

CAPTURE SOFTWARE STUDY FOR PRESERVATION OF ANALOG VIDEOTAPE

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ABSTRACT

Bay Area Video Coalition is a non-profit video preservation service provider whose goal is to provide subsidized digitization services and other types of support to archives, artists and cultural heritage organizations. As part of its Dance Preservation & Digitization Project partnership with the Dance Heritage Coalition, the organization has been investigating capture software and encoding practices for digitizing analog videotape.

This paper presents a case study of how capture software was chosen for this project. It also summarizes and provides user experience summary from a survey of moving image archive community regarding analog video digitization capture software interfaces and features. The survey examined how software's editing and creative purposes can impact a preservationists' experience and how the archiving and conservation community might re-imagine software functionality. Issues examined include needed features and contextual questions in computing environments. By presenting user feedback about digitization workflow and capture software, this paper aims to advocate for more tools and software created specifically for preservation rather than for editing and creative functions.

INTRODUCTION

Dance Heritage Coalition (DHC) is the sole national non-profit alliance of institutions holding significant collections of materials documenting the history of dance. Its mission is to preserve, make accessible, enhance, and augment the materials that document the artistic accomplishments in dance of the past, present, and future. The DHC was founded in 1992 to address problems in documenting dance and preserving its record, problems which were identified in a study commissioned by The Andrew W. Mellon Foundation and the National Endowment for the Arts. This study, titled *Images of American Dance*, recommended the formation of an alliance of the nation's major dance collections to facilitate communication; develop national standards, policies, and priorities; and implement collaborative activities and projects in the fields of dance preservation, documentation, and access. In keeping with this history and mission, in 2009 the DHC embarked on an ambitious project to preserve and make accessible vital dance documentation, rare performances, and other notable works via a digital preservation repository of moving image materials, as well as a corresponding web-accessible repository available on-site at DHC member archive institutions.

Bay Area Video Coalition (BAVC) is collaborating with DHC on this Andrew W. Mellon Foundation-funded project to digitize, preserve, and make accessible analog and digital tape-based documentation of key importance to dance heritage. In creating a digital repository, materials and workflow are managed using a suite of tools and standards, including Open Archival Information (OAIS) standard (ISO 14721:2003) based systems. At this point in development, digital sustainability will be managed using Archivematica repository software, along with a suite of open-source software tools for transcoding, file analysis and information about moving image video files, including FFmpeg, ExifTool, cron and custom scripts developed by technologist Dave Rice.

The Dance Preservation & Digitization Project (DPDP, formerly the Secure Media Network) digital repository project is just one of these collaborative activities, meant to develop a variety of different elements to create a secure way to access and preserve video assets collected by member institutions. These elements include:

- A union catalog of dance-related moving image materials openly accessible on the web at <http://archive.danceheritage.org>
- An access web service with streaming videos at DHC archive sites
- Development of an OAIS-compliant workflow for digital preservation of analog videotape, to be utilized at digitization station hubs located at DHC member institutions around the country
- Installation of digitization stations at DHC partner sites
- Planning and implementation of an on-site and mirrored off-site, server-controlled hard drive storage
- Digitization fellowships focusing on transfer protocol and practices, and incorporation into DPDP's implementation of the OAIS workflow, and ingest into the repository

ARCHIVAL VIDEOTAPE: RISK FACTORS AND WAYS FORWARD

For archives, providing preservation and accessibility can be a particularly costly and technically encumbered process. Bay Area Video Coalition's mission is to "inspire social change by empowering media makers to create and share diverse stories through art, education and technology." Within this mission, BAVC provides services to archives and other non-profit organizations to help them to preserve and provide access to histories captured on videotape. BAVC first began its partnership with the Dance Heritage Coalition in 2009, creating a repository plan and mapping out digitization centers for analog video to server DHC's constituency. In choosing

to work with BAVC, a like-minded organization, serving archives and creating ways forward that work for underserved organizations, the project brings to the forefront advocacy for analog videotape preservation, as well as intending to serve as a model for collaborative work in the digital preservation field.

The challenge for archives moving from analog to digital is most apparent when working with video materials. Video is composed of chemical elements that affect its rate of decay. Storage conditions can also exacerbate or prevent this decay. In 1995, a study published by the Council on Library and Information Resources (CLIR) voiced the urgency in examining and pursuing strategies for preservation of analog videotape. This study included an appendix outlining the life expectancy for analog videotape; Appendix B, Estimation of Magnetic Tape Life Expectancies (LEs) states, “The binder systems used in today’s audio and videotapes are generally based on polyester polyurethanes. These polymers degrade by a process known as hydrolysis—where the polyester linkage is broken by a reaction with water” (Bogart 1995, 34). The article further states that even stored in ideal conditions, any analog tape will have a maximum LE of 30 years; under poorer storage conditions, the LE may be 10 years.

The CLIR article also notes that a carrier cannot be read without functional technology to access it. The difficulties of analog video preservation are two-fold: an accelerated rate of decay compared to paper-based materials and technological obsolescence. In 1995, analog tape and machines were still being manufactured; now, only low-quality consumer videotape is still manufactured at low production rates, while machinery for playback is obsolete. In order to transfer these videotapes, keeping aging playback decks on the one hand and making sure there is advocacy for the need to digitize analog materials and service providers to perform this work is essential.

Part of this investigation culminated in the recent publication of “Codec Comparison for Digitized Analog Videotape” (Sacerdote and Sorensen 2012). The paper presents a survey of capture software practices from a variety of archives and vendors, listed below. It also gives a review of some digital preservation tests performed in our preservation lab. It states what was found to work best for this project’s requirements, outlining specific project goals and how the choice of codec affected those goals.

CODEC COMPARISON FOR DIGITIZED ANALOG VIDEOTAPE

In order to look at our capture software testing as a case study, here we will provide background information on how the project came to choose the target codec for analog video capture and digital preservation. This study was presented as a comparison of different high-quality video codecs, and included lossless, lossy, and uncompressed. A group of colorists, archivists, video editors, and preservationists were asked to evaluate a set of the same video clip encoded in several different video codecs. The testers were asked to provide specific feedback on aspects of the clip, in a blind test.

Overall, most participants noticed major differences only in the H.264 files and the IMX files. Some participants noticed minor color differences between 8-bit and 10-bit uncompressed files, but all stressed that these differences were very subtle. Time-base correctors, playback equipment, or monitor issues can also introduce these types of color changes. In general, artifacts such as blockiness, blur, or motion artifacts were not seen when comparing 8-bit and 10-bit uncompressed files, but were seen in H.264 files. Visible artifacts included subtle visual softening in varying degrees on certain clips and a reduction in apparent noise, which led some participants to conclude that the compressed file was better. Most of the lower-quality analog tape formats exhibited signal problems that can be difficult to distinguish from other artifacts that may be introduced by digital compression.

Based on this study, BAVC recommends 10-bit, uncompressed files for any visually significant recording, the case for performing arts documentation. These lossless, high-quality files are also useful in any future transcoding that may be required for preservation of the digital files. Lossy codecs, when transcoded (in the case of a new standard format or codec adopted by the archive), lose information and result in poorer image quality.

The purpose of this study is to examine current, common workflow and equipment practices for the digitization of analog videotape onto a hard drive, and to incorporate in these reflections into the digitization practices that are part of the Dance Preservation & Digitization Project project. Often, Non-Linear Editing (NLE) software is used as a means for presenting digitally while capture occurs, and wrapping the digital audio and video stream. Meaning, common features of this software includes functionality which allows digitization technician may view a digital presentation of the content on the tape while it is digitized, and the software will output a file containing (wrapping) two streams of content, audio and video, via hardware called a capture card. Software drivers for the hardware work with these NLE systems, where the intention is largely editing or creative purposes. The hope is that this study will prompt discussion and help in establishing workflows. This information can help those pursuing video preservation and reformatting think about establishing an archival workflow with capture software by being able to consider what options colleagues in the field have also pursued. It also describes the needs of the preservation community regarding development of software directed to this group of users.

SUMMARY OF CAPTURE SOFTWARE SURVEY, QUANTITATIVE RESULTS

The first part of the survey investigated common practices related to workflow in computing, staff position, and dealt with contextualizing an organization's choice in working with a capture software in pursuit of analog video preservation. An account of the quantitative survey

results can be found in Appendix 1. The survey found that most of the participants used a Macintosh computing environment, possibly for the product's reputation for working well with graphics and moving images. Most also worked in a Graphical User Interface environment, an advantage if staff has a background in video production or if staff monitors the image during digitization (as is the case with Apple Final Cut Pro 7.0.3, and Adobe Premiere).

Not surprisingly given the constituency surveyed (subscribers to the Association of Moving Image Archivists email listserv), the majority of respondents are operators who digitize analog media, and close to 30% perform duties in addition to digitization for their or other organizations. Close to half of the survey respondents are solely responsible for analog digitization; the rest are responsible for both managing digital assets and analog video digitization. More than 80% of respondents digitize their analog videotape assets for purposes of preservation.

The qualitative report below examines which specific file use is tied to which software type. Capture hardware is one of the central contextualizing questions posed in the survey. It was noted that the decision to choose capture software was often two-fold, and software is very closely tied to hardware for many products on the market. AJA and Blackmagic Design have marketed to the preservation community, but there remains a wide variety of capture hardware used for digitization of analog video in the moving image archiving community.

Another contextual consideration was the choice to capture standard definition (SD) or high definition (HD). While HD is making more of an appearance in the preservation community, these specifications are not widely adopted, and mostly SD specification is used for preservation purposes. Digitization occurred mostly as a supervised transfer, while there was a small number in the group, 9 out of 28 responses, who performed batch digitization of analog video. Since capture hardware is

often closely associated with the software choices, this question was included in the survey for context. Settings within the capture software can at times be dictated by capture hardware and driver settings, as well.

DANCE PRESERVATION & DIGITIZATION PROJECT CASE STUDY

Several types of software are used in the context of Blackmagic Design's Decklink Studio capture card device the hardware chosen for the Dance Preservation & Digitization Project project.¹ The project uses the Macintosh environment due to staff training and context, as well as Mac's strong reputation in the professional video field. The capture card hardware allows for specific bit depth and sampling rates: 24-bit depth and 48 kilohertz sampling rate for audio, and 10-bit depth 4:4:4, approximately 250 megabytes per second data rate, 4:2:2 chroma sampling was chosen in this instance because the SD content and analog source did not demand a chroma sampling as 4:4:4.

Because the project involves building geographically diverse digitization centers, software types vary. Engineers must also keep abreast of software dependencies as they shift, and as companies adopt new versions of software. For example, the release of Apple Final Cut Pro 10 brought criticism to the company from the professional editing community following its early release. Additionally open-source Ubuntu Linux operating systems do not support Final Cut Pro in any version. Blackmagic Design Media Express is the capture software used by our Ubuntu hub in lower Manhattan. It is a simple, out-of-the-box software for capturing video developed by the hardware company. Other digitizing stations use Final Cut Pro version 7.0.3 for interfacing with the capture process. Capture software choices for the hubs involved context questions, including budgetary restrictions, technician familiarity and ability to map BAVC's processes and practices to the hubs in Washington and New York and elsewhere. Ubuntu operating system station running Media Express was built in February 2011. The software

used to transfer DV tape to file is an open-source system called dvgrab, used with dvanalyzer. Both of these command line tools are available on Github. Running these two programs was one of the reasons for choosing Ubuntu as a desktop software operating system, as well as cost. Our user feedback from technicians has been essential in establishing workflow and in many ways, very similar to those above: a desire for a more simple interface, more of an aim of the software in relationship to the end goal of preservation and sustainability of digital files, and clarity around technology processes that may not be where the technicians' familiarity lies. The project also uses export bypass by selecting for preservation purposes the file directly from the capture scratch.

SUMMARY OF CAPTURE SOFTWARE SURVEY, DESCRIPTIVE RESULTS

The second part of the survey solicited more subjective responses. These questions, as follows, aimed to describe the character of the user group for digitization software in the video preservation and archiving community. Though responses varied, common concerns emerged regarding usability. Many times, decisions were made because of budget concerns and staff expertise and training.

Survey question

Please explain, if you were involved in the decision-making, why this particular capture software was selected.

- User who operates software for multiple purposes, including preservation: "Capture software is intimately wrapped with the hardware, so the decision is oftentimes two-fold. Blackmagic Design is a well-documented encoder for video, but lacks proper architecture for sampling audio. When recording at 48 the differences in quality between the Blackmagic and the Benchmark ADC were apparent. Blackmagic Media Express allows for various external I/Os, so this was not an issue."

- User who operates out-of-the-box software provided by hardware vendor for preservation (long term storage): “I use the Blackmagic and AJA capture software because it a) came with the hardware, b) doesn’t require as powerful a machine to run, c) doesn’t cause problems that Final Cut Pro can introduce if you make any edits in that software - such as stripping out audio, timecode info., d) it’s easier to teach assistants and interns to use the software than FCP.”
- User who operates Final Cut Pro 7.0.3 software for multiple purposes, including preservation: “FCP was chosen at a time when it appeared ‘open source friendly’ and handles the .mov container well. JPEG-2000 is not yet a truly open standard and MOV is the best current wrapper although it is, in fact, a bit Mac-facing.”
- User who operates software for restoration purposes: “VTR Xchange is used for most capture sessions because it contains a very basic feature set that limits the amount of necessary setup prior to digitization (i.e. - RS-422 TC calibration, ‘abort capture on dropped frames,’ etc.). In some situations, FCP is useful because the capture tool offers functionality beyond those in VTR Xchange. For example, FCP will automatically stop when a time code break is encountered, pre-roll, and start capturing a new file after the time code break. This might not be desirable given the parameters of a particular project, but it is an available option.”
- User who operates software for unknown purposes: “We chose FCP because it is the easiest for a myriad of available technicians to use, and because we already use it for quick edit jobs. Additionally, it was very cost-effective.”
- User who operates software for multiple purposes, including preservation: “At the time we decided to use it, it was revolutionizing the industry - people were excited about FCP and how cheap it was. Now I am very disappointed with FCP X and considering switching to Adobe Premiere.”
- User who operates software for unknown purposes: “Final Cut: cost and multi system shared storage was a huge consideration.” *Editor’s note: Noting storage likely refers to the storage capability of the Final Cut Server within the FCP workflow. Final Cut Server is no longer supported by Apple.*
- User who operates Final Cut Pro 7.0.3 software for preservation purposes: “More control over the capture vs. Blackmagic’s Media Express.”
- User who operates Final Cut Pro 7.0.3 software for access purposes: “We are digitizing for access only, mostly capturing short clips from our collections and putting those clips as ‘teasers’ online (YouTube, web exhibits, and our online catalog). We wanted decent quality, but didn’t need top of the line software/ hardware. We wanted something that a variety of staff and interns could learn and use. We needed to be able to capture AND edit, and while this can be done with two different software solutions, it seemed easier for us to just use one. Finally, I was the primary person making the recommendations and knew I would be the primary person using the software (at least for some time), and I am very familiar and comfortable with Final Cut Pro.”
- User who chooses to bypass software for preservation purposes: “... Neither editing software nor consumer software (survey brands mentioned) are suitable for preservation quality digitization - frames can be dropped, and there is no error detection - these apps are built for another purpose. The capture process is not computer-intensive (it’s I/O intensive, particularly for HD but even for SD), and the ability to capture uncompressed directly to an SSD device is both cheap and effective. We developed a JPEG-2000 implementation for lossless (or lossy, if chosen) preservation-quality coding, which we plan to offer to others.”

Survey question

If you had the choice, what features would you look for in a capture software for preservation purposes? A series of features were given as examples in our deliberations over what features may be desired for preservation (see appendix for quantitative questions); respondents were then asked to follow up with elaborate below on why you are looking for any of the features listed above. Additionally, please describe features or settings that you would find useful to be built into capture software for preservation purposes. Repeating features are highlighted in bold.

Popular answers included: digitally monitoring the signal during capture; ensuring that capture codecs and wrappers are consistent with policy set by the archive or digitizing body; ease of use; flexibility in choosing file formats, simplicity in software's native workflow; and automatic generation of metadata reports and file analysis. Following these set options, we asked respondents to consider what options they might find especially useful in a preservation workflow.

- User operating Final Cut Pro for multiple purposes, including preservation: "Ease and simplicity of use are critical in ongoing migration and digitization of analog materials."
- User operating other software for multiple purposes, including preservation: "Good software provides seamless transition from capture to playback modes, meaning that your SDI outs feed the same display as your analog ins do. Audio levels should be easily readable, but not distracting."
- User operating Final Cut Pro 7.0.3 and out-of-the-box software from hardware vendor: "A way to log video and audio problems. Something that could be assessed after a tape to see if tape had problems."
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: "In capture software built for preservation, I would look for integrated quality assurance tools that would verify that each captured file conforms to the spec put forth by the archive/repository, and that each file is well-formed and meets a customizable quality threshold (i.e. - average RF levels during playback, signal clipping, etc.) Because many tools currently available are built for use in post-production workflows, the analysis/reporting functions are fairly limited."
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: "Definite multi-output transcodes. Our uses are quite broad: from master digital files in various formats to e-mail-able approval dubs. Legitimate reference: IE legit color bars, and audio meters that are SDI calibratable (is this a word?). Reference and set-up are so critical!"
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: "It's hard to discredit any of the functionality in the options suggested above; capture software isn't specifically written for preservation purposes; additionally, since we're an academic institution, we depend on student work a lot of the time, so simplicity & clarity would be a nice touch. Most of all QC issues for preservation purposes are key."
- User operating out-of-the-box software provided by hardware vendor: "Software that stops capture at a designated time or time code (in case you have to step away from the capture process and you're not there to stop the capture when you wanted to). Real time vector scope and wave form monitoring, as well as accurate audio level monitoring to insure that video and audio levels are being captured at acceptable industry standards. As part of the capture software - the option to run the following directly after capture automatically, or, at the end of the day as a batch: a video file data integrity check, generate an MD5 or similar checksum and the ability to re-encode to other formats. The capture software

should have a way to provide an easy-to-use interface for metadata tagging. I'd like to see some type of report gauge generated in real time during the capture process that shows indications of not only dropped frames but A/D conversion issues, data errors, computer drive issues, audio/video signal levels that go beyond the boundary of acceptable standards, and other measurements that could provide advanced warning during capture that the end file may have a problem. It would save so much time to know you have a problem during conversion/capture instead of waiting till the end and finding out you have to start over."

- User operating Final Cut Pro 7.0.3 for access purposes: "Metadata reporting and automatic creation of a checksum would be great - it's also nice to visually check the resulting file, but you can't do that for everything, so error reporting and detailed metadata (such as SAMMA provides) can help ID which files should be checked. I prefer open-source, but would certainly accept proprietary software that offered open-source, standards-based codecs and wrappers, if the company upholds a certain level of transparency and collaboration with this software. Ease of use would be nice, and being able to train non-specialists to operate is very appealing, but I am doubtful that a product could really do that without trading on some functionality. If it can have both, then great!"
- User operating Final Cut Pro 7.0.3 for preservation purposes: "Automatic metadata generation (especially md5 checksums) would be ideal upon completion of a transfer. However, I find putting too much trust into one single application is a bit worrisome, so I prefer to double-check upon QA/QC with Mediainfo and Dumpster whether the file is sound. In addition, constant monitoring is a requirement of the type of transfers I'm performing, so multiple points of monitoring allow me

to see a better picture of the transfer (pre- and post-digitization, for example)."

Survey question

Please explain why your capture software does or does not adequately perform the functions you and your archive, project, or repository requires, and what these functions and requirements are. (Please be as specific as possible as to the type of software).

- User operating Final Cut Pro for multiple purposes, including preservation: "We're able to use Final Cut Pro to do exactly what we want, which is to capture and digitize at various compressions based on the value of the materials. Essentially we use it to migrate U-matic tapes, capture 16mm film, and capture videotape from a variety of tape formats."
- User operating Blackmagic Media Express for multiple purposes, including preservation: "Blackmagic Media Express adequately performs 10-bit uncompressed Quicktime-wrapped files for preservation of Standard Definition video. It has a very easy-to-use interface."
- User operating Final Cut Pro 7.0.3 for preservation: "It is adequate as long as the operator understands how to wrap the essence file in the .mov without re-transcoding it."
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: "The software we are currently using satisfies the basic requirements for our lab: accurate capture (and playback) of 10-bit uncompressed video and 24-bit/48 kHz audio and accurate time code capture (if calibrated correctly) over RS-422, as well as customizable profiles for situations where we might want to capture using a different video codec or audio configuration. The software has integrated well with our storage devices, and the incidence of halted capture due to dropped frames is very low."

- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: “We like that there are so many export codecs to choose from, and we use Final Cut Server to organize our assets archive. Due to the death of FCS support, however, we are exploring other options for archiving, editing, and digitizing. I would absolutely love to see an open source approach, but I am not holding my breath on that one!”
- User operating other software for multiple purposes, including preservation: “Digital Rapids captures the analog videos and outputs several files (for example, master, editing, and streaming) simultaneously in real time. We have been using it for six years, and it has always proved satisfactory. The only limitation we are facing now is that the hardware and software are still not built for 64 bit systems.”
- User operating other software for multiple purposes, including preservation: “We are pleased with SAMMA Solo machines. They produce multiple digital formats at the same time, produce detailed metadata re: almost frame-by-frame capture for multiple parameters, are customizable, and the vendor is responsive.”
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: “FCP offers flexibility to capture depending on the stability of the media; we can batch digitize, or capture on the fly. We have also used Blackmagic Media Express with good results. We run the capture through a waveform & vectorscope to follow the signal quality. Of course, the functionality of capture programs is in a post-production environment rather than an archival environment where media comes in many flavors and conditions. Particularly in the application of a metadata wrapper, it would be nice if there were more flexibility.”
- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: “Personnel are most familiar with this software vs. other available software.”
- User operating out-of-the-box software provided by hardware vendor: “Just need a basic capture software. All metadata, etc. is added later when footage is reviewed by archivist. Tapes are in such bad shape we want to have as few passes over the video heads as possible.”
- User operating out of the box software provided by hardware vendor: “File integrity analysis, generating an associated MD5 checksum and metadata tagging are additional steps after the initial capture has been completed. It would be nice if these could be added to the process as automatic steps after the capture has been completed along with other measurement devices that could be used on setup and during capture.”
- User operating hardware without need for software interface upon capture: “Requirements: 1) no dropped frames during capture (must be verifiable); 2) SD and HD from tape, film from file; 3) preserve ALL incoming metadata (e.g. timecode, user bits); 4) support 10-bit SD (a ‘nice to have’ - analyze incoming content for 8/10 bit origin - e.g. don’t save empty bits); 5) capture first, process next - it’s important to validate that a conformant file has been captured, and there is no reason to tie up a tape deck for anything other than capture; 6) profile-based capture and encoding - the ability to define and adhere to profiles across codecs, no need for operational staff to choose detailed settings.”
- User operating Final Cut Pro 7.0.3 for access purposes: “Although our main use is digitization for access, we did also want something that was scalable and could be used for ‘emergency preservation’ capture – i.e., if we had no funds to outsource digitization for preservation of analog tapes and decided to do the best we could in-house, that we’d have sw/hw that could capture uncompressed 10-bit video and uncompressed

audio. None of the staff are experienced with QA/QC, monitoring waveform monitors, etc., so we did not look into these kinds of requirements. We have not needed to attempt preservation digitization, but we have used the system to capture uncompressed video for a few stock footage requests, and the system has worked well and provided what we need (in these cases, we captured with FCP but took the uncompressed .mov file direct from the 'Capture Scratch' folder and did not transcode within FCP). For access, the software and hardware perform great, allowing us to create nice-looking digital files that are compressed enough that our small storage set-up (a RAID plus two external hard drives, RAID capacity is three TB) can handle the media."

- User operating Final Cut Pro 7.0.3 for preservation purposes: "FCP is perfectly adequate for the capture of analog, SD material. I am also operating Blackmagic Ultrascopes as well as analog scopes to monitor the digitization of the source material. FCP does exactly what I need it to do when capturing multiple streams of audio and video. Since there is a high amount of monitoring during the capture, I am less concerned about FCP's performance (outside of dropped frames) and more concerned with how the Blackmagic is operating with the A/D conversion."

Survey question

Please describe any key features, settings, or workflow issues pertaining to the capture software that you currently use that unnecessarily complicate or impede your workflow in digitizing for preservation, and why. Please feel free to be as broad or as specific as you like.

- User operating Final Cut Pro 7.0.3 for multiple purposes, including preservation: "For the current setting the Final Cut Server is not as robust as we would need. The requirement for a more powerful setting is expected with the full

implementation of the MAMS. The Final Cut environment has been OK for the purpose it was put together."

- User operating Final Cut Pro 7.0.3 for access purposes: "Actually too many choices of codecs. We have created "go-to" set ups for different types of digitization (uncompressed for stock requests, compressed for access), but FCP is designed for editing pros, so the amount of choice can make it confusing for those less familiar with the software. Dedicated capture software would likely be simpler. Too easy to mess up the file name, or enter it, but not have it register. Capture Scratch folder is buried. Too easy to digitize to the wrong 'project' and then can be hard to find the files because they are in the wrong sub-folder w/in capture scratch. Have to go to the original file in capture scratch to adjust file name, if needed; cannot rename the actual file from within the software."
- User operating Final Cut Pro for multiple purposes, including preservation: "As we are capturing with Final Cut Pro via AJA hardware, we are never quite sure how well the files we create will work on other people's systems, or on our own systems in the future. There have been a few times where outside clients have needed to download a codec from the AJA website in order to play the file we supplied to them. Before setting out to perform actual preservation of our video materials, ensuring that the files will remain readable and supported would be a definite priority."

Survey question

Do you have any workflow adjustments or alterations, such as settings purposefully ignored, export bypass, or other changes that you've adopted to your workflow that is not native to the software's intended workflow? If so, why did you chose to incorporate this change and

how does it help you get the results you need from the capture software?

- User operating Final Cut Pro for access purposes: “... we are employing ‘export bypass’ when we take files direct from capture scratch folder. It’s not a big hassle to do this, generally. If we are digitizing for the web, we do light editing (trim heads and tails, add our watermark, add a tail title card) and use FCP’s export feature to compress to the settings we need.”
- User operating out-of-the-box software for multiple purposes, including preservation: “I always use a set of analog scopes for monitoring levels directly from an analog VTR, but to monitor input levels from the digitizer, I will often bypass the available vectorscope and waveform in VTR Xchange and use a different toolset in another application.”

CONCLUSION

Common needs or feature requests expressed in the survey include:

- Fixity checking as a part of the software workflow for capture, various other common to digital preservation workflow features
- Fewer “features” in graphical user interface NLE software, more simplified interface, and even a desire to bypass the software entirely
- Ability to draw down number of codecs available for capture needs, especially for preservation purposes
- Assurance that the file has not undergone any extra processing or transcoding by the software. Allow the operator to retrieve the video file prior to any transcoding or other manipulation as a default mode of operating the software
- Open and persistent documentation about the analog-to-digital conversion process from hardware manufacturers

- Ability to verify if dropped frames occurred during capture and a mechanism to report out errors like this one.
- Automatic metadata generation, including technical metadata which would allow the technician to verify file characteristics and streamline workflow
- Application is friendly to non-specialists’ skillsets
- Clarity around system compatibility; for example, how the files produced from the capture workflow will playback and remain current on other systems compared to the system the files were created on

Software users in the preservation community have specific needs, such as automated fixity checks and signal analysis reporting. Open-source tools are promising options to create desired software features. The survey revealed that some users are distrustful of proprietary software and systems. The strategy that BAVC has used, because we rely on commercial products in our day-to-day work is three-fold: 1) keep in touch with manufacturers, keep track of software updates and what, if any, changes were made to the software that might affect our system and make certain all relevant aspects of the digitization system are supported and usable for their intended purposes in your institution; 2) complete periodic testing of software and hardware compatibility on sample tapes; and 3) become involved in the digital preservation community, including keeping tabs on usability of open-source standards and obsolescing file formats that may result from standards shifts.

Open knowledge of what happens to a file when processed and how it affects a work’s authenticity is extremely important in the archives world. Continued investigation of practices, processes, and information sharing, such as in this study, will help the preservation community document and share practices with materials’ custodians moving forward.

ACKNOWLEDGMENTS

Thanks to BAVC's Moriah Ulinskas, Sarolta Cump, and Jennifer Brice. Thanks to project consultants Dave Rice and Tanisha Jones, and to Dance Heritage Coalition's Christopher Miller and Libby Smigel.

Thanks to survey participants:

A/V Geeks LLC, Raleigh, North Carolina
 Arthur Hall Collection, Searsport, Maine
 California Institute of the Arts, Valencia, California
 Fortunoff Video Archive for Holocaust Testimonies,
 Yale University, New Haven, Connecticut
 Johns Hopkins University Applied Physics Laboratory,
 Baltimore, Maryland
 Linear Cycle Productions, North Hills, California
 Mary Pickford Institute for Film Education
 Media Burn Independent Video Archive,
 Chicago, Illinois
 The Museum of Modern Art, New York, New York
 Northeast Historic Film, Bucksport, Maine
 New York University, Moving Image Archiving and
 Preservation, New York, New York
 Oddball Film + Video, San Francisco, California
 Pacific Title Archives, Burbank, California
 Penn State Special Collections Library,
 University Park, Pennsylvania
 Postmodern Company, Denver, Colorado
 Preferred Media, Inc., Chicago, Illinois
 Preserving The Past, LLC, Rochester, NY
 Reliance MediaWorks, Mumbai, India
 San Francisco Bay Area Television Archive,
 San Francisco, California
 Stanford Media Preservation Lab, Stanford, California
 Thanouser Company Film Preservation, Inc.
 Portland, Oregon
 Timeless Recordings Tel Aviv, Israel
 United Nations, New York, New York
 Video Data Bank, Chicago, Illinois

APPENDIX 1. QUANTITATIVE RESULTS OF CAPTURE SOFTWARE SURVEY

Percentages apply only to those participants who chose to respond to the question listed.

Does your organization house and do you operate the digitization of analog videotapes?

- Yes: 69% (34 respondents)
- Yes, but not all the time: 29% (14 respondents)
- No: 2% (1 respondent)

Comments: These results demonstrate that many operators who digitize analog media (close to 30%) perform other duties in addition to digitization services for their organization or other organizations.

What is your specific role as a digitization service provider?

- I operate and/or maintain legacy analog videotape playback equipment: 43.9% (36 respondents)
- I operate digitizing hardware and/or maintain digital files and computer equipment (systems administration and/or digital repository upkeep): 7.32% (6 respondents)
- Other answers:
 Management: (1)
 All of the above (Post-Supervisor): (1)
 Simple business needs: (1)
 Manage audiovisual archives: (1)

What are the functions of the files produced following digitization?

- Multiple purposes, including preservation: 68% (34 respondents)
- Preservation (long term storage): 14% (7 respondents)
- Access: 8% (4 respondents)

- Multiple purposes, not including preservation: 6% (3 respondents)
- Other: 4%, Restoration (1), Distribution (1)

Comments: Respondents, members or followers of AMIA (Association of Moving Image Archivists), represent a diverse community within the larger professional association. Some communities and organizations focus on preservation, while others focus on distribution and access. The purpose of this question was to lay the groundwork for analysis of subsequent queries.

What brand of capture hardware do you currently use?

- AJA: 19% (16 respondents)
- Blackmagic: 17% (14 respondents)
- Sony: 6% (5 respondents)
- Other or unanswered: 58% (included Avid, Canopus, Digital Rapids, iGrabber, Matrox, Panasonic, SAMMA Solo, and several unidentified)

Comments: Since capture hardware is often closely associated with software choices, this question was included in the survey for context. Settings within the capture software are often dictated by capture hardware and driver settings.

What digitization software do you use to handle capture of analog videotape?

- Apple Final Cut Pro 7.0.3: 23% (19 respondents)
- Other 22%*: (18 respondents)
- Apple Final Cut Pro (any other version or don't know): 16% (13 respondents)
- Out-of-the-box software provided by capture card vendor: 15% (12 respondents)
- Custom-built software: 6% (5 respondents)
- Open source software: 4% (3 respondents)

- Apple Final Cut Pro X (version 10): 1% (1 respondent)
- Adobe Premiere: 1% (1 respondent)
- Unanswered: 30 respondents

If capture software is open source or other, please list here:

- Avid Technology : 2 respondents
- Geniatech iGrabber: 1 respondent
- SpecSoft, LLC Rave HD: 1 respondent
- Sony Vegas: 1 respondent
- Microsoft Windows Movie Maker: 1 respondent
- Front Porch Digital, Inc. SAMMA Solo: 1 respondent
- Apple Final Cut Express: 1 respondent
- Autodesk Smoke: 1 respondent
- Grass Valley Edius: 1 respondent
- Image Systems Phoenix Refine: 1 respondent
- Direct to storage media: 1 respondent

Do you capture SD (Standard Definition) video or HD (High Definition) video?

- SD: 64% (35 respondents)
- SD and HD: 28% (15 respondents)
- HD: 5% (3 respondents)
- I don't know: 3% (1 respondent)
- Unanswered: (28 respondents)

Are your projects completed as a supervised transfer or batch transfer?

- Supervised transfer: 72% (39 respondents)
- Batch transfer: 17% (9 respondents)
- I don't know: 5% (3 respondents)
- Both supervised and batch: 3% (2 respondents)
- Unanswered: 28 respondents

What operating system do you use when digitizing your analog videotape assets?

- Apple Mac OS X 10.5–10.7: 58% (25 respondents)
- Microsoft Windows XP: 12% (5 respondents)
- Apple Mac OS X 10–10.4: 7% (3 respondents)
- Microsoft Windows 7: 7% (3 respondents)
- Linux: 2% (1 respondent)

Do you digitize via command line or graphical user interface?

- Graphical user interface: 63% (34 respondents)
- Command line: 26% (14 respondents)
- I don't know: 9% (5 respondents)
- Other: hardware buttons on SSD device 2% (1 respondent)

Do you perform any file analysis following capture?

- Yes: 48% (26 respondents)
- Yes, file analysis is automated: 6% (2 respondents)
- No: 44% (24 respondents)
- I don't know: 4% (2 respondents)

REFERENCES

- Blackmagic. 2012. Blackmagic Design, Pty, Ltd. www.blackmagicdesign.com (accessed 06/06/13).
- Bogart, J. V. 1995. Magnetic tape storage and handling: A guide for libraries and archives. Washington, DC: Commission on Preservation and Access. Available at www.clir.org/pubs/reports/pub54 (accessed 01/15/13).
- Sacerdote, A. and L. Sorensen. 2012. Codec comparison for the digital preservation of analog video *The Electronic Media Review*. 1: 59–70.

SOURCES OF MATERIALS

Wufoo, The Online Form Builder
 Infinity Box, Inc.
 285 Hamilton Avenue, Suite 500
 Palo Alto, CA 94301
www.wufoo.com

Lauren Sorensen
 Preservation Project Manager
 Bay Area Video Coalition
 2727 Mariposa Street, 2nd Floor
 San Francisco, CA 94110
 (415) 558-2130
laurens@bavc.org

ENDNOTES

- 1 From the Blackmagic Design web site: "Blackmagic Design capture cards are codec independent. Which codecs and video containers can be captured, or played back are determined by software. Typically you would expect to be using the Quicktime .mov container on Macs, and on Windows, .avi, but certain software may use different containers. Codec support is much more particular to your software. Our Media Express application will capture and playback Uncompressed 10 bit and 8 bit YUV, as well as support for 10 bit Uncompressed RGB and DPX with certain cards. On PC there is also Motion JPEG support. If your Mac has Final Cut Pro installed, you will also have access to DVCPRO and DVCPROHD, as well as ProRes 422 HQ. Other third party software such as Final Cut Pro, and Premiere Pro, support capture and playback of a wider range of codecs, as this is built into the software." (Blackmagic 2012).

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