

June 29, 2015

Ms. Jacqueline C. Charlesworth
General Counsel and Associate Register of Copyrights
United States Copyright Office
101 Independence Ave. S.E.
Washington, D.C. 20559-6000

Re: Docket No. 2014-7
Exemptions to Prohibition Against Circumvention of Technological Measures Protecting
Copyrighted Works
June 3, 2015 Questions Posed to Class 1 Witnesses

Dear Ms. Charlesworth,

Thank you for this opportunity to say more about screen capture software and its limitations as an alternative to circumvention for lawful educational uses. We hope our response will be helpful to you, and we welcome any further questions you may have.¹

Screen capture is not a viable alternative to circumvention for educational uses.

As the extensive record in this proceeding demonstrates, all of the screen capture technologies mentioned in the hearings and in the comments of parties opposed to the proposed Class 1 exemption produce low quality clips that do not meet the needs of teachers and students. Footage obtained with screen capture technologies is riddled with imperfections, including interlacing, dropped frames, frame rate issues, insufficient resolution, and artifacting.² Some of these problems were demonstrated in opponents' own exhibits.³ At the May 27, 2015, hearing, a

¹ Since several witnesses who testified on these issues received the same question as part of their post-hearing inquiries, we collaborated on our responses. In particular, this response includes substantial contributions from Jack Lerner, Aaron Johnson, and R.J. Szuba from the UCI Intellectual Property, Arts, and Technology Clinic and Blake Reid and Molly McClurg from the CU Boulder Samuelson-Glushko Technology Law and Policy Clinic.

² See *Question for Those Using Camtasia*, Avid Community (Jan. 30, 2006, 8:06 PM), <http://community.avid.com/forums/t/8559.aspx>; *Progressive Screen Capture with Interlaced-Looking Parts, VideoHelp (Sept. 11, 2014)*, <http://forum.videohelp.com/threads/367096-Progressive-Screen-Capture-with-interlaced-looking-parts>; *"Jerky" and Out of Sync, Dropped Frames in Preview Window and Input*, TechSmith, <https://feedback.techsmith.com/techsmith/topics/-jerky-and-out-of-sync-dropped-frames-in-preview-window-and-output>; *How Many Dropped Frames is Normal?, TechSmith*, https://feedback.techsmith.com/techsmith/topics/how_many_dropped_frames_is_normal; *Dropped Frames, VideoHelp (May 18, 2015, 9:08 AM)*, <http://forum.videohelp.com/threads/371952-Dropped-framesSnagit>; *Never Use EzVid (Why it is the Worst Screen Recorder)*, Minecraft Forum (Aug. 4, 2013), <http://www.minecraftforum.net/forums/off-topic/computers-science-technology/hardware-software-support/499609-never-use-ezvid-why-it-is-the-worst-screenCamStudio>; *Slow Frame Rate in Jing*, TechSmith, https://feedback.techsmith.com/techsmith/topics/slow_frame_rate_in_jing; *Where are the Video Setup and Frame Rate Settings in Snagit 11?*, TechSmith, https://feedback.techsmith.com/techsmith/topics/where_are_the_video_setup_and_frame_rate_settings_in_snagit_11?topic-reply-list%5Bsettings%5D%5Bfilter_by%5D=company_promoted; *Camtasia Studio Poor Video Quality Exporting to Mp4*, TechSmith, https://feedback.techsmith.com/techsmith/topics/camtasia_studio_lost_video_quality_on_production_to_mp4; *Screen Artifacts in QuickTime Version*, TechSmith, https://feedback.techsmith.com/techsmith/topics/screen_artifacts_in_quicktime_version; *Weird Screen Artifacts Replaying Video Recorded Using Camtasia*, Adobe Communities, <https://forums.adobe.com/thread/1488216>.

³ See 2015 Reply Comment of International Documentary Association et al. Docket No. 2014-07, Appendix F: Analysis of Opponents Screen Capture Exhibits.

representative of DVD CCA admitted that screen capture software produces footage of visibly diminished quality.⁴ These quality problems wholly preclude using screen capture software to extract clips from DVDs. Moreover, no one contends that screen capture is even capable of capturing clips of any quality from Blu-ray discs or other high definition sources.⁵

Even if screen capture software worked reliably, it remains unclear whether it is actually an alternative to circumvention. Users of screen capture software cannot be certain how it works, and in particular, whether it involves circumvention that may violate the DMCA.⁶ With the exception of WMCapture, none of the screen capture programs identified by opponents of the proposed exemptions make the representation required by the current exemption—that the software “enabl[es] the reproduction of motion picture content after such content has been lawfully decrypted.”⁷ TechSmith, the makers of Jing, Camtasia, and Snagit, even urges its customers to circumvent TPMs on DVDs to enable screen capture technology to function.⁸

In short, even absent the compatibility issues raised in the hearings and addressed in more detail below, screen capture software is not a viable alternative to circumvention.

Most screen capture software is not fully capable of recording from DVD and other protected formats on the latest versions of Mac OS X.

We have reviewed the specifications and websites of the manufacturers of the software in question, as well as comments by users, to determine operating system compatibility, and detail our results in the appendix to this letter.

Of the eight screen capture programs mentioned in the proceedings so far, three—WM Capture, EzVid, and Cam Studio—are not compatible with Mac OS X.⁹ Two other programs—Jing and Screencast-O-Matic—are compatible with OS X, but are not sufficient to capture high quality video. By their manufacturers’ own descriptions, these programs only support basic forms of screen capture and are designed only to enable users to create short tutorial videos that track a cursor’s movement on the screen.¹⁰

The remaining three programs— Movavi Screen Capture for Mac, Camtasia and Snagit—are not capable of capturing clips from DVDs or iTunes purchased videos on OS X. Beginning with OS X 10.7, Apple implemented its own measures to prevent capture of video content played from iTunes or the built-in DVD player that comes with the system software.¹¹ Techsmith, the maker of Camtasia, Jing, and Snagit, suggests in a recent support document that

⁴ *Transcript of Section 1201 Rulemaking Hearing Before the U.S. Copyright Office, Washington, D.C.* (May 27, 2015) at 58:13–61:16, available at <http://copyright.gov/1201/2015/hearing-transcripts/1201-Rulemaking-Public-Roundtable-05-27-2015.pdf> [hereinafter *May 27 Hearing*].

⁵ AACCS admitted that it is not aware of any screen capture technology capable of Blu-ray level quality. *Id.* at 45:1.

⁶ *See id.* at 11.

⁷ *Id.*; see 37 C.F.R. § 201.40 (emphasis added).

⁸ *See* discussion *infra*, at 3.

⁹ *See* WM Capture, WM Recorder, <http://wmrecorder.com/products/wm-capture>; Ezvid, <http://www.ezvid.com/download>; CamStudio, <http://camstudio.org>.

¹⁰ *See* Jing, <https://www.techsmith.com/jing.html>; Screencast-O-Matic, <http://www.screencast-o-matic.com/>.

¹¹ *See* *Movavi Screen Capture For Mac*, Movavi, <http://www.movavi.com/mac-video-recorder/> (“Please be aware that Movavi Screen Capture for Mac does not allow to capture [sic] copy protected videos and audios [sic]”); *Why Can’t I Capture from a DVD?*, Ambrosia Software Inc. (Nov. 13, 2013), <http://www.ambrosiasw.com/support/faqs/products/snapz-pro-x/Why-cant-I-capture-from-a-DVD>; *Lion Killed My Snapz Pro X DVD Screen Capture Software*, Apple Support Communities (July 24, 2011, 1:59 PM), <https://discussions.apple.com/thread/3207660?tstart=0>.

users employ potentially circumventing software such as Handbrake or VLC in order to defeat Apple’s video protection.¹² Because the makers of these programs suggest that their utilization requires a separate circumvention that might itself violate Section 1201, neither program is likely to serve as an alternative to circumvention.¹³

Dual booting and emulation have numerous flaws that render them unsuitable solutions to the problem of limited screen capture functionality on Mac OS X.

Screen capture programs that are only available on PCs are not a viable option for teachers and students who seek to operate in a Mac environment, notwithstanding the existence of programs like Boot Camp and Parallels Desktop. To use Boot Camp, a user must undertake a time-consuming and lengthy process that can include each of the following steps: purchasing a new Mac, moving data from an old Mac to another drive, or partitioning an existing Mac’s hard drive; purchasing and installing a copy of Microsoft Windows; installing Boot Camp and Windows; and devising a mechanism to move large video files back and forth from one operating system to the other, which may require purchasing an external hard drive.

In addition, creating a partition suitable for creating large video files substantially reduces the storage space available to the main Mac OS portion of the machine—a critical consideration when managing the large files involved in the creation of multimedia presentations.¹⁴ Further, some University IT offices have warned students about security risks associated with using dual-OS machines.¹⁵

In short, a requirement that Mac users seeking to make fair use must utilize Boot Camp would be unduly burdensome. A student who uses Apple hardware because of its ease of use and its well-developed ecosystem of media creation and editing tools would suddenly find herself the reluctant owner of a possibly insecure machine with significantly reduced storage space on the

¹² Mike Spink, *Camtasia (Mac): Cannot capture DVD video on OS 10.7, 10.8 or 10.9*, TechSmith, <https://support.techsmith.com/hc/en-us/articles/203727498-Camtasia-Mac-Cannot-capture-DVD-video-on-OS-10-7-10-8-or-10-9> (last updated Jan. 20, 2015) [hereinafter Spink, *Camtasia*]; Mike Spink, *Snagit (Mac): Cannot capture DVD video on OS 10.7 or later*, TechSmith, <https://support.techsmith.com/hc/en-us/articles/203732478-Snagit-Mac-Cannot-capture-DVD-video-on-OS-10-7-or-later> (last updated Jan. 20, 2015) [hereinafter Spink, *Snagit*]. Techsmith makes exactly the same representation in connection with Jing. Mike Spink, *Jing (Mac): Cannot capture DVD video on OS 10.7*, TechSmith, <https://support.techsmith.com/hc/en-us/articles/203733738-Jing-Mac-Cannot-capture-DVD-video-on-OS-10-7> (last updated Jan. 20, 2015) [hereinafter Spink, *Jing*];

¹³ See 37 C.F.R. § 201.40.

¹⁴ See *Dual-booting: The Pros and Cons* (Mar. 20, 2014, 7:25 AM), Pocketnow, <http://pocketnow.com/2014/03/20/dual-booting>.

¹⁵ See *Windows on a Mac*, University of Arizona Information Technology Services, http://uits.arizona.edu/services/win_mac/macosex (last visited June 18, 2015); *Windows on a Mac*, Stanford University IT, <https://itservices.stanford.edu/service/helpdesk/osxresources/windowsonmac> (last modified Jan. 25, 2010); *Computer Use Policies*, NC State University, <http://www.csc.ncsu.edu/it/policies.html> (stating that Dual OS boot setups are not allowed on departmental owned computers because of a “huge” likelihood that one of the operating systems may be offline for a long period of time, miss critical system updates, and thus face significant risks of being compromised); *Dual Booting & Virtualization*, University of Michigan Computing & Technology Support, <http://cats.lsa.umich.edu/Policy-Help/virtual-machines-dual-booting> (discouraging “highly” the use of dual booting for, in addition to other reasons, security compromises); *Basic Installation Notes*, University of Liverpool Computing Services, <http://www.liv.ac.uk/csd/mws/install/basic.htm> (noting that there are “a number of drawbacks” to dual booting, including risks that virus infections in one operating system could infect files in the other operating system, resulting in both systems being compromised); *Encryption: How to protect your computer and University Data*, Princeton University Office of Information Technology, <http://helpdesk.princeton.edu/kb/display.plx?id=9944> (noting that Dual boot computers do not support encryption) (last updated Mar. 4, 2015).

OS X side, and will be forced to do most of her media work in the Windows environment. To require a Mac user to partition her hard drive and dual boot Windows is not much better than requiring her to purchase a PC.

Emulation software is an even less viable alternative. A machine running Windows OS using emulation software such as Parallels or VMware Fusion suffers severe constraints in operability. Emulators tax system resources, reducing the computing power available for playing and capturing video.¹⁶ Reduced computing power naturally means more dropped frames, lower resolution, and visibly lower-quality output. Opponents have acknowledged that screen capture simply cannot handle the HD video output from Blu-ray discs without serious visual defects.¹⁷ Indeed, our research indicates that a Blu-ray disc cannot even be played from within an emulator, much less captured.¹⁸ Once the CPU is taxed by emulation software, DVD capture will naturally suffer as well.

Reverting to earlier versions of Mac OS X is not a viable option for Mac users.

Because Apple has configured OS X 10.7 and later to block screen capture programs from capturing DVD clips, the only remaining option is to configure a Mac with OS X 10.6 or earlier.¹⁹ However, this alternative presents numerous disadvantages and is impossible in many circumstances, and thereby would not make screen capture viable for purposes of making lawful educational uses.

The install base of OS X 10.6 and earlier is extremely small; the vast majority of Mac users run the latest version of the operating system.²⁰ The lifespan of most laptops is around three to five years, so the majority of Apple laptops now in use will have been purchased with OS X 10.7 or later pre-installed.²¹ Apple has been releasing its OS updates as free downloads since the release of Mac OS X 10.9 in 2013, so even older laptops will most likely have upgraded to recent OS versions.²² Once a recent OS is installed, downgrading to an older version is challenging, even for experienced Mac users.²³ Additionally, Apple support explicitly discourages installing an OS earlier than that which was originally installed on that Mac.²⁴ Even if an educator or a student were to ignore this warning and go through the trouble of

¹⁶ For many accounts of users running Parallels and experiencing extreme slowing of computer speed and operability see *Slowing Down Computer*, Parallels Forums, <https://forum.parallels.com/threads/slowing-down-computer.90728/>.

¹⁷ *May 27 Hearing*, supra note 4, at 45:1.

¹⁸ See *CyberLink PowerDVD 13 Ultra crashes and reports program is not running on a Virtual Machine*, Parallels, <http://kb.parallels.com/en/118609> (last updated May 11, 2014) (stating that Virtual Machines, such as Parallels, cannot play Blu-ray discs).

¹⁹ See *Why Can't I Capture from a DVD?*, supra note 11.

²⁰ See *Desktop Operating System Market Share*, NETMARKETSHARE (May, 2015), <http://www.netmarketshare.com/operating-system-market-share.aspx?qprid=10&qpcustomd=0>.

²¹ See Jane Williams, *The Average Lifespan for Laptops*, Hous. Chron., <http://smallbusiness.chron.com/average-lifespan-laptops-71292.html>.

²² See Ryan Tate, *Apple Just Ended the Era of Paid Operating Systems*, WIRED (Nov. 22, 2013, 6:24 PM), <http://www.wired.com/2013/10/apple-ends-paid-oses/>.

²³ See Lou Hattersley, *How to Downgrade Mavericks to Mountain Lion. How to roll back Mac OS X 10.9 to 10.8 (and earlier)*, Macworld (Dec. 20, 2013), <http://www.macworld.co.uk/how-to/mac-software/downgrade-mavericks-mountain-lion-3494785/> (stating that it is “by no means easy to roll back to an earlier operating system” because the process involves, among other things, creating a recovery install disk, cloning a hard drive, securely erasing the drive, and restoring and installing the older operating system).

²⁴ See *Don't Install a Version of Mac OS X Earlier than what Came with Your Mac*, Apple Support, <https://support.apple.com/en-us/HT201686>.

downgrading her OS, she would then need to install older versions of screen capture programs because the latest versions of these programs are only compatible with Mac OS X 10.9 and later.²⁵ However, older versions of screen capture programs will likely result in even lower quality footage.

Problems with screen capture software on OS X affect DVD, streaming, and Blu-ray.

We reiterate that screen capture is not a viable alternative to circumvention with respect to any format. OS X prevents screen capture recording of DVD and iTunes content. OS X also frustrates efforts to capture streaming video.²⁶ Further, screen capture technology is particularly unsuitable for procuring HD content because it introduces severe visual artifacts such as dropped frames and precludes obtaining full 1080p resolution.²⁷ To ensure that lawful educational uses are not adversely affected by the law's bar on circumvention, the Register should recommend, and the Librarian should grant, an exemption for proposed Class 1.

Best regards,



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²⁵ See *infra* Appendix, Figure 1.

²⁶ See Harry Brindley, *How to record streaming video to your Mac*, slappHappe, <https://slapphappe.wordpress.com/2015/01/04/how-to-record-streaming-video-to-your-mac/> (Jan. 4, 2015) (describing how “Mac’s QuickTime Player and Safari conspire to prevent” screen capture of streaming video, and a convoluted process to circumvent these measures).

²⁷ See *May 27 Hearing*, *supra* note 4 at 45:1; 2015 Reply Comment of Authors Alliance et al. Docket No. 2014-07 at 10–11.

APPENDIX

Screen capture operating system capabilities as represented by software makers' websites and specifications

Screen Capture Software (vendor)	Compatible with?					Notes
	Mac OS X 10.10	Mac OS X 10.9	Mac OS X 10.8	Mac OS X 10.7	Windows 7, 8, 8.1	
Camtasia (TechSmith)	Yes*	Yes*	No	No	Yes	*According to TechSmith support, though Camtasia says that it is compatible with 10.9 or higher, Apple DVD software 10.7 and beyond prevents it from working. ²⁸ Workarounds suggested by TechSmith require using VLC or Handbrake, which may involve circumventing TPMs. ²⁹
Movavi	Yes*	Yes*	Yes*	Yes*	Yes*	*Movavi's website indicates that none of its screen capture software, on any platform, allows capture of protected formats. ³⁰ This is also true for Movavi Video Converter. ³¹
Snagit (TechSmith)	Yes**	Yes**	No	No	Yes	**Though Snagit's system requirements asserts compatibility with Mac OS 10.9 or higher, ³² Apple DVD software 10.7 and beyond prevents it from working, and workarounds suggested by TechSmith require using VLC or handbrake which may also constitute circumventing of TPMs. ³³
WM Capture	No	No	No	No	Yes	WM Capture's requirements list includes only Windows 8, 7, Vista, XP, or Macs with Parallels or Bootcamp and Windows installed. ³⁴
EzVid	No	No	No	No	Yes	EzVid Wiki & Screen Recorder is compatible with Windows XP SP3, Vista, Windows 7, Windows 8, and Windows 8.1. ³⁵ EzVid has obtained poor reviews by users and is known for having very low frame rates and poor sound quality. ³⁶

²⁸ See *System Requirements*, TechSmith, <https://www.techsmith.com/camtasia-system-requirements.html>.

²⁹ See Spink, *Camtasia*, *supra* note 12.

³⁰ *Movavi Screen Capture For Mac*, Movavi, <http://www.movavi.com/mac-video-recorder/> ("Movavi Screen Capture for Mac does not allow to capture copy protected videos and audios.").

³¹ See *Help Center*, Movavi, <http://www.movavi.com/support/> (click "Installation Questions").

³² See *Snagit System Requirements*, TechSmith, <https://www.techsmith.com/snagit-system-requirements.html>.

³³ See Spink, *Snagit*, *supra* note 12.

³⁴ See *WM Capture*, WM Recorder, <http://wmrecorder.com/products/wm-capture>

³⁵ See ezvid, <http://www.ezvid.com/download>.

³⁶ See *Never Use Ezvid (Why it is the worst screen recorder)* (Aug. 4, 2013), Minecraft Forum, <http://www.minecraftforum.net/forums/off-topic/computers-science-technology/hardware-software-support/499609-never-use-ezvid-why-it-is-the-worst-screen>.

Screen Capture Software (vendor)	Compatible with?					Notes
	Mac OS X 10.10	Mac OS X 10.9	Mac OS X 10.8	Mac OS X 10.7	Windows 7, 8, 8.1	
CamStudio	No	No	No	No	Yes	CamStudio asserts compatibility only with Windows operating systems. ³⁷ CamStudio is a well-known purveyor of malware and is not sufficiently trustworthy for use by authors. ³⁸
Jing (TechSmith)	Yes*	Yes*	Yes*	Yes*	Yes	Jing is basic screen capture software intended for short, fast communication. ³⁹ *TechSmith support also claims that Jing is blocked from recording DVD or iTunes purchased content. ⁴⁰
Screencast-O-Matic	Yes	Yes	Yes	Yes	Yes	Screencast-O-Matic, like Jing, is clearly advertised as a basic capture tool not capable of capturing high quality video. ⁴¹

³⁷ See CamStudio, <http://camstudio.org>.

³⁸ 2015 Reply Comment of International Documentary Association et al. Docket No. 2014-07 at 10; See CamStudio Video/Screen Capture FREE., <http://camstudio.org/> (last visited Apr. 30, 2015); see also *When good software goes bad: the sad saga of camstudio*, One More Tech, <https://onemoretech.wordpress.com/2014/04/01/when-good-software-goes-bad-the-sadsaga-of-camstudio/> (discussing malware concerns in the operation of screen capture software such as CamStudio) (last visited Apr. 30, 2015).

³⁹ See Spink, *Jing*, *supra* note 12; see also *Jing: 5 Minute Recording Limit*, TechSmith (Mar. 13, 2013 2:15 PM), <https://support.techsmith.com/hc/en-us/articles/203733698-Jing-5-minute-recording-limit> (stating that Jing “is intended for short, fast communication; not so much for long tutorials or presentations”).

⁴⁰ See Spink, *Jing*, *supra* note 12

⁴¹ See Screencast-O-Matic, *supra* note 11 (advertising the program as a tool for teachers, students, “how to-ers,” and “YouTubers;” note that all examples provided are basic computer tutorial-type videos).