52.
\textsuperscript{51} Id. at 571.
\textsuperscript{52} Id. at 562.
\textsuperscript{53} Id., see also 1 NIMMER & NIMMER, supra note 35, § 1.08[A], at 1-44.33 (noting that the broad construction given to "writings" in Goldstein is consistent with Judge Learned Hand's statement in Reiss v. National Quotation Bureau, 276 F 717 (S.D.N.Y. 1921). As Nimmer states, " 'Writings' must be given a content sufficient to encompass the artistic and technological developments of a contemporary society." Id.
device." Section 102 indicates that works of authorship include musical works and sound recordings.

A MIDI file must satisfy the requirements of section 102 to be within the subject matter of the Copyright Act. A MIDI file, therefore, must meet the fixation requirement in order to be copyrightable. Section 102 describes this requirement as follows: "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." To fit this definition, a MIDI file must be the embodiment of a work in a "copy" or "phonorecord." Because a MIDI file is not a "material object in which sounds are fixed," it is not a phonorecord. A MIDI file, therefore, must be a "fixed" "copy" of some work, in order to be copyrightable.

The work copied by a MIDI file may be characterized in any of three ways, each resulting in different legal consequences. First, the set of instructions stored in object code could be a work in and of itself. Second, the set of instructions could be considered a copy of the musical work. Lastly, the MIDI file could be a copy of the musical work, and the musical work could also be a copy of the MIDI file. The three possibilities describe fine distinctions in the nature of the copyrightable work, but these distinctions will prove significant in determining the scope of copyright protection granted to a MIDI file. An analysis of copyright protection for a MIDI file is best understood by limiting

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56. Id. § 102(a)(2).
57. Id. § 102(a)(7).
58. For the purposes of this Note, a MIDI file and the musical work it generates are assumed to be "original works of authorship," id. § 102(a), in order to eliminate questions of infringement.
59. Id. § 101.
60. Id.
61. See supra text accompanying notes 20-27.
63. See infra notes 66-92 and accompanying text.
64. See infra notes 93-124 and accompanying text.
65. See infra notes 226-45 and accompanying text.
the MIDI file to its most discreet characterization as instructions stored in object code, or a computer program.

COPYRIGHT PROTECTION FOR COMPUTER PROGRAMS

Computer programs written in source code and object code are copyrightable. Courts consistently have held that the language and history of the Copyright Act of 1976 indicate congressional intent to overrule White-Smith and to extend copyright protection to computer programs. The analysis is relatively straightforward. An "original work[] of authorship fixed in any tangible medium of expression" is copyrightable subject matter.

The Copyright Act enumerates seven such categories of works of authorship, including "literary works" defined as "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, discs, or cards, in which they are embodied." Legislative history states that computer programs were considered copyrightable under this definition. In addition, Congress appointed a Commission on New Technological Uses (CONTU) to study computer uses of copyrighted works and enacted a temporary provision, section 117, in the 1976 Copyright Act concerning such computer uses pending the commission's report and recommendations.

66. 1 NIMMER & NIMMER, supra note 35, § 2.04[C].
67. See Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1248 (3d Cir. 1983) (holding that a computer program, whether in object or source code, is protected under the Copyright Act), cert. dismissed, 464 U.S. 1033 (1984); Williams Elecs., Inc. v. Artic Int'l, Inc., 685 F.2d 870, 876-77 (3d Cir. 1982) (holding that the duplication of a computer program on a silicon chip was a "copy" of the program under the Copyright Act); Stern Elecs., Inc. v. Kaufman, 669 F.2d 852, 855-56 (2d Cir. 1982); see also Midway Mfg. Co. v. Strohon, 564 F Supp. 741, 750-51 (N.D. Ill. 1983) (extending copyright protection to video games).
69. Id. § 101.
70. See H.R. REP. No. 1476, 94th Cong., 2d Sess. 54 (1976), reprinted in 1976 U.S.C.C.A.N. 5659, 5667 ("literary works" include[] computer programs").
72. See H.R. REP. No. 1476, at 116, reprinted in 1976 U.S.C.C.A.N. at 5731 (stating that § 117 applied only to the scope of protection accorded to copyrighted works
The CONTU Report

CONTU recommended that Congress explicitly provide that computer programs are the proper subject matter of copyright. To this end, CONTU suggested two changes. First, Congress should replace section 117 with a section limiting exclusive rights in computer programs to ensure that rightful possessors of copies of computer programs may use or adapt these copies for their use. Second, CONTU recommended adding a definition of computer programs to section 101.

Congress adopted the two suggestions in 1980, defining a computer program as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result." The statutory language indicates that a computer program is copyrightable even though it is used "directly" in a computer, as object code is. In addition, the majority position in the CONTU report, from which Congress adopted the definition, was that object code is a proper subject matter of copyright. Section 102 has always included works which can be "perceived, reproduced, or otherwise communicated, either directly or with the aid of machine or device." Sections 101 and 102 and the accompanying legislative history indicate that computer programs, whether in object or source code, are works of authorship.

73. NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, FINAL REPORT 1 (1979) [hereinafter CONTU REPORT] ("Computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright.").
74. Id. at 12-14.
75. Id.
76. Act of Dec. 12, 1980, Pub. L. No. 96-517, § 10, 94 Stat. 3015, 3028 (codified at 17 U.S.C. § 117 (1988)) ("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.").
78. CONTU REPORT, supra note 73, at 21. The minority position argued that the machine control phase is not directed at a human audience and is therefore not an original work of authorship. Id.
80. Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1248 (3d
Fixation

The determination that a computer program is copyrightable subject matter leaves a final requirement of the Copyright Act to be fulfilled. The computer program must be embodied in a "copy." The Act 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 machine or device."

Computer programs are perceived with the aid of a computer, which leaves the question of whether the computer program is "fixed." The Act describes a "fixed" work as one found in a "tangible medium of expression" and whose "embodiment in a copy is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration." A program, therefore, is "fixed" when stored in the memory devices of the computer.

Copyrighting a MIDI File as a Computer Program

Based on the above discussion, a MIDI file is copyrightable as a computer program because it consists of a set of instructions used directly by a computer (the synthesizer) to play a musical work. Unlike a word processor's files, which store text, musical notation is not stored. Rather, a MIDI file instructs synthesizers to execute specific gestures in a particular sequence. The copyright owner is entitled to the exclusive rights enumerated in section 106 of the Copyright Act. Infringement of the copy-
right occurs when the exclusive rights of the copyright owner, as defined in sections 106 through 118 are violated.87 As a result, whenever an unauthorized copy or phonorecord is produced, an infringement has occurred.88 Thus, the "copyrighted work" is protected from copying. In the case of computer programs in general and the MIDI file in particular, the copyrighted work is difficult to discern. The text of the computer program is copyrightable as discussed above, but that program, the MIDI file, generates a musical work that also is copyrightable if properly fixed.89 The potential for two copyrightable works presents the dilemma of whether a copyright on the MIDI file protects the musical composition from being copied or whether the musical composition must be copyrighted separately. Phrased in accordance with the Copyright Act, the issue is whether the MIDI file is a "copy" of the musical work.

Courts have struggled with a similar question regarding audiovisual displays created by computer programs for both video games and user interfaces. The early cases asked whether a copyright on the audiovisual display protected the computer program.90 Later the question became whether a copyright on the computer program protected the audiovisual display.91 An

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Subject to sections 107 through 120, the owner of copyright under this title has the exclusive rights to do and to authorize any of the following: (1) to reproduce the copyrighted work in copies or phonorecords; (2) to prepare derivative works based upon the copyrighted work; (3) to distribute copies or phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending; (4) in the case of literary, musical, dramatic, and choreographic works, panto- mimes, and motion pictures and other audiovisual works, to perform the copyrighted work publicly; and (5) in the case of literary, musical, dramatic, and choreographic works, panto- mimes, and pictorial, graphic, or sculptural works, including individual images of a motion picture or other audiovisual work, to display the copyrighted work publicly.

87. Id. § 501(a).
88. 2 NIMMER & NIMMER, supra note 35, § 8.02(C).
90. Id. § 102(a)(2); see also supra notes 81-84 and accompanying text. This Note has assumed that the musical composition is an original work of authorship under this section of the Act.
91. See infra text accompanying notes 105-24.
92. See infra text accompanying notes 154-74.
examination of the audiovisual display, or video game, cases will provide much insight into the protection afforded a MIDI file. In both instances the problem reduces to whether a copyright on a computer program protects the original work of authorship generated by the program.

THE VIDEO GAME CASES

Video Games "Fixed" in ROM

The plaintiff in Midway Manufacturing Co. v. Artic International, Inc. registered its copyrights on two video games as audiovisual works, but not as computer programs. In the ensuing action Midway sought a preliminary injunction barring Artic from distributing a video game called Puckman and a speed-up kit for the video game Galaxian. Midway claimed copyright protection "only in the series of images and sounds appearing on the screen on the Galaxian and the Pac-Man games." Artic contended that the video games were not "fixed" as required by section 102(a) of the Copyright Act. The contention was that symbols or patterns contained in the ROMs were combined by the microprocessor in various ways to create the images seen on the screen. Artic, therefore, argued that the computer was generating new unfixed images at all times.

The court determined that the audiovisual display could be "reproduced with the aid of a machine or device' over and over again, for extended periods of time," and was "re-
Copyright protected the original artistic expression displayed on the screen of Midway’s games, even though the underlying computer program had not been copyrighted. The court found that specific images, namely the Pac-man figures and ghost figures, were stored in ROM and combined by the microprocessor to form the completed image on the computer screen.

In actuality, the ROM stored a computer program capable of generating the images displayed on the game screen. This factual misperception weakens the court’s conclusion because the court believed that the elements of the display were recorded on the ROM and merely assembled into different formations by the microprocessor. The ROM itself stores no images, only instructions on how to generate them. The link between the audiovisual display and the ROM is more tenuous than the court believed. The court’s reasoning, however, is applicable even to a computer program. The video game could be reproduced over and over with the aid of a computer regardless of whether the images were stored in the ROM or not.

**Video Games Protected Without Copyright on Underlying Computer Program**

The court in *Midway Manufacturing Co. v. Dirkschneider* did not suffer from the misperception noted above. Rather, it held that audiovisual works are fixed in printed circuit boards because they are tangible objects from which the audiovisual works can be perceived for a time period that is more than transitory. This case, however, presented a challenge not voiced

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100. Id. at 1008.
101. Id. at 1009.
102. Id. at 1007; see also supra text accompanying note 85. Regarding the text accompanying supra note 98, “symbols” and “patterns” are unlikely terms to be used in reference to a computer program, but such an interpretation is possible. See *Midway*, 547 F Supp. at 1007 (“Artic notes that the ROMs in the video games do not contain enough memory to store the entire picture that appears on the game’s screen at any one instant.”).
104. Id.
106. Id. at 480.

The defendants in *Dirkschneider* contended that the suit was brought not to prevent infringement of the plaintiff's audiovisual works, but rather to protect the computer programs contained in the circuit boards. The defendants argued, "[s]ince the computer programs are not the subject of a copyright registration the plaintiff [Midway] cannot bring the action." The court held that a failure to obtain copyright registrations on the computer programs underlying audiovisual works did not preclude a suit for infringement of the audiovisual works because a computer program is a fixed copy of the audiovisual work.

**Computer Program a "Copy" of the Video Game**

*Williams Electronics, Inc. v. Artic International, Inc.* provides the clearest analysis of why a video game is protected under an audiovisual display copyright. Williams sued Artic for infringement of its copyright on its "Defender" video game because Artic was selling circuit boards containing a computer program that generated a game identical to Williams' Defender. Artic contended that Defender was not "fixed," and therefore not protected by copyright. The court stated that a computer program is a fixed copy of the audiovisual work because

"[t]he [video game's] display satisfies the statutory definition of an original 'audiovisual work;' and the memory devices of the game satisfy the statutory requirement of a 'copy' in which the work is 'fixed.' The audiovisual work is permanently embodied in a material object, the memory devices, from

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108. See *Dirkschneider*, 543 F Supp. at 481.
109. Id.
110. See *id.* (citing Stern Elecs., Inc. v. Kaufman, 523 F Supp. 635, 638-39 (E.D.N.Y. 1981), aff'd, 669 F.2d 852 (2d Cir. 1982)).
111. 685 F.2d 870 (3d Cir. 1982).
112. See *id.* at 871-73.
113. Id. at 873.
which it can be perceived with the aid of the other components of the game."\textsuperscript{114}

**Copying the Underlying Computer Program**

*M. Kramer Manufacturing Co. v. Andrews*\textsuperscript{115} presented a new question regarding the scope of protection afforded by the audiovisual copyright on a video game.\textsuperscript{116} In *Kramer*, the plaintiff claimed that the defendant had infringed the plaintiff's copyright in a video game, "High-Lo Double Up Joker Poker," by copying not only the audiovisual aspects of the game, but also the underlying computer program.\textsuperscript{117} The plaintiff asked the court to determine whether a copyright on the audiovisual display protected the computer program from being copied. Citing *Williams* and *Stern Electronics, Inc. v. Kaufman*\textsuperscript{118} approvingly, the court held that a computer program was a copy of the plaintiff's audiovisual work even though it could be copyrighted separately.\textsuperscript{119} Because section 106(1) of the Copyright Act grants the copyright holder the exclusive right to reproduce copies or derivative works, a copyright in an audiovisual display generated by a computer program protects both the audiovisual display itself and the underlying computer program to the extent the game's expression is embodied in the program.\textsuperscript{120}

The computer program or "memory device" is the form in which the audiovisuals are "permanently embodied" and are fixed in a tangible medium of expression "capable of being" reproduced or otherwise communicated, "either directly or with the aid of a machine or device." The "memory device," or computer program, is an essential element of the audiovisual copyright, satisfying the "fixation" requirement for the issuance of a copyright and, as a "copy," \textit{within the statutory

\textsuperscript{114} Id. at 874 (alteration in original) (quoting Stern Elecs., Inc. v. Kaufman, 669 F.2d 852, 855-56 (2d Cir. 1982)); see also supra text accompanying notes 76-85.  
\textsuperscript{115} 783 F.2d 421 (4th Cir. 1986).  
\textsuperscript{116} See id. at 441-42.  
\textsuperscript{117} Id. at 425.  
\textsuperscript{118} 523 F Supp. 635 (E.D.N.Y. 1981), aff'd, 669 F.2d 852 (2d Cir. 1982).  
\textsuperscript{119} Kramer, 783 F.2d at 441-42.  
\textsuperscript{120} Id. at 442.
A computer program thus was protected by the copyright on an audiovisual display generated by the program.

Kramer raises a number of additional questions due to its unique factual setting. Kramer, who had obtained the audiovisual copyright on the video game, was sued for infringement by another company holding a copyright on the underlying computer program. The parties to that litigation settled and assigned the right to sue Andrews to Kramer. Through settlement, the parties had avoided the question of the scope of protection granted by a copyright on a computer program that generates an original audiovisual work. The court in Kramer held that a computer program is a copy of the audiovisual work, but did not decide whether the audiovisual work is a copy of the computer program. Copies are the "material objects in which a work is fixed." A copyright on a computer program presents a unique problem because a copyright of the computer program subsists in the "set of statements or instructions used directly or indirectly in a computer." These instructions generate a work, but whether that work is a copy of the set of instructions has perplexed the courts.

The Scope of Protection Granted to Computer Programs

Protecting the Nonliteral Aspects of a Computer Program

The federal courts of appeals first examined the scope of protection granted by a copyright in a computer program in Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc. Jaslow Dental Laboratory ("Jaslow Lab") hired Strohl Systems Group ("Strohl") to design and install a computer system that would perform bookkeeping and administrative functions. Elaine

121. Id. at 441.
122. Id. at 429.
124. Id.
126. Id. at 1225.
Whelan, a part owner of Strohl, wrote a computer program called Dentalab for Jaslow Lab.\textsuperscript{127} Ms. Whelan then formed Whelan Associates, which acquired Strohl's interest in the program.\textsuperscript{128} Two and one-half years later, Jaslow Lab developed a computer program called Dentcom PC that performed largely the same functions as Dentalab, but was written in a different language so that smaller dental firms could use it on their computers.\textsuperscript{129} The district court ruled that the Dentcom program infringed the Dentalab program "because its structure and overall organization were substantially similar,"\textsuperscript{130} even though the Dentcom program did not copy Dentalab's source or object code because it was written in a different language.\textsuperscript{131}

The appeal addressed the sole issue of whether a copyright protection on a computer program covers "the structure of the program or only the program's literal elements, i.e., its source and object codes."\textsuperscript{132} The court of appeals first stated that computer programs are copyrighted as "literary works"\textsuperscript{133} and that copyright infringement of other literary works is possible even without a finding that the literal elements of the works bear a substantial similarity\textsuperscript{134} For example, the copyright on a play or book is violated by copying its plot or plot devices.\textsuperscript{135} By analogy, infringement of the copyrights of computer programs can occur even without copying of the literal elements of the program.\textsuperscript{136}

\textsuperscript{127} Id. at 1225-26.
\textsuperscript{128} Id. at 1226.
\textsuperscript{129} Id. Dentalab was written in a computer language known as EDL so that it would work with IBM Series One computers. Dentcom PC was written in the BASIC language because many smaller dental firms did not use IBM Series One computers. Id.
\textsuperscript{130} Id. at 1228-29. The court found the programs to be similar in three respects: the file structures and screen outputs were virtually identical and, five important subroutines were performed almost identically. Id. at 1242-45.
\textsuperscript{131} Id. at 1233.
\textsuperscript{132} Id. at 1234.
\textsuperscript{133} Id., see supra notes 66-84 and accompanying text (discussing the copyright protection afforded to computer programs).
\textsuperscript{134} Whelan Assocs., 797 F.2d at 1234.
\textsuperscript{135} Id.
\textsuperscript{136} Id.
The court then derived a rule for distinguishing idea from expression in the computer program context. The purpose or function of a utilitarian work would be the work's idea and everything that is not necessary to that purpose or function would be part of the expression of the idea. If a variety of means are available for achieving the desired purpose, then the specific means chosen is not necessary to the purpose. The chosen means, then, is expression and not idea. The rule was intended to advance the basic rationale underlying the idea/expression distinction: the balance between competition and protection.

Among the more significant costs in computer programming are those attributable to developing the structure and logic of the program. The rule proposed here, which allows copyright protection beyond the literal computer code, would provide the proper incentive for programmers by protecting their most valuable efforts, while not giving them a stranglehold over the development of new computer devices that accomplish the same end.

Because a number of noninfringing programs that incorporated many of the same ideas and functions were available for the business management of dental laboratories, the court concluded that the structure of the Dentalab program was not the idea, but rather, part of the expression of the program. The court explained its conclusion by stating that "[t]he 'expression of the idea' in a software computer program is the manner in which the program operates, controls and regulates the computer in receiving, assembling, calculating, retaining, correlating, and

137. Id. at 1235. The defendants argued that the structure of a computer program was, by definition, the idea underlying the computer program and not expression of the idea. Id., see also 17 U.S.C. § 102(b) (1988) ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").
138. Whelan Assocs., 797 F.2d at 1236 (emphasis omitted).
139. Id.
140. Id.
141. Id. at 1237.
142. Id. (footnote omitted).
143. Id. at 1238-39.
producing useful information either on a screen, printout or by audio communication."\textsuperscript{144}

\textit{Whelan Associates} is important because it is the first circuit court case to deal with the scope of protection afforded by a copyright on a computer program. The court extended copyright protection beyond the literal code of the computer program to the "structure, sequence, and organization" of that code.\textsuperscript{145} The passages in which the court stated that screen outputs generated by computer programs cannot be direct evidence of copyright infringement of computer programs emphasized the limited nature of the holding.\textsuperscript{146} Screen displays have "some probative value"\textsuperscript{147} because of their relation to the underlying program, but are not direct evidence of infringement.\textsuperscript{148} The holding did not extend protection beyond elements contained in the written program code,\textsuperscript{149} or "set of statements or instructions."\textsuperscript{150}

\textit{Screen Displays as Nonliteral Aspects of a Computer Program}

Once copyright protection was afforded to nonliteral aspects of a computer program, the next logical question was whether the same copyright protected the screen display generated by a copyrighted computer program. Courts generally have dealt with this issue in cases involving similar user interfaces generated by different computer programs.\textsuperscript{151} The courts have split in their determination, some holding that user interfaces are protected

\begin{footnotesize}
\begin{itemize}
\item[144.] \textit{Id.} at 1239 (quoting \textit{Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc.}, 609 F Supp. 1307, 1320 (E.D. Pa. 1985)). The court found additional support for this conclusion in \textit{17 U.S.C. § 103} (1988), which extends copyright protection to compilations and derivative works. The definitions of these terms indicated "that Congress was aware of the fact that the sequencing and ordering of materials could be copyrighted, \textit{i.e.}, that the sequence and order could be parts of the expression, not the idea, of a work." \textit{Whelan Assocs.,} 797 F.2d at 1239.
\item[145.] \textit{Id.} at 1248.
\item[146.] \textit{See id.} at 1244 (discussing the different treatment accorded screen outputs and computer programs under the copyright law).
\item[147.] \textit{Id.}
\item[148.] \textit{Id.}
\item[149.] \textit{Id.} at 1248 (including the computer program's structure, sequence, and organization).
\item[151.] \textit{See infra} notes 154-86 and accompanying text.
\end{itemize}
\end{footnotesize}
by a copyright on a computer program, others holding user interfaces beyond the scope of copyright protection on a computer program. An examination of these cases will provide the basis for determining the scope of copyright protection afforded to a computer program.

Broderbund Software, Inc. v. Unison World, Inc.

Broderbund Software, Inc. v. Unison World, Inc. placed the issue of whether user interfaces were protected by a copyright on the computer program squarely before the court. The plaintiff, Broderbund Software ("Broderbund"), held the exclusive licenses, and plaintiff, Pixellite Software ("Pixellite"), held the exclusive copyright on a computer program called "The Print Shop." The defendant, Unison World ("Unson"), sold a computer program called "The Printmaster." Both pieces of software were menu-driven programs designed to enable users "to create customized greeting cards, signs, banners, and posters." Broderbund claimed that "the overall appearance, structure, and sequence of the audiovisual displays in 'Printmaster' infringe[d] plaintiffs' copyright on 'Print Shop.'"

The court first determined that the "Print Shop" user interfaces were copyrightable expression distinguishable from the idea underlying the menu screens, input formats, and sequencing of screens, which are not copyrightable. It then proceed-

152. See, e.g., Johnson Controls, Inc. v. Phoenix Control Sys., Inc., 886 F.2d 1173, 1175 (9th Cir. 1989).
155. Id. at 1130.
156. Id. at 1129-30.
157. Id. at 1130.
158. Id.
159. Id.
160. Id. at 1132-33; see also 17 U.S.C. § 102(b) (1988). An examination of this determination is beyond the scope of this Note. Because all copyrightable works must pass the idea-expression test, this Note is concerned only with the question of whether a computer generated work is protected by a copyright on the underlying computer program, assuming the generated work is copyrightable expression.
ed to compare two decisions involving alleged copyright infringement of computer programs: Synercom Technology v. University Computing Co.\textsuperscript{161} and Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.\textsuperscript{162}

The court in Synercom Technology held that the idea underlying input formats, which are a type of screen display, and the expression of that idea were indistinguishable.\textsuperscript{163} The input formats therefore were not copyrightable expression.\textsuperscript{164} The court in Broderbund Software rejected this position and held that copyright protection of a computer program extended to its audiovisual displays.\textsuperscript{165} The court based its holding on an interpretation of Whelan Associates that viewed the case as standing for "the proposition that copyright protection is not limited to the literal aspects of a computer program, but rather that it extends to the overall structure of a program, including its audiovisual displays."\textsuperscript{166} Not only is this interpretation of Whelan Associates erroneous, the court in Broderbund Software also confused fundamentally different legal questions and made an illegitimate comparison of cases.

Synercom Technology addressed the question whether a particular audiovisual display (input formats) was copyrightable expression separable from the idea underlying the formats.\textsuperscript{167} Whether the holding was correct, this issue is not discussed in Whelan Associates. Instead, Whelan Associates addressed the question whether the copyright of a computer program protected just the source and object codes or if instead protection extended to the structure and organization of the copyrighted program.\textsuperscript{168} The right in Whelan Associates relates to the nonliter-

\textsuperscript{161} 462 F Supp. 1003 (N.D. Tex. 1978).
\textsuperscript{162} 797 F.2d 1222 (3d Cir. 1986).
\textsuperscript{163} See Synercom Technology, 462 F Supp. at 1013-14.
\textsuperscript{164} Id. at 1014.
\textsuperscript{165} Broderbund Software, 648 F Supp. at 1133.
\textsuperscript{166} Id.
\textsuperscript{167} Synercom Technology, 462 F Supp. at 1013. The court in Broderbund Software should have used this case in the first step of its analysis.
\textsuperscript{168} See supra notes 125-50 and accompanying text. A determination of whether the overall organization of a computer program was idea or expression was required in Whelan Associates, as in all copyright cases, but the court was looking at the structure of the text, not the audiovisual display. The display was only used as
al elements of the computer program itself. Those nonliteral elements do not necessarily include the screen display.

Support for this proposition is found in *Computer Associates International v. Altai, Inc.* 169 In that case, Computer Associates sued Altai for infringing the structure of its “Adapter” computer program. 170 The Second Circuit concluded that nonliteral aspects of computer programs, such as the structure, fell within the scope of copyright protection, but suggested that nonliteral elements of computer programs did not include screen displays. 171 The court stated:

> We have no reservation in joining the company of those courts that have already ascribed to this logic [that the nonliteral aspects of a computer program are protected by copyright].

> [W]e note that our decision here does not control infringement actions regarding categorically distinct works, such as certain types of screen displays. These items represent products of computer programs, rather than the programs themselves, and fall under the copyright rubric of audiovisual works. 172

The court’s holding in *Broderbund Software*, therefore, is based on a misinterpretation of the Third Circuit’s holding in *Whelan Associates* and on confusion over the appropriate analysis. 173

*Synercom Technology* and *Whelan Associates*, however, did examine the appropriate issues: whether a screen display is copyrightable expression separable from an underlying idea, and whether copyright protection on a computer program extends to the audiovisual work generated by the program. *Altai* embodies this two-step approach. The preliminary question requires application of an established doctrine and depends on the specific work and art being applied. 174

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Evidence of similarity in the infringement action.

169. 982 F.2d 693 (2d Cir. 1992).
170. *Id.* at 696-97.
171. *Id.* at 702-03.
172. *Id.*
174. See *Baker v. Selden*, 101 U.S. 99, 103-04 (1879) (holding that where the work
tion is necessary because the generated work may be inseparable from the idea underlying that work.

Extending the scope of copyright protection of computer programs to generated works is based on the unique technology used and an interpretation of the Copyright Act. Discerning how far copyright protection of nonliteral elements of a computer program extends is essential to determining whether a copyright on a MIDI file protects the musical work generated. The musical work, similar to a screen display or video game, is generated by the MIDI file, or computer program. If copyright protection for the computer program does not extend beyond the code stored in a MIDI file, the musical work may not be protected. The following cases present the two competing positions.

**CONGRESSIONAL LIMITATIONS ON THE SCOPE OF COPYRIGHT PROTECTION GRANTED TO COMPUTER PROGRAMS**

*Protection Limited to the “Set of Statements or Instructions”*

The court in *Digital Communications Associates v. Softklone Distributing Corp.*[^175] held “that copyright protection of a computer program does not extend to screen displays generated by the program.”[^176] The court rejected the interpretation of *Whelan Associates* used by the court in *Broderbund Software* for the reasons discussed above[^177] and then turned to an analysis of *M. Kramer Manufacturing Co. v. Andrews*,[^178] holding that a copyright on the audiovisual display of a video game protected the underlying computer program from copying.[^179] The basis for this conclusion was that a computer program is a copy in which the audiovisual screen display is fixed.[^180] However, a variety of separate and independent computer programs can gener-

[^176]: Id. at 455.
[^177]: See supra text accompanying notes 161-68.
[^178]: 783 F.2d 421 (4th Cir. 1986).
[^179]: Softklone, 659 F Supp. at 456.
[^180]: Id.
ate the same screen display. The court thought it "illogical to conclude that a screen can be a 'copy' of many different programs." The unusual nature of computers explains the apparent anomaly created by holding that a computer program is a "copy" of a screen display, but a screen display is not a copy of a computer program.

The distinction between programs and screen displays lies in the fact that if one has a fixed computer program, one can, with the aid of a computer, repeatedly produce the same screen display. Thus, a computer program is a copy of a screen display. The converse, however, is not true. If one has a fixed screen display, one cannot, even with the aid of a machine, repeatedly create the same program (source or object code) as many different programs can create the same screen display.

Screen displays generated by computer programs are not protected by a copyright on a computer program because they "are not direct 'copies' or 'reproductions' of the literary or substantive content of the computer programs." The court's holding in Softklone is consistent with those cases relying on a separate audiovisual copyright to protect video games from copying.

Softklone draws a line between the computer program as a literary work and the output generated by the program. Two distinct works exist, but due to the unique nature of computers, the computer program can be a copy of the screen display even though the screen display cannot be a copy of the computer program.

MIDI files resemble video games and screen displays in this respect because two distinct works, the MIDI file and the musical composition, exist. The MIDI file, or computer program, is the form in which the musical work is permanently embodied and fixed in a tangible medium of expression capable of being

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181. Id.
182. Id.
183. Id. at 455.
184. Id., see supra text accompanying notes 91-124.
186. Id. at 456.
reproduced with the aid of a computer and synthesizer. Under the rationale outlined in Softklone, because a MIDI file creates two separate works, the scope of copyright protection granted by a copyright on a MIDI file depends on whether the musical composition is a copy of the MIDI file. Softklone’s reasoning is persuasive if one accepts that the original work of authorship created by the programmer is solely the text of the computer program. A computer program and the output it generates, however, might be considered part of one single work.

**Extending Protection Beyond the Code**

The Ninth Circuit implicitly characterized a computer program and its output as one work in *Johnson Controls v. Phoenix Control Systems*. The court held that the test of whether copyright protected an element of a computer program depended on whether the element qualified as the expression of an idea rather than as the idea itself. The court based its holding on the fact that computer programs consist of several different elements, including the source and object codes, the structure, the sequence and organization of the program, the user interface, and the purpose of the program. Whether the nonliteral elements of the program are protected depends on the particular facts of each case and on whether the element is an expression or an idea.

**The Idea/Expression Test for Protected Elements of Computer Programs**

*Lotus Development Corp. v. Paperback Software International* presents a detailed legal analysis supporting the idea/expression test as the only limit on protecting nonliteral elements of a computer program. Beginning with the general

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187. 886 F.2d 1173, 1175 (9th Cir. 1989).
188. *Id.*
189. *Id.*
190. *Id.*
192. *Id.* at 53-62.
proposition that original, literal manifestations of a computer program, the source and object code, were copyrightable as literary works,\textsuperscript{193} the court proceeded to examine the Copyright Act to determine whether Congress had intended to protect screen displays by a copyright in the underlying computer program.\textsuperscript{194} Computer programs, like all other works of authorship, are not entitled to an unlimited scope of copyright.\textsuperscript{195} The most relevant limitation is contained in the Copyright Act: "In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."\textsuperscript{196} The House Report declared that "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 process or methods embodied in the program are not within the scope of the copyright law."\textsuperscript{197}

Recognizing that the Copyright Act of 1976\textsuperscript{198} did not adequately address copyright protection for computer programs, Congress appointed CONTU to study and compile data on the use of copyrighted works in conjunction with computers and other new technologies.\textsuperscript{199} CONTU recognized the importance of protecting computer programs,\textsuperscript{200} but did not propose any statutory changes with respect to the copyrightability of com-

\begin{enumerate}
\item \textsuperscript{193} Id. at 45.
\item \textsuperscript{194} Id. at 47-54. Much of the opinion in \textit{Lotus} tracks legislative history that this Note previously discussed in connection with the copyrightability of the literal aspects of a computer program, \textit{see} supra notes 34-57 and accompanying text, but reiteration is appropriate in order to understand the reasoning behind extending copyright protection of computer programs to screen displays.
\item \textsuperscript{195} \textit{Lotus}, 740 F. Supp. at 49.
\item \textsuperscript{196} Id. (quoting 17 U.S.C. § 102(b) (1988)).
\item \textsuperscript{198} Id. (citing H.R. REP NO. 1476, at 116, \textit{reprinted in} 1976 U.S.C.C.A.N. at 5731).
\item \textsuperscript{199} Id. at 49-50 (citing Act of Dec. 31, 1974, Pub. L. No. 93-573, § 201(b)-(c), 88 Stat. 1873, 1873-74 (establishing the National Commission on New Technological Uses of Copyrighted Works)).
\item \textsuperscript{200} Id. at 50 (citing CONTU REPORT, \textit{supra} note 73, at 20-21).
\end{enumerate}
puter programs.\textsuperscript{201} The Commission did recommend two amendments with respect to \textit{permissible copying} of computer programs.\textsuperscript{202} The proposed amendments were then adopted by Congress with little modification or additional legislative history.\textsuperscript{203} The definition of a computer program was added to section 101 of the Copyright Act, and section 117 was amended to permit owners of a computer program to make additional copies or adaptations of the program.\textsuperscript{204} The CONTU Report also re-emphasized the distinction between copyrightable expression and noncopyrightable methods, processes, and ideas.\textsuperscript{205}

The court then noted that a copyright in a musical, dramatic, or motion picture work or a work of literature may be infringed by copying the nonliteral aspects of the work.\textsuperscript{206} A most telling remark accompanied this observation: "This type of copying of nonliteral expression, if sufficiently extensive, has never been upheld as permissible copying; rather, \textit{it has always been viewed as copying of elements of an expression of creative originality}."\textsuperscript{207} In granting copyright monopolies, Congress aimed to serve the public welfare by stimulating authors to create and disclose new ideas to the public.\textsuperscript{208} The idea/expression limitation balances the competing goals of copyright protection.\textsuperscript{209}

\textit{The Idea/Expression Limitation}

In construing the Copyright Act, courts must avoid broadening the scope of protection to an extent that would hamper development of improved products. At the same time, courts must not construe the scope too narrowly and thereby discourage the

\textsuperscript{201} \textit{Id.}
\textsuperscript{202} \textit{Id.}
\textsuperscript{203} \textit{Id.}
\textsuperscript{205} \textit{Id.} (citing CONTU REPORT, \textit{supra} note 73, at 37-46).
\textsuperscript{206} \textit{Id.} at 51-52.
\textsuperscript{207} \textit{Id.} at 52 (emphasis added).
\textsuperscript{208} \textit{Id.} at 52-53.
\textsuperscript{209} \textit{Id.} at 52-54.
creation of all but modest incremental advances. \(^{210}\) Congress did not provide a boundary line between the copyrightable and noncopyrightable elements of a computer program. \(^{211}\) The courts, therefore, must evaluate the statutory language while remaining sensitive to the object and policy underlying copyright law. \(^{212}\) "The interplay between sections 102(a) and 102(b), illumined by the related legislative history, manifests that the statute extends copyright protection to expressive elements of computer programs, but not to the ideas, processes, and methods embodied in computer programs." \(^{213}\) The court, therefore, determined that Congress intended to use the idea/expression distinction as part of the test for copyrightable elements of a computer program. \(^{214}\) Accordingly, the court in *Lotus* determined that the Lotus 1-2-3 menu command structure was original, nonobvious, and capable of being expressed in a virtually unlimited number of ways. \(^{215}\) The user interface, therefore, was protected as a nonliteral element of expression of the underlying computer program. \(^{216}\)

**Computer Program and User Interface as a Single Work of Authorship**

The *Lotus* opinion concluded with a discussion of a defense presented by Paperback Software. Paperback argued that Lotus' allegations of copyright infringement in the user interface of Lotus 1-2-3 were really allegations of infringement in the program's *screen displays*. \(^{217}\) Because Lotus had not registered the screen displays as separate audiovisual works, the court lacked jurisdiction over the allegations of infringement in them. \(^{218}\) Stating that the contention "border[ed] on the frivo-

\(^{210}\) *Id.* at 53.

\(^{211}\) *Id.*

\(^{212}\) *Id.*


\(^{214}\) *Id.* at 54.

\(^{215}\) *Id.* at 68.

\(^{216}\) *Id.* at 68, 80.

\(^{217}\) *Id.* at 79.

\(^{218}\) *Id.*
lous,"219 the court concluded that Lotus' registration certificates extended protection to the screen displays.220 According to the court, the defendants had failed to account for the statutory language related to the copyrightability of nonliteral elements of a computer program, including the user interface.221 According to the court, screen displays, viewed in a narrow sense, were not copies of the "set of statements or instructions [used] to bring about a certain result,"222 but the screen display was useless "unless it is integrated with other parts of the computer program so as to become indirectly part of the means by which the user communicates instructions through the total program to bring about the desired result."223 Copyright protection extended to screen displays because the screen display was created and used "as a part of the 'set of statements or instructions' in a program that is designed 'to be used directly or indirectly in a computer in order to bring about a certain result.'"224 The practice of the Copyright Office buttressed the above conclusion. For the purposes of registration, "all copyrightable expression owned by the same claimant and embodied in a computer program, including computer screen displays, is considered a single work."225 Under Lotus and Johnson Controls, the idea-expression test is the only limitation on the scope of copyright protection granted to computer programs and, therefore, the only limitation on the scope of copyright protection granted to MIDI files.

**Computer Programs and the Generated Work as One Work of Authorship**

Although the court quickly dispensed with Paperback Software's argument, the question posed above formed the basis

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219. Id.
220. Id. at 80.
221. Id.
222. Id. at 80 (citing 17 U.S.C. § 101 (1988)).
223. Id.
224. Id.
225. Id. at 81 (quoting Copyright Office, Library of Congress, Registration of Computer Screen Displays, 53 Fed. Reg. 21,817 (1988)). In addition, Lotus had tried to register the screen displays separately but was denied registration because the displays were considered an integral part of the computer program. Id.
of dispute in *Broderbund Software, Softklone, Johnson Controls,* and *Lotus.* Before determining whether a screen display generated by a computer program is protected as copyrightable expression by a copyright subsisting in the underlying computer program, the court must determine whether the screen display is part of the computer program, or more precisely, whether a work generated by a computer program is part of that program under the Copyright Act.

The analysis in *Lotus* is persuasive—computer programs are copyrightable as "literary works." By analogy, the nonliteral aspects of structure, sequence, and organization of the code are copyrightable. The scope of protection afforded the nonliteral elements of computer programs is limited by the idea/expression distinction codified in section 102(b) of the Act. Whether the nonliteral elements of a program are protected depends on the particular facts of each case. The screen display is copyrightable because it is part of the programmer’s expression, and because it is part of the integrated whole called a computer program. The screen display, therefore, is a nonliteral element of the computer program. By concluding that screen displays are nonliteral elements of computer programs, the *Lotus* opinion loses its force, but not for want of reasonable and compelling arguments. Screen displays are in fact part of the programmer’s expression and in the broad sense part of one work. Screen displays are not, however, part of a “computer program” as defined by the Copyright Act.

“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.” It receives copyright protection as a “literary work” and by analogy its nonliteral aspects are also copyrightable. The copyrightable nonliteral aspects of a computer program are the structure, sequence, and organization of the

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226. See supra text accompanying notes 191-93.
227. See supra text accompanying note 197.
228. See supra text accompanying notes 207-16.
230. See supra text accompanying notes 210-16.
232. Id.
code itself. The structure, sequence, and organization of the “set of statements or instructions” are the protected aspects of the programmer’s expression. The “result” brought about by this “set of statements or instructions” is not part of a computer program. By providing a definition of a “computer program,” Congress limited the copyrightable elements of the work created by a programmer.

Extending copyright protection of nonliteral elements of computer programs to screen displays generated by computer programs based on legislative history and case law ignores two important factors. First, the literary aspect of a computer program is the code itself. The code is “expressed in words, numbers, or other verbal or numerical symbols” 233 and therefore satisfies the Copyright Act’s definition of a “literary work.” A screen display does not satisfy this definition and is therefore outside the scope of protection granted a “literary work.” Instead, a screen display is a separate audiovisual work, not part of the computer program.

Categorizing computer programs generally as “original works of authorship fixed in any tangible medium of expression” could overcome this limitation. 234 The protected work would be defined broadly to include the result generated by the program and would recognize the special nature of computer programs. Congress, however, precluded this option in its choice of definition for “computer programs.” The existing statutory definition indicates that “computer programs” are copyrightable as “literary works” and that the results generated by computer programs are not part of the nonliteral aspects of computer programs. 235 The cases holding video game displays separately copyrightable also support this conclusion. 236 Protection of MIDI files, therefore, cannot be based on an extension of the scope of protection granted to nonliteral elements of a computer program. The scope of protection granted by copyright on a MIDI file is limited to the

233. Id.
234. Id. § 102(a).
235. See, e.g., Digital Communications Assocs. v. Softklone Distrib. Corp., 659 F Supp. 449, 455 (N.D. Ga. 1987); see also supra text accompanying note 160 (screen displays are separately copyrightable as audiovisual works).
236. See supra text accompanying notes 93-124.
literary aspects of the MIDI file's code and does not extend to the musical work.

In addition to the above limitation, the video game cases explain why a screen is not a "copy" of a computer program, a position that Lotus supports when applied to the narrow view of a computer program. Most original works of authorship generated by computer programs will not be copies of the underlying program because many programs can produce the same result. Because a MIDI file is an industry-wide protocol, however, it may be a copy of the work generated. Generally, the scope of copyright protection granted a computer program does not include the result generated by the program, and that result is not a copy of the underlying program. MIDI files present a situation in which a computer program is a copy of the result generated, in this case a musical composition.

**MIDI Files as Copies of the Underlying Computer Program**

MIDI files are nothing more than "computer programs" as defined by the Act. They are a set of instructions used to control synthesizers and to produce a musical work. By assumption, the musical work generated by the MIDI file is an original work of authorship, but it is not protected as an element of the computer program itself. The musical work, however, is a "copy" of the MIDI file. Anyone who hears a piece of music can reproduce the MIDI file. MIDI is an industry protocol defining the language used by electronic instruments to communicate. Each byte of binary code is a translation of a gesture made on the attached musical instrument and indicates a special function or note. The MIDI file stores the instructions created by the gestures in real time. As a result, the order in which a synthesizer executes these instructions cannot be varied without changing the musical work. Because MIDI is an industry protocol recorded in

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237. Lotus Dev. Corp. v. Paperback Software Int'l, 740 F Supp. 37, 80 (D. Mass. 1990) (citing Softklone, 659 F. Supp. at 455-66, for the proposition that it is illogical to conclude that a screen can be a copy of many different programs).
238. *See supra* notes 12-19 and accompanying text.
239. *See supra* notes 20-27 and accompanying text.
240. *See supra* notes 12-20 and accompanying text.
real time, one set of instructions generates only one work and when that work is played into the computer, the same MIDI file is always created. The musical work dictates every aspect of the program. A one-to-one relationship exists between the MIDI file and musical work. This fact eliminates the anomaly described in Softklone.\textsuperscript{241} Playing the musical work into a synthesizer and utilizing a sequencing program repeatedly creates the same MIDI file or computer program.\textsuperscript{242}

In effect, by standardizing the way synthesizers communicate through the industry wide protocol, MIDI simply creates another method of musical notation. That a sequencing program can translate the MIDI file into a screen display indicating the notes played, their order, duration, attack, fade, and patch number, among other aspects, evidences MIDI's notational character.\textsuperscript{243} The musical work stored in a MIDI file is the equivalent of a musical work written on a piece of paper in traditional staff notation. The only difference between MIDI notation and staff notation is that MIDI includes more information about the notes and how they will be sounded. It is not a "sound recording" or a "phonorecord" because no sounds are fixed, just instructions.\textsuperscript{244}

The anomaly that a computer program can be a copy of the work generated, but the work generated is not a copy of the underlying program, has been eliminated by the establishment of an industry wide protocol. Because the musical work is a copy of the instructions contained in a file, copyright protection of MIDI files extends to the musical work generated by the instructions contained in the file.

Special circumstances make the original expression embodied in a MIDI file protectable by a copyright on the underlying computer program. While this outcome may not offend anyone's sensibilities, it does bring the current Copyright Act's treatment of computer programs into question. If protecting MIDI files is

\textsuperscript{241} 659 F Supp. at 456 (holding that a computer program is considered a "copy" of a screen display but a screen display is not considered a "copy" of a computer program).

\textsuperscript{242} See id. (noting that a fixed screen display cannot repeatedly create the same computer program, even with the aid of a machine).

\textsuperscript{243} See supra note 30 and accompanying text.

\textsuperscript{244} 17 U.S.C. § 101 (1988).
acceptable, why are other forms of original expression generated by computer programs not protected by copyrights on the underlying program? The double limitation applied to computer programs, separating the code and the result of a computer program, and then applying the idea/expression test, does not appear justified. The idea/expression test is the only limitation applied to the copyright protection granted to all other original works of authorship.\textsuperscript{245} Applying this test to works of authorship generated by a computer program is no more difficult than applying the test to works viewed in isolation. The same considerations arise in each case.

CONCLUSION

The Copyright Act protects “computer programs” as “literary works.” The scope of that protection is limited to the literal and nonliteral aspects of the “set of statements or instructions” contained in the program. “Original works of authorship” generated by computer programs do not fall within the scope of copyright protection granted a computer program and, in general, are not “copies” of the “computer program.” The existence of an industry-wide protocol that records instructions designed to control a computer in real time creates a one-to-one correspondence between the work generated by a “computer program” and the program itself. The “computer program” and the work it generates become “copies” of each other. Copyright protection on a MIDI file should extend to the musical work generated by the file because the musical work is a “copy” of the MIDI file.

The practical inseparability of computer programs and their output or result, combined with the computer’s potential as a creative tool, indicate that Congress should amend the Copyright Act to include a separate category of work that protects any original expression embodied in or generated by a “computer program.”

Congress can extend copyright protection to original expression generated by computer programs without requiring a sec-

ond copyright. One original work of authorship encompassing the literary aspects of the program as well as the result generated by the program would have to be recognized in order to eliminate the division between the program code and the result generated by the code. The Copyright Clause, as interpreted in Goldstein v. California, grants Congress discretion in determining whether such a work deserves protection; that determination depends not only on the character of the writing, but also on the writing’s commercial importance. Computers present a problem because one act of creation results in two separately identifiable works: the program itself and the result generated by the program.

The desirability of protecting computer programs was recognized in the CONTU Report:

The cost of developing computer programs is far greater than the cost of their duplication. Consequently, computer programs are likely to be disseminated only if [t]he creator may spread its costs over multiple copies of the work with some form of protection against unauthorized duplication of the work. The Commission is, therefore, satisfied that some form of protection is necessary to encourage the creation and broad distribution of computer programs in a competitive market. The commission’s conclusion is that the continued availability of copyright protection for computer programs is desirable.

The works generated by computer programs are too numerous and varied to be listed, but the Copyright Act indicates that “original works of authorship” are protected. Examples described above include musical compositions and audiovisual displays. Congress, therefore, has determined that both the computer program and the result it generates deserve copyright protection if original. Limiting the scope of copyright protec-

247. See supra text accompanying notes 51-53.
248. CONTU REPORT, supra note 73, at 11.
250. See supra notes 56-57 and accompanying text.
251. See supra notes 97-114 and accompanying text.
tion to the "set of statements or instructions" creates an easily identifiable line with little justification.

The creative energy involved in making a MIDI file is entirely directed at conceptualizing the musical work. Having created the musical work, the composer simply inputs the work into the computer. The gestures are stored in sequence, and the computer program necessary to replay the musical work is complete. The effort required to encode the musical work is minimal to nonexistent from the composer's point of view. In addition, the MIDI file's value is based solely on the quality of the musical work.

Video games may be viewed in a similar fashion. "The popularity of a video game depends on the creativity of its audiovisual display, not on the form of its computer program." While the percentage of creative energy required to produce the program underlying a video game is significantly greater than that required to create a MIDI file, the aim and value of the program is determined by the audiovisual display.

More utilitarian programs, such as Lotus 1-2-3 or Dentalab, present a slight variation because the conception of the computer program becomes more important. The bulk of the expense and difficulty in creating these programs is attributable to the development of the logic, structure, and sequence of the program. Also, creating a suitable user interface for these programs is more difficult and requires greater creativity than merely encoding the user interface design. In these cases, the relative values of the creative work that ultimately produces the computer programs is unclear. Conceptualizing the screen display is likely to be a small part of the overall structure of the program. The value of programs like Lotus 1-2-3 and

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253. Id. § 101.
255. See supra notes 191-225 and accompanying text.
256. See supra notes 125-29 and accompanying text.
Dentalab, however, still rests on their ability to communicate results to the user. The results in these cases are, respectively, calculations on a spreadsheet and general record keeping.

Ultimately, all computer programs are designed to communicate a useful result to the user. Communication of this result necessarily takes the form of a computer-generated work that is not part of the underlying computer program. The generation of this work is why consumers buy the computer program in the first instance; the form of the underlying code is unimportant. The value of a computer program, therefore, is based on the ability of the program to communicate its results to the user effectively. Divesting the set of instructions from the result renders a computer program valueless. A computer program is an integrated whole that includes the "set of statements or instructions" and the work designed to communicate the program's results to the user.

Copyright law strives "to stimulate artistic creativity for the general public good." Copyright monopolies serve an as incentive for authors to generate new ideas and disclose them to the public. The public welfare, therefore, is advanced by using personal gain to encourage individual effort. Extending the scope of copyright protection afforded a computer program will increase the incentive to disclose original works of authorship while maintaining the limitations imposed by the idea/expression test. The computer is an extremely useful creative tool that provides individuals with an opportunity for expression unparalleled in recent history. Computer control of video images and music permits a person with access to a computer to become an artist. MIDI is a great example. With a multitrack recording studio available at their fingertips, individuals working in small studios can become viable composers.

259. See M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421 (4th Cir. 1986) (discussing the fact that although computer code is used ultimately in a process, this fact should not affect the copyrightability of computer programs as expression).
260. See supra text accompanying notes 210-18.
261. Twentieth Century Music Corp. v. Aiken, 422 U.S. 151, 156 (1975) (Stewart, J.).
Protecting works generated by computer programs increases the available pool of authors by providing affordable means for individuals to generate works that once could be produced only in specialized and expensive studios. In turn, the number and diversity of works created will increase.

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