Game Console Modification Chips: The Effect of Fair Use and the Digital Millennium Copyright Act on the Circumvention of Game Console Security Measures

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I. INTRODUCTION

Game console modification is a relatively new phenomenon that has very little established law to use as a guideline. Although commercial developers have exploited the reverse engineered functional processes in the past, the climate is different today. Modification chips ("mod chips") sell for as little as twenty-five dollars to average consumers, and allow game consoles, such as the Xbox or PlayStation, to perform functions never intended by the

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1. See generally Sega Enters. Ltd. v. Accolade, Inc., 977 F.2d 1510 (9th Cir. 1992); Sony Computer Entm’t Inc. v. Connectix Corp., 203 F.3d 596 (9th Cir. 2000).
manufacturer. Schematics and installation diagrams are easily found on the Internet, and require very little technical knowledge. The proliferation of game console mod chips has led to some interesting questions. In the past, mod chips had been used primarily for playing pirated copies of games. However, with the advent of more sophisticated gaming hardware, the climate has changed. PlayStation 2 and Xbox have dozens of amateur coding projects, including games, media players, emulators, and even alternative operating systems. The Xbox, in particular, has a hard drive and an internal architecture very similar to that of a personal computer. However, the downside to this explosion in creative talent is that most mod chips, and other exploits, allow any type of unauthorized code to be run on the console, including pirated games. The fear of piracy has prompted game console manufacturers and the government to seize websites and stores prohibiting the sale and promotion of these grey market devices.

The law is unclear as to how to approach the problem. The Digital Millennium Copyright Act ("DMCA") provides some protection to copyright holders, and other protections for those engaging in reverse engineering. The Second and Ninth Circuits are split on how to approach the reverse engineering issue when dealing with potential mass piracy; and no court has interpreted the DMCA to its fullest extent. Legal developments in foreign

8. U.S. Dept. of Justice, supra note 4. United States v. Rocci involved the government shutdown of a website that sold Xbox mod chips. Id. The case was brought under the DMCA anti-trafficking provisions. Id. The defendant's website promoted piracy activities and provided news as to the availability of pirated software. Id. No defense was pled, leaving little precedential value to the case since the adversarial process was not used. See id. Additionally, the case has not been reported in any legal reporters or online databases.
jurisdictions are helpful, but offer little guidance. What follows is a survey of applicable law surrounding this issue, as well as, a helpful analysis of the problem.

II. THE DMCA, REVERSE ENGINEERING, AND FAIR USE

The proliferation of peer-to-peer media file sharing through programs such as Napster, and the advent of digital media for movies ("DVD") had created the fear of easy and user-friendly piracy.2 This fear of digital piracy led the music and video industries to lobby Congress for greater protection.3 Additionally, the World Intellectual Property Organization ("WIPO") recently negotiated treaties that banned circumvention devices and other copying methods.4 Congress responded to both pressures by enacting the DMCA, which forbids the circumvention of "a technological measure that effectively controls access to a [copyrighted] work . . ."5 The DMCA further states:

No person shall manufacture . . . or otherwise traffic in any technology . . . that
(A) is primarily designed or produced for the purpose of circumventing a technological measure that effectively controls access to a work protected under this title;
(B) has only limited commercially significant purpose or use other than to circumvent a technological measure that effectively controls access to a work protected under this title; or
(C) is marketed by that person or another person acting in concert with that person with that person’s knowledge for use in circumventing a technological measure that effectively controls access to a work protected under this title.6

However, the DMCA does make certain exceptions for reverse engineering.7 The first is that:

13. See generally id.
14. Id. at 25.
17. § 1201(f). Reverse engineering is "[t]he process of analyzing an existing system to identify its components and their interrelationships and create representations of the system in
Notwithstanding the provisions of subsection (a)(1)(A), a person who has lawfully obtained the right to use a copy of a computer program may circumvent a technological measure that effectively controls access to a particular portion of that program for the sole purpose of identifying and analyzing those elements of the program that are necessary to achieve interoperability of an independently created computer program with other programs, and that have not previously been readily available to the person engaging in the circumvention, to the extent any such acts of identification and analysis do not constitute infringement under this title.  

The DMCA goes on to state that “a person may develop and employ technological means to circumvent a technological measure, or to circumvent protection afforded by a technological measure, in order to enable the identification and analysis under” § 1201(f)(1) of the United States Code or for interoperability purposes to the extent that it does not infringe on copyrighted material. In short, the DMCA allows circumvention in cases of reverse engineering to create interoperable software, as long as it does not infringe any copyright. The only works expressly exempted from the prohibition against circumvention are “(1) [c]ompilations consisting of lists of websites blocked by filtering software applications; and (2) [l]iterary works, including computer programs and databases, protected by access control mechanisms that fail to permit access because of malfunction, damage or obsolescence.” However, according to § 102, functional processes have no copyright protection. Section 107 provides a defense for copyright infringement:

the fair use of a copyrighted work . . . is not an infringement of copyright. In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include—

(1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;

(2) the nature of the copyrighted work;

(3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and

another form or at a higher level of abstraction.” HYPERDICTIONARY, at http://www.hyperdictionary.com/computing/reverse+engineering (last visited Feb. 4, 2004).

18. § 1201(f)(1).
19. § 1201(f)(2).
20. See § 1201. The DMCA defines interoperability as “the ability of computer programs to exchange information, and of such programs mutually to use the information which has been exchanged.” § 1201(f)(4).
22. § 102(b). Section 102(b) reads that “[i]n no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.”
(4) the effect of the use upon the potential market for or value of the copyrighted work. 23

The copyright law also gives developers substantial leeway in creating independent software because § 1201(f) allows circumvention for purposes of interoperability of independent software. 24 Furthermore, § 102(b) does not confer copyright protection to processes or methods of operation, and § 107 allows developers "fair use" of copyrighted works. 25 Therefore, it would seem that developers have a variety of means of developing programs to run on systems with security measures in place. Statutory law is not enough, however, to determine the issue. Case law must be examined to determine where the law stands on this issue, and how courts have dealt with similar problems in the past.

III. RELEVANT CASE LAW

The case law is split on whether circumvention is an acceptable method of reverse-engineering for purposes of creating a commercially viable product. In Sony Computer Entertainment, Inc. v. Connectix Corp., the Ninth Circuit, without ever addressing the DMCA, held that reverse-engineering and intermediate copying of copyrighted material is allowable if necessary to reach the functional elements of the material. 26 However, in Universal City Studios, Inc. v. Corley, the Second Circuit held that circumvention is unlawful under the DMCA if there is any possible infringing use of the software, regardless of a legitimate purpose. 27

A. Sega Enterprises Ltd. v. Accolade, Inc.

Sega Enterprises Ltd. v. Accolade, Inc., predates the DMCA, but is important because it is the first case to specifically target the circumvention of game console security measures. 28 In Accolade, Inc., Sega Enterprises Ltd. ("Sega") manufactured the Sega Genesis game console. 29 In order to develop games for the console, Sega developed a licensing scheme in which it li-

23. § 107.
24. See § 1201(f)(1)-(2).
25. See §§ 102(b), 107.
29. Id. at 1514.
licensed its copyrighted computer code to its licensees.\textsuperscript{30} In addition, Sega would be the exclusive manufacturer of all cartridges created by its licensees.\textsuperscript{31} To avoid entering into the licensing agreement, Accolade, Inc. ("Accolade") decided to reverse engineer Sega's cartridges, so that it could create its own cartridges for use on the Sega Genesis.\textsuperscript{32} Through a process called disassembly, Accolade converted Sega's binary object code into a source code, which is readable by humans.\textsuperscript{33} After the code was finished being interpreted, Accolade created a manual on how to make a Genesis-compatible game cartridge that contained no trace of Sega's code.\textsuperscript{34} Accolade developers then used this manual to create game cartridges that were playable on the Sega Genesis console.\textsuperscript{35} To counter the effects of reverse-engineering and piracy, Sega created and patented a new security measure named "trademark security system," or TMSS, to be used in a new iteration of its Sega Genesis console, the Genesis III.\textsuperscript{36} In order for a cartridge to function on the Genesis III, it must have the TMSS initialization code in the header of the file.\textsuperscript{37} Upon further reverse engineering, Accolade found the header and copied that actual piece of code into its development manual.\textsuperscript{38}

The Ninth Circuit rejected all but one of Accolade's defenses against copyright infringement that are beyond the scope of this article.\textsuperscript{39} However, the court looked to fair use as a defense for what it terms "intermediate copying."\textsuperscript{40} Intermediate copying of computer programs involves copying the entire program so that the functional elements can be extracted.\textsuperscript{41} Although intermediate copying may inherently be infringement, the court asserted that "[w]here there is [a] good reason for studying or examining the unprotected aspects of a copyrighted computer program, disassembly for purposes of such study or examination constitutes a fair use."\textsuperscript{42} However, Accolade still had to meet the four statutory factors set out in § 107 of the Copyright Act.\textsuperscript{43} In examining the purpose and character of the use, the court found that al-

\textsuperscript{30} Id.
\textsuperscript{31} Id.
\textsuperscript{32} Id.
\textsuperscript{33} Accolade, Inc., 977 F.2d at 1514.
\textsuperscript{34} Id. at 1515–16.
\textsuperscript{35} Id.
\textsuperscript{36} Id.
\textsuperscript{38} Id. at 1515–16.
\textsuperscript{39} Id. at 1518.
\textsuperscript{40} Id. at 1518–20.
\textsuperscript{41} See id. at 1518.
\textsuperscript{42} Accolade, Inc., 977 F.2d at 1520.
\textsuperscript{43} See id. at 1521–22.
though the use was for commercial purposes, most of Accolade’s games were originally developed for other platforms, and that the company only wanted to make them playable on the Genesis console. The court found these actions to be only indirectly exploitative because any copying was performed only at the intermediate stage. Moreover, the court noted that:

Accolade’s identification of the functional requirements for Genesis compatibility has led to an increase in the number of independently designed video game programs offered for use with the Genesis console. It is precisely this growth in creative expression, based on the dissemination of other creative works and the unprotected ideas contained in those works, that the Copyright Act was intended to promote.

As to the second statutory fair use factor, the “nature of the copyrighted work,” the court asserted that not all copyrights are protected at the same level. Here, the software was protected at a lower level than traditional copyrighted works, such as books, because “computer programs are, in essence, utilitarian articles—articles that accomplish tasks.” Moreover, the court noted that “there is no settled standard for identifying what is protected expression and what is unprotected idea in a case involving the alleged infringement of a copyright in computer software.” The Ninth Circuit asserted that software requires a lower degree of protection because its unprotected functional elements cannot be accessed without some copying and disassembling. The court minimized the third statutory fair use factor, “amount and substantiality of the portion used,” by stating that the portion used in the final product was insubstantial. The court addressed the fourth factor, “effect on the potential market,” by arguing that although Accolade will be competing against Sega, its games are not similar to Sega’s and have not cornered the market in any way. Based on Accolade’s fair use defense, the Ninth Circuit held that where a legitimate reason exists, and disassembly is the only way to reach the § 102(b) unprotected aspects of a computer pro-

44. Id. at 1522.
45. Id.
46. Id. at 1523 (citing Feist Publ’ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 350 (1991)).
47. Accolade, Inc., 977 F.2d at 1524.
48. Id.
49. Id.
50. Id. at 1526.
51. Id. at 1526–27.
52. Accolade, Inc., 977 F.2d at 1523.
gram, "disassembly is a fair use of the copyrighted work, as a matter of law."53

B. Sony Computer Entertainment, Inc. v. Connectix Corp.

Sony Computer Entertainment, Inc. v. Connectix Corp. is a Ninth Circuit opinion that is contemporaneous with the DMCA.54 Although the opinion never addresses the DMCA, it reaffirms Accolade, Inc., and helps to shed some light on the current state of copyright law in the Ninth Circuit.55 Here, Connectix Corp. ("Connectix") attempted to emulate the Sony PlayStation console so that PlayStation software could be played on a home PC using Connectix's "Virtual Game Station."56 To create a working emulator, Connectix had to create its own version of the Sony PlayStation basic input-output system ("BIOS") for use in its Virtual Game System.57 In order to do this, Connectix had to engage in intermediate copying of the PlayStation BIOS using a disassembler.58 Sony brought suit for copyright infringement and obtained a preliminary injunction from the district court.59 On appeal, the Ninth Circuit reversed the injunction and held that the intermediate copying was a protected fair use.60

Although the Ninth Circuit has never raised the issue of DMCA circumvention, it expounds on the feasibility of reverse engineering copyrighted computer programs:

[reverse engineering encompasses several methods of gaining access to the functional elements of a software program. They include: (1) reading about the program; (2) observing "the program in operation by using it on a computer;" (3) performing a "static examination of the individual computer instructions contained within the program;" and (4) performing a "dynamic examination of the individual computer instructions as the program is being run on a computer."61

53. Id. at 1527–28.
54. See 203 F.3d 596 (9th Cir. 2000).
55. See id.
56. Id. at 598.
57. Id.
58. Id. at 600.
60. Id. at 599.
The court argued that the first method is ineffective and that the other methods all require some amount of infringement to take place. The court asserted that BIOS code is only observable with the use of a debugger that allows programmers to observe the interaction between the BIOS and other code on the computer. Additionally, in order to examine the BIOS, programmers would have to use a disassembler to covert the BIOS’ object code—binary code only readable by a computer—into source code that can be read by a programmer. Using either method—observing or examining the BIOS—requires that the BIOS be copied into memory at some point for the purposes of reverse engineering. Sony alleged this intermediate copying to be copyright infringement.

Relying on Accolade, Inc., the Ninth Circuit emphasized the importance of the fair use defense in copyrighted computer programs. The court asserted that in the context of computer software, “[t]he object code of a program may be copyright as expression, 17 U.S.C. § 102(a), but it also contains ideas and performs functions that are not entitled to copyright protection.” Referring back to Accolade, Inc., the Ninth Circuit stressed that disassembly is protected as fair use if it is “the only way to gain access to the ideas and functional elements embodied in a copyrighted computer program...” Since disassembly requires some copying of the BIOS, this type of “intermediate copying” should be protected as well, if it is necessary to gain access to the unprotected elements of the BIOS.

Additionally, the court inquired into the four statutory fair use factors. First, the court inquired into the “nature of the copyrighted work” and found that Sony’s BIOS could not be examined without copying because no information about the BIOS was available to the public, nor was the BIOS readily observable since it is an internal operating system. It was therefore necessary for Connectix to make intermediate copies of the BIOS to extract its unprotected elements because any other method would have been either inef-
fective or grossly inefficient; and the copyright law was not designed to hinder public access to functional concepts. 73

Second, the court found that where the final product contains no trace of infringing material, the “amount and substantiality of the portion used” has little relevance. 74 Third, the court inquired into the “purpose and character of the use” and found that the Virtual Game Station “creates a new platform, the personal computer, on which consumers can play games designed for the Sony PlayStation.” 75 As such, the court held that the Virtual Game Station is a “transformative” product within the definition of the United States Supreme Court, and that the commercial use is not unfair. 76

Finally, the court inquired into the effect of the use upon the potential market and found that the Virtual Game Station is a “legitimate competitor” to PlayStation since Connectix has created a transformative product and not merely something that replaces the PlayStation console. 77 The court further stated that although Sony may suffer some economic loss, “[t]he copyright law, however, does not confer such a monopoly,” and a ruling in favor of Sony would run counter to public policy because it would inhibit creative expression. 78 For all of the foregoing reasons, the Ninth Circuit held that Connectix’s intermediate copying of Sony’s BIOS used during the creation of the Virtual Game Station constituted fair use and affirmed its pre-DMCA holding in Accolade, Inc. 79

C. Universal City Studios, Inc. v. Corley

Universal City Studios, Inc. v. Corley is the most recent case to adequately address reverse engineering as it applies to the DMCA. 80 In Corley, movie studio co-plaintiffs brought suit against a website owner for providing links to other websites that contained DVD decryption software. 81 Before the movie studios decided to take the plunge into DVD production, they were concerned about finding a way to inhibit piracy. 82 Movie studios realized that DVDs could provide pirates with a “virtually perfect copy” of a movie

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73. See id. at 605 (citing Feist Publ’ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 354 (1991)).
74. Connectix Corp., 203 F.3d at 606.
75. Id.
76. Id. (citing Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 579 (1994)).
77. Id. at 607 (relying on Campbell, 510 U.S. at 591).
78. Id. (relying on Accolade, Inc., 977 F.2d at 1523-24).
79. Connectix Corp., 203 F.3d at 608.
80. See generally 273 F.3d 429 (2d Cir. 2001).
81. Id. at 435-36.
82. Id. at 436.
that can be easily and repeatedly copied.\textsuperscript{83} To counter piracy, movie studios developed the Content Scramble System ("CSS") to encrypt DVD content to avoid unauthorized copying.\textsuperscript{84}

CSS is an encryption scheme that employs an algorithm configured by a set of "keys" to encrypt a DVD's contents. The algorithm is a type of mathematical formula for transforming the contents of the movie file into gibberish; the "keys" are in actuality strings of 0's and 1's that serve as values for the mathematical formula. Decryption in the case of CSS requires a set of "player keys" contained in compliant DVD players, as well as an understanding of the CSS encryption algorithm. Without the player keys and the algorithm, a DVD player cannot access the contents of a DVD.\textsuperscript{85}

In order to manufacture functional DVD players, manufacturers had to license the CSS scheme and keep the information confidential.\textsuperscript{86}

In September 1999, a group of individuals attempted to create a DVD player that would run on the Linux operating system, which did not have any licensed DVD players at that time.\textsuperscript{87} To achieve this end, they had to reverse-engineer a DVD player that was licensed for use on a Microsoft operating system.\textsuperscript{88} This required that the movie studios' CSS encryption scheme be decrypted.\textsuperscript{89} Decryption was accomplished and the group released the software program, which they called DeCSS.\textsuperscript{90}

DeCSS will decrypt the DVD's CSS protection, allowing the user to copy the DVD's files and place the copy on the user's hard drive. The result is a very large computer file that can be played on a non-CSS-compliant player and copied, manipulated, and transferred just like any other computer file.\textsuperscript{91}

Corley wrote an article on his website about DeCSS, which contained the object and source code of the decryption program.\textsuperscript{92} The movie studios then brought suit against Corley and his website for violating the DMCA's

\begin{itemize}
\item \textsuperscript{83} Id.
\item \textsuperscript{84} Id.
\item \textsuperscript{85} Corley, 273 F.3d at 436–37.
\item \textsuperscript{86} Id. at 437.
\item \textsuperscript{87} Id.
\item \textsuperscript{88} Id.
\item \textsuperscript{89} Id.
\item \textsuperscript{90} Corley, 273 F.3d at 437.
\item \textsuperscript{91} Id. at 437–38.
\item \textsuperscript{92} Id. at 439.
\end{itemize}
anti-trafficking provisions. Corley brought forward several constitutional defenses against the movie studios.

Corley's constitutional arguments lay primarily in attacking the DMCA for inhibiting First Amendment free speech, as well as for violating the Copyright Clause, both of which are beyond the scope of this article. However, Corley did assert a fair use defense. The Second Circuit summarily rejected the fair use argument on the grounds that DeCSS is a "decryption code that enables unauthorized access to copyrighted materials." Finally, the court suggested that fair use does not necessarily permit fair users to use the "identical format of the original." The Second Circuit essentially held that the interest in protecting copyright holders' security measures is greater than the interest of fair users that may attempt to use the functional components of intellectual property to create new platforms and software. That is, the threat of piracy alone seems to be enough to prohibit prospective fair users from circumventing security measures for legal purposes.

IV. AN INTERNATIONAL APPROACH

Since the DMCA was implemented into law as part of the WIPO treaties, it may be helpful to examine how a court in a foreign jurisdiction has dealt with game console modification. Although game console manufacturers have been hesitant in bringing forth litigation on mod chips in the United States, this has not been the case internationally. In *Sony Computer Entertainment Inc. v. Lik Sang International Ltd.*, the Hong Kong Court of
First Instance examined the issue.\textsuperscript{103} It is important to note that this case is a lower court decision, and the issues of copying unauthorized code into random access memory ("RAM") addressed in the opinion are beyond the scope of this article.\textsuperscript{104}

Hong Kong has implemented anti-circumvention language into its copy-protection ordinance that is similar to what is found DMCA.\textsuperscript{105} The Hong Kong version of the DMCA states that where:

\begin{quote}
copies of a copyright work are issued or made available to the public; ... [t]he person issuing or making available the copies ... has the same rights and remedies against a person who ... makes, imports, exports, sells or lets for hire, offers or exposes for sale or hire, advertises for sale or hire, or possesses for the purpose of trade or business, any device or means specifically designed or adapted to circumvent the form of copy-protection employed.\textsuperscript{106}
\end{quote}

Additionally, the Hong Kong ordinance defines "copy-protection" as "any device or means specifically intended to prevent or restrict copying of a work or fixation of a performance or to impair the quality of copies or fixations made."\textsuperscript{107}

The defendant in \textit{Lik Sang Int'l Ltd.} was a distributor of mod chips for PlayStation and PlayStation 2 consoles.\textsuperscript{108} The mod chips allow a user to bypass the Sony access code, which prohibits unauthorized software, such as copies or imports, from being played on Sony's gaming consoles.\textsuperscript{109} As such, Sony brought suit against the defendants, alleging that mod chips bypass Sony's copy-protection scheme.\textsuperscript{110} The defendants claimed that the Sony access code is not primarily aimed at protecting against "copying protection."\textsuperscript{111} Additionally, the defendants claimed that there are legitimate, non-infringing uses of mod chips, including "the playing of multi-region games and DVD movies, self-written games, [and] lawful back-up" purposes.\textsuperscript{112} The Hong Kong court, without offering much analysis on how it reached the decision, ruled that the Sony access code is protected under the

\textsuperscript{103} See generally [2003] HKEC 521 (Hong Kong Court of First Instance, Apr. 11, 2003), available at 2003 WL 17921.
\textsuperscript{104} Id. ¶ 27(b).
\textsuperscript{105} See 528 LOHK § 273 (2003).
\textsuperscript{106} § 273(1)(a), (2)(a).
\textsuperscript{107} § 273(4).
\textsuperscript{108} Lik Sang Int'l Ltd., 2003 WL 17921, ¶¶ 9–10.
\textsuperscript{109} Id. ¶ 9(b).
\textsuperscript{110} Id. ¶ 16.
\textsuperscript{111} Id. ¶ 24.
\textsuperscript{112} Id. ¶ 23.
ordinance as a copy-protection scheme, even though it does not completely guard against unauthorized usage.\textsuperscript{113} The court also rejected the defendants’ argument that there are non-infringing uses of mod chips, holding that the copyright ordinance is violated even if one of the possible uses is infringing.\textsuperscript{114} Therefore, the court held that mod chips are a circumvention device, and that Sony is protected under the ordinance.\textsuperscript{115}

\section*{V. GAME CONSOLE MODIFICATION CHIPS, FAIR USE, AND THE DMCA}

In both Ninth Circuit cases, software developers engaged in reverse engineering before they released a final product to market.\textsuperscript{116} In \textit{Accolade, Inc.}, Accolade attempted to develop software that would be playable on the Sega Genesis hardware by reverse engineering code found on Sega’s cartridges.\textsuperscript{117} In \textit{Connectix Corp.}, Connectix attempted to develop a PlayStation emulator for a PC by reverse engineering Sony’s BIOS.\textsuperscript{118} Both developers made sure that their final product did not contain much, if any, of the manufacturer’s original code.\textsuperscript{119} However, to complete the reverse engineering process, the developers had to engage in intermediate copying.\textsuperscript{120} The Ninth Circuit justified intermediate copying by giving computer programs a lower degree of copyright protection. The court ruled that fair use applied if the only method of learning the ideas and functional elements of a computer program is through disassembly.\textsuperscript{121} Still, in \textit{Accolade, Inc.} Accolade’s final products contained traces of the original Sega TMSS code,\textsuperscript{122} and the court ruled in favor of Accolade because the statutory fair use balancing test weighed in its favor.\textsuperscript{123}

However, both \textit{Accolade, Inc.}, and \textit{Connectix Corp.}, are Ninth Circuit opinions which never addressed the DMCA and relied at least in part on public policy concerns.\textsuperscript{124} In those cases, the Ninth Circuit stressed that the

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copyright laws were not meant to inhibit creativity. In *Corley*, the Second Circuit took a different approach. There, the court held that any circumvention of security measures violates the DMCA, regardless of a possible non-infringing use. Due to this apparent circuit split, the law remains irresolute. Complicating the matter even further, the concept of interoperability of independently created software with copyrighted software in the context of the DMCA has never really been addressed. Although the Ninth Circuit briefly addressed the public benefit of creating a larger library of software in *Accolade, Inc.*, this statement from just one of the thirteen circuits is far from being authoritative on the matter.

Analyzing the treatment of mod chips by courts in foreign jurisdictions provides little guidance. The Hong Kong Court of First Instance held that the access code is protected by the copyright ordinance. This holding by the Hong Kong court is useful because the statutory language is similar to that of the United States. The Hong Kong court found that the mod chip is a circumvention device that has little significant value other than allowing console users to play pirated software. The problem with this holding is that Hong Kong’s copyright ordinance does not contain the reverse-engineering-for-interoperability exception contained in the DMCA. Additionally, the court failed to consider the public policy concerns traditionally addressed by courts in the United States.

**A. Modification Chips**

Microsoft’s gaming console, the Xbox, implements security features that disallow the machine from running unsigned code. That is, the Xbox cannot run software that is not digitally signed by Microsoft. The effect of this security measure is that software developers that are not licensed by Mi-
Microsoft may not run their own software on the Xbox. The problem regarding the Xbox’s inability to run unsigned code has led to the proliferation of mod chips. These mod chips alter or replace the Xbox’s BIOS to allow the Xbox to run unsigned code. Hobbyist developers claim that without reverse engineering, they would not have been able to create interoperable software. Other “homebrew” software has been developed, such as media players, file managers, and ftp servers. Sony’s PlayStation and PlayStation 2 consoles have similar security measures set in place. To prevent unlicensed software from running on its gaming consoles, Sony has created an access code that authenticates the media that is placed in the console. The proliferation of these mod chips runs the risk of piracy, which is why Sony opposes the sale of these devices.

The main difference between mod chips for the Sony PlayStation 2 and Xbox lies in the methods in which they work. Xbox mod chips work by either altering or replacing the original retail Xbox Flash ROM (which contains the BIOS), created by Microsoft. The Flash ROM is write protected, and needs to be altered to be written over. This can be done by soldering parts of the chip or by adding a mod chip to the console. The problem with most Xbox mod chips is that the manufacturers of these chips very often use the Microsoft code, and then change parts of it to generate the desired results. However, there is one “clean” BIOS that is also shipped with many mod chips, named Cromwell. The problem with Cromwell, however, is that it is only used to boot the Xbox version of Linux, and has little application to any other software that is designed for Xbox.

136. Cf. id.
138. XBOX FAQ, supra note 7.
139. XBOX-SCENE.COM, supra note 5.
141. See id., ¶ 16.
142. See Paul Bartholomew, Understanding the Xbox Boot Process/Flash Structures The Xbox, at http://xbox-linux.sourceforge.net/docs/msbios.html (last visited Feb. 4, 2004); HUANG, supra note 137.
144. Id.
145. See Green & Steil, supra note 6.
146. XBOX FAQ, supra note 7.
PlayStation and PlayStation 2 mod chips are similar to Xbox mod chips in that they allow homebrew software to be played on the console, as well as pirated games. However, PlayStation and PlayStation 2 mod chips do not usually create a new BIOS. Rather, PlayStation mod chips are aimed more at bypassing the Sony access code that performs a media check and prevents imported games and unauthorized software from being played. The process was reverse engineered using a logic analyzer presumably because very little information about the functional processes was made available. Although there is very little documentation concerning PlayStation 2 modification it seems that it may be a more sophisticated, but similar access code. After the mod chip bypasses the access code, imported and unauthorized software can be played on the machine.

B. Why Modification Chips May Be Legal

In the case of Xbox mod chips, it may be difficult to see the legal grounds on which they can be justified, but an examination of the current law leads to some answers. Like Connectix Corp., potential unlicensed programmers that wish to develop for Xbox start with very little information. Microsoft has certainly not been very forthcoming with detailed specifications, and is not likely to if approached. The only way, then, to learn the functional elements of the Xbox console is to reverse-engineer the protected elements because reading about the program is fruitless. In both Accolade, Inc., and Connectix Corp., the Ninth Circuit held that when the only way to learn the functional elements of a computer program is through intermediate copying, fair use is a valid defense for the infringement. The first process that must be accomplished is reverse engineering of the Microsoft retail BIOS because the retail BIOS is what inhibits unlicensed Microsoft software

150. See id.
151. See id.
152. Lik Sang Int'l Ltd., 2003 WL 17921, ¶ 16.
153. See Sony Computer Entm't Inc. v. Connectix Corp., 203 F.3d 596, 603 (9th Cir. 2000).
154. See LETTER TO MICROSOFT, supra note 2.
155. See Connectix Corp., 203 F.3d at 600.
156. Sega Enters. Ltd. v. Accolade, Inc., 977 F.2d 1510, 1527–28 (9th Cir. 1992); Connectix Corp., 203 F.3d at 602.
This BIOS creation is very similar to the situation in *Accolade, Inc.* Just as Accolade had to reverse-engineer a method to make its cartridges run on Genesis, so too must the hobbyist Xbox developer reverse-engineer a method to make the Xbox boot unsigned code. This has been accomplished in two ways: 1) the Cromwell BIOS that only runs Linux, and 2) the modified Microsoft retail BIOS. Surely, each method requires some amount of intermediate copying because such copying is inevitable in reverse-engineering the functional aspects of a computer program. Thus, each BIOS is subject to the statutory fair use test.

The Cromwell BIOS was "recreated from scratch...[and] contains no Microsoft code." This type of "clean" BIOS is similar to the Sony BIOS that Connectix reverse-engineered for use in its emulator because neither contains any of the original code, although intermediate copying was most certainly involved. As such, the fair use analysis is going to be similar. The first factor, "purpose and character of the use," is similar to *Connectix Corp.*, because here the use is commercial since mod chips are sold with the BIOS for profit. There is no presumption that a commercial use is unfair. Here, Cromwell and other mod chips are transformative because they allow independently created software to be played on game consoles. The second factor, the "nature of the copyrighted work," is also similar to *Connectix Corp.*, because the BIOS is not readily observable, and no information is available to the public and therefore, some copying must take place to reach the functional elements of the Microsoft BIOS. The third factor, "amount and substantiality of the portion used" has little relevance in this situation because the Cromwell BIOS contains no trace of Microsoft code, just as the Connectix BIOS contained no trace of the Sony BIOS. The

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157. See Green & Steil, supra note 6.
158. See *Accolade, Inc.*, 977 F.2d at 1514.
159. See *XBOx FAQ*, supra note 7.
160. See *Connectix Corp.*, 203 F.3d at 600.
161. *Accolade, Inc.*, 977 F.2d at 1521; accord *Connectix Corp.*, 203 F.3d at 602–03.
162. Green & Steil, supra note 6.
163. See id.; *Sony Computer Entm’t Inc. v. Connectix Corp.*, 203 F.3d 596, 600 (9th Cir. 2000).
165. See § 107; *Connectix Corp.*, 203 F.3d at 603; see also *MODCHIPS.CA*, supra note 2.
166. *Connectix Corp.*, 203 F.3d at 608 (citing *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 584, 594 (1994)).
167. § 107(2).
168. See *Connectix Corp.*, 203 F.3d at 603; *LETTER TO MICROSOFT*, supra note 2.
169. § 107(3).
170. See *Connectix Corp.*, 203 F.3d at 605–06; *XBOX FAQ*, supra note 7.
fourth factor, the "effect of the use upon the potential market"\(^{171}\) may be somewhat different than *Connectix Corp.* because the mod chip is not in direct competition with the Microsoft BIOS.\(^{172}\) Every consumer must first buy an Xbox with the Microsoft BIOS before installing a mod chip with the Cromwell BIOS. In this sense, Microsoft may even be benefited by the Cromwell BIOS, since users must first purchase an Xbox before using a mod chip. If a court interprets all of these factors in this way, then a mod chip with a Cromwell BIOS may pass the fair use test.

A mod chip with a modified Microsoft BIOS may also pass the fair use test. The only factor that would change in a fair use analysis of a modified Microsoft BIOS is the third factor, "amount and substantiality of the portion used."\(^{173}\) Unlike *Connectix Corp.*, the final product of a modified Microsoft BIOS mod chip contains at least some Microsoft code in it. Still, the fair use factors are a balancing test, and a court may, in its discretion decide that the other three factors outweigh this one.\(^{174}\) The court may even decide that the product released may differ enough from the original product (the Microsoft BIOS), and hold that this factor weighs in favor of the mod chips with a patched Microsoft BIOS.

As for PlayStation and PlayStation 2 mod chips, the original PlayStation consoles had an authentication sequence similar to the TMSS code in the Genesis III console as described in *Accolade, Inc.*\(^{175}\) As such, the fair use factors should be almost identical to those found in that case. First, though the use is a commercial one because mod chips are sold for profit, fair use is not necessarily abandoned because mod chips allow independent software to be played on the Sony game consoles.\(^{176}\) Second, the nature of the Sony access code is such that no documentation is available, so it must be reverse engineered to gain access to its unprotected elements.\(^{177}\) Third, though some

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171. § 107(4).
172. See *Sony Computer Entmt’ Inc. v. Connectix Corp.*, 203 F.3d 596, 607 (9th Cir. 2000).
173. § 107(3).
174. See *Connectix Corp.*, 203 F.3d at 606 (citing *Campbell*, 510 U.S. at 578.
177. See *Accolade, Inc.*, 977 F.2d at 1524; *Sony Computer Entmt’ Inc. v. Lik Sang Int’l Ltd.*, [2003] HKEC 521, ¶ 9(b) (Hong Kong court of first instance, Apr. 11, 2003), *available at* 2003 WL 17921.
part of the code is used, the authentication sequence, it is only a small portion, and this factor does not alone outweigh the other three factors. Finally, as in the case of Xbox, mod chips might actually help improve Sony’s position in the market because consumers would have to purchase the console before buying the mod chip and taking advantage of the increased software available in the market. The facts are so similar to Sega—because of the similar authentication schemes—that PlayStation mod chips may be found to be as non-infringing as Accolade’s cartridges.

Mod chip manufacturers for any system can also claim that Corley does not apply because the Second Circuit did not rule on whether DeCSS fell under the reverse-engineering-for-interoperability exception in the DMCA. So, a court deciding a case under the DMCA may have to interpret the meaning of § 1201(f) by performing a first impression review. First, copies of the Microsoft BIOS and Sony access code are legally obtained by purchasing those game consoles. Second, mod chips allow independently created software such as media players and alternative operating systems to run on the existing software. Third, as already established, mod chip manufacturers had no other way of learning the functional elements of the copyrighted Microsoft BIOS or Sony access code. Finally, any infringement that has taken place is subject to the statutory fair use test outlined above. These facts fit right into the statutory framework of § 1201(f), possibly making mod chips legal circumvention devices under the DMCA. An argument can also be made that mod chips circumvent an obsolete “access control mechanism” as outlined in the Code of Federal Regulations, thereby making this kind of circumvention exempted from the DMCA. This argument may especially have some weight in the case of the original PlayStation because its access code is rather old in terms of computer life.

It is important to note that the Ninth Circuit also made its decision partly based on public policy concerns. The Ninth Circuit was wary of allowing Sony to have a de facto monopoly over platforms on which Play-

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179. *Accolade, Inc.*, 977 F.2d at 1523.
180. *See id* at 1526.
182. *XBOX-SCENE.COM, supra* note 5.
185. *See § 1201(f).*
186. *See 37 C.F.R. § 201.40 (2002).*
Station games could be played. Additionally, the Ninth Circuit held that copyright law was not meant to inhibit creative expression based on the functional elements of copyrighted work. The same policy concerns are at issue here. If mod chips are found to be unlawful circumvention devices, then Microsoft and Sony will have de facto monopolies over Xbox and PlayStation games and software, respectively. Additionally, without mod chips, it may not be likely that hobbyist developers would be able to express themselves creatively through their software. For those reasons, public policy may be in favor of mod chips.

C. Why Modification Chips May Not Be Legal

Although a court may find that mod chips are legal for the reasons stated above, there is a better possibility that they may be found to be illegal. They may not be able to survive the Ninth Circuit's fair use rationale. Although the second factor of the statutory fair use test will likely be met because little information could be obtained without reverse-engineering, the other factors of the test may together weigh too heavily for mod chips to survive the analysis.

The first factor, "purpose and character of the use," raises some interesting questions. Although Accolade, Inc. and Connectix Corp. both state that a commercial use does not preclude fair use, the fact is that in both of those cases, the final product had more to offer than the original. In Accolade, Inc., the authentication code was a small part of the larger software package that Accolade created. In Connectix Corp., Connectix was creating a new platform upon which PlayStation games would be played. In fact, in Connectix Corp., the court made a distinction between products that were "transformative" and those that were merely substitutions. The United States Supreme Court suggests that reverse-engineered computer programs used for commercial purposes should be products that are transformative.

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188. Id.
190. Cf. Connectix Corp., 203 F.3d at 603–08.
191. See § 107(1).
192. See Accolade, Inc., 977 F.2d at 1522; see also Sony Computer Entm't Inc. v. Connectix Corp., 203 F.3d 596, 606 (9th Cir. 2000).
194. Connectix Corp., 203 F.3d at 606.
196. See id. (relying on Campbell, 510 U.S. at 579.)
The third factor, "amount and substantiality of the portion used," seems to weigh in favor of console manufacturers. The Cromwell BIOS for Xbox survives this factor because it contains no Microsoft code. However, the modified Microsoft BIOS and PlayStation and PlayStation 2 mod chips do contain portions of the original code. Accolade, Inc., and Connectix Corp., only hold that where the final product contains no "infringing material," this factor has little relevance. Even though the Accolade code contained some TMSS code, it was a small part of the larger software product. Here, the product is the BIOS or access code, albeit placed on a mod chip. As such, there is a substantial portion of the original code being used in mod chips. Although no detailed technical analysis can be found for any of the modified Xbox BIOS files, it can be inferred from the term "modified portion" that the "modified portion" is less than the substantial whole. In the case of PlayStation and PlayStation 2 mod chips, at least part of the authentication sequence is copied to the mod chip. With the exception of the Cromwell chip, mod chips are products that are primarily based on copyrighted code, and a substantial portion of that code is used in the chip. Therefore, the third factor of the fair use test seems to weigh in favor of the console manufacturers.

The fourth factor, "effect of the use upon the potential market," may also weigh in favor of console manufacturers. Although mod chips may not hurt the sales and profits of game consoles, they may have an adverse effect on the video game industry in general. Except for Cromwell, all mod chips allow pirated games to be played, on game consoles. Even then the Cromwell chip does not allow any commercial games to be played on Xbox. Moreover, reverse-engineered products that supplant the original will likely be found to be unfair. Here, the Cromwell chip turns an Xbox into a Linux

197. § 107(3).
198. See Accolade, Inc., 977 F.2d at 1526–27; see also Connectix Corp., 203 F.3d at 606 (citing Accolade, Inc., 977 F.2d at 1527).
199. See Accolade, Inc., 977 F.2d at 1516.
200. See Green & Steil, supra note 6; MOD CHIP II, supra note 175.
201. See XBox FAQ, supra note 7.
202. See MOD CHIP I, supra note 149.
203. § 107(4).
204. See XBox FAQ, supra note 7; see also Sony Computer Entm't Inc. v. Lik Sang Int'l Ltd., [2003] HKEC 521, ¶ 42 (Hong Kong court of first instance, Apr. 11, 2003), available at 2003 WL 17921.
205. XBox FAQ, supra note 7.
PC and the other mod chips do nothing more than take copy protection away from the consoles.\textsuperscript{207} Mod chips have an adverse effect on the sales of licensed games because none of them promote the sale of commercially licensed games. This loss in video game revenue will detrimentally impact game console manufacturers because they will be losing revenue from their licensees. For these reasons, the fourth fair use factor may also weigh in favor of the console manufacturers.

Mod chip manufacturers may lose in a \textit{Corley} analysis simply based on the fact that the Second Circuit favored the rights of copyright holders over those of fair users.\textsuperscript{208} In \textit{Corley}, DeCSS code was created to help develop a DVD player for Linux, and the court held that the code circumvented DVD encryption and was unlawful despite a possible legitimate fair use.\textsuperscript{209} The same type of situation arises here because mod chips have the legitimate purpose of allowing homebrew software to be used on the console.\textsuperscript{210} Despite this, a court following \textit{Corley} will likely find that, except for Cromwell, mod chips also allow pirated games to be played and hold that mod chips are an unlawful circumvention device regardless of fair use.\textsuperscript{211}

A defense of § 1201(f) interoperability may also fail. The interoperability analysis in the previous section is valid, but may be fundamentally flawed. Although mod chips may allow interoperable software to be used on a console, the mod chip itself is not the interoperable software. Also, § 1201(f)(2) allows circumvention when "necessary to achieve such interoperability."\textsuperscript{212} Although § 1201(f)(2) allows the use of "technological means," such as a mod chip, it still refers back to § 1201(f)(1), which also has the "necessary" requirement.\textsuperscript{213} It is difficult to predict how a court may interpret necessity in this situation. A court will likely look to \textit{Accolade, Inc.}, and acknowledge that Accolade built the authentication code into its software, and did not require a separate device to boot its cartridges.\textsuperscript{214} Although the necessity requirement is not an absolute bar to bringing a valid interoperability defense, it would not be difficult for a court to hold that the mod chip is not interoperable software because it merely substitutes the original code. Alternatively mod chips may not be "necessary" to run inter-
operable software since there may be a way to build a boot loader into the software itself as in *Accolade, Inc.*\(^{215}\) Further limiting the interoperability argument, is that circumvention may be done only to the extent that it does not constitute infringement.\(^{216}\) If the mod chip manufacturers are not successful in asserting the fair use defense for their intermediate copying of the Microsoft BIOS or Sony access code, then their actions constitute infringement,\(^{217}\) which would probably bar an interoperability defense. The court may also consider *Lik Sang*, which opined that a mod chip is a circumvention device.\(^{218}\) Additionally, the *Code of Federal Regulations* dealing with obsolete security measures is ill-defined and would likely not apply to the more recently introduced consoles, PlayStation 2 and Xbox.\(^{219}\)

Finally, public policy may not be in the mod chip manufacturers’ favor. The threat of piracy alone may be enough to outlaw mod chips.\(^{220}\) Additionally, mod chips do not seem to be a form of creative expression as encouraged by the court in *Accolade, Inc.*\(^{221}\) In *Accolade, Inc.* and *Connectix Corp.*, the court referred to the computer program actually produced by the defendant as a creative expression, not as a circumvention.\(^{222}\) Mod chips are a pure circumvention device that may have very little creative value, especially when, as in the case of modified Microsoft BIOS and PlayStation mod chips, they contain original code. At least two district courts have taken this point of view.\(^{223}\) De facto monopolies may still be avoided if a boot loader can be written into the code of interoperable software as in *Accolade, Inc.*\(^{224}\)


\(^{216}\) § 1201(f)(1).

\(^{217}\) Id.


\(^{219}\) See 37 C.F.R. § 201.40 (2002).

\(^{220}\) Landau, *supra* note 100, at 294 (analyzing Universal City Studios, Inc. v. Corley, 273 F.3d 429, 459 (2d Cir. 2001)).

\(^{221}\) *Accolade, Inc.*, 977 F.2d at 1523.

\(^{222}\) Id.; *Sony Entm’t Inc. v. Connectix Corp.*, 203 F.3d 596 (9th Cir. 2000).

\(^{223}\) See generally *Lexmark Int’l, Inc.*, 253 F. Supp. 2d at 943; *Sony Computer Entm’t Am., Inc. v. Gamemasters*, 87 F. Supp. 2d 976 (N.D. Cal. 1999). In these cases, temporary injunctions were issued in favor of copyright holders because defendants were unlikely to prevail on a DMCA claim involving products that contained copyrighted code. *Lexmark Int’l Inc.*, 253 F. Supp. 2d at 974; *Gamemasters*, 87 F. Supp. 2d at 988. In *Lexmark*, the devices were replacement ink cartridges that used copyrighted authentication codes to function in a Lexmark printer. *Lexmark Int’l, Inc. v. Static Control Components, Inc.*, 253 F. Supp. 2d 943, 947 (E.D. Ky. 2003). Although *Lexmark* does address interoperability, the court summarily rejects the defense because the ink cartridges are not interoperable with anything other than the infringed code, and also that use of the original code constitutes infringement, which would disallow an interoperability defense. *Id.* at 970–71. The key difference between mod
VI. CONCLUSION

Though the issue may swing either way, the facts seem to favor mod chips as being an unlawful circumvention device under the DMCA. The main distinguishing feature between mod chips and fair use circumvention seems to be that, unlike Accolade’s Genesis games or Connectix’s PlayStation emulator, mod chips offer little more than the circumvention itself. Additionally, most mod chips contain infringing code. The saving grace of the mod chip is that independently created interoperable software can be played through its use, but the question of the necessity of the method of achieving interoperability is one that courts have yet to fully consider. The past has shown that courts favor circumvention for interoperability when the reverse-engineered code is built into the software itself. However, these cases do not address the DMCA in any form. This in no way precludes a court from finding otherwise, but the potential for piracy is a factor that a court must consider heavily, as the Second Circuit did in Corley. In Accolade, Inc, and Connectix Corp., the Ninth Circuit never addressed the issue of piracy, and the holdings may have been different if the issues were framed as a way of preventing piracy. Regardless, neither of those cases addressed an issue as ripe with piracy issues as here. Corley dealt with the threat of mass piracy and chose to favor copyright protection over fair use. If the mod chip issue ever goes to trial, the result will likely be the same.

chips and the ink cartridges in Lexmark is that mod chips may have other useful and creative purposes for interoperability and fair use purposes (such as enabling the use of homebrew software) other than ink cartridges, which are a mere replica of the original and perform no function that the original did not. In Gamemasters, the device under the DMCA issue was a "game enhancer" that allowed users to alter codes on existing games and also play games from other regions. Gamemasters, 87 F. Supp. 2d at 987. Although both cases may be insightful as to how a court may interpret the DMCA, they are not discussed in further detail here because: 1) they are not final decisions, but rather grants of temporary injunction; 2) although "game enhancers" are strikingly similar to mod chips, the Gamemasters court offered little analysis on its DMCA holding; 3) the interoperability analysis in Lexmark is limited and offers little guidance, and 4) neither case was defended on the basis of fair use or possible non-infringing uses. See generally Lexmark Int’l Inc., 253 F. Supp. 2d at 943; Gamemasters, 87 F. Supp. 2d at 976.

225. See id.; Sony Entm’t Inc. v. Connectix Corp., 203 F.3d 596, 606 (9th Cir. 2000).
226. Id.
227. See Accolade, Inc., 977 F.2d at 1510; Connectix Corp., 203 F.3d at 596.
228. See Universal City Studios, Inc. v. Corley, 273 F.3d 429, 459 (2d Cir. 2001).
229. See Accolade, Inc., 977 F.2d at 1510; Connectix Corp., 203 F.3d at 596.
Still, the possibility of a legal mod chip remains. For example, Cromwell may be an exception to the potential unlawfulness of mod chips since it is made solely for the purpose of running Linux on Xbox, contains no infringing code, and does not play pirated software. Additionally, mod chips that prevent pirated software from running, but are designed to allow independently designed non-infringing software to run, may also be considered differently. As it currently stands, however, (with the exception of Cromwell) mod chips do not seem to be lawful circumvention devices.