The Electronic Media Review

Electronic Media Group

Volume Three 2015

Papers presented at the Electronic Media Group session of the 41st AIC Annual Meeting, Indianapolis, Indiana, 2013, and the 42nd AIC Annual Meeting, San Francisco, California, 2014.

Jeffery Warda and Briana Feston-Brunet, Managing Editors

Edited by Helen Bailey, Briana Feston-Brunet, Karen Pavelka, and Jeffrey Warda

Layout by Amber Hares
(Original design by Jon Rosenthal, JonRosenthalDesign.com)
Typeset in Trade Gothic LT and Myriad Pro

American Institute for Conservation of Historic and Artistic Works
Washington DC

The Electronic Media Review was published once every two years in print format by the Electronic Media Group (EMG), a specialty group of the American Institute for Conservation of Historic and Artistic Works (AIC), until 2013 and published online only thereafter. *The Electronic Media Review* is distributed as a benefit to members of EMG who held membership during the year of the issue. Additional copies or back issues are available from AIC. All correspondence concerning subscriptions, membership, back issues, and address changes should be addressed to:

American Institute for Conservation of Historic and Artistic Works
727 15th Street NW, Ste. 500
Washington, DC 20005
info@conservation-us.org
http://www.conservation-us.org

The Electronic Media Review is a non-juried publication. Papers presented at the EMG session of the AIC Annual Meeting are selected by committee based on abstracts. After presentation, authors have the opportunity to revise their papers before submitting them for publication in *The Electronic Media Review*. There is no further selection review of these papers. Independent submissions are published at the discretion of the EMG Publications Committee. Authors are responsible for the content and accuracy of their submissions and for the methods and materials they present. Publication in *The Electronic Media Review* does not constitute official statements or endorsement by the EMG or by the AIC.

Presented at the Electronic Media Group Session, AIC 41st Annual Meeting, May 29–June 1, 2013, Indianapolis, IN.

WRANGLING ELECTRICITY: LESSONS LEARNED FROM THE MASS MIGRATION OF ANALOG AND DIGITAL MEDIA FOR PRESERVATION AND EXHIBITION

PETER OLEKSIK

ABSTRACT

In 2011, the Museum of Modern Art (MoMA) began a process of making its extensive video art collection of over 1500 works available to the public through an installation of interactive monitors in the galleries. With a collection that spans the history of independent video production, the project was especially urgent because of video degradation in some of the early works, technology obsolescence, and the availability of some of the original artists. To facilitate the project, an in-house transfer and monitoring station was established at the museum. Numerous systems were developed for transport, in-house migration, metadata capture, working with artists, and outsourcing some of the migration. Now with over half the material migrated and the launch of MoMA's media lounge in February 2012, a large body of information has been collected that helps inform best practices in migrating and managing video art. This presentation will detail the project workflow that was formulated in collaboration with MoMA's media conservators, curators, registrars, audiovisual staff, and IT department. Special attention will be paid to the question of in-house migration vs. vending out to specialized transfer houses. Examples will be drawn from the project to illustrate challenges in migrating analog and digital material and the impact of performing migration and other media conservation work within the museum. Whether one is dealing with one analog source or 100,000, this presentation will hopefully further the discussion on the conservation of analog and digital moving image material.

MAGNETIC MEDIA AT MOMA

Founded in 1929, the Museum of Modern Art is "dedicated to helping people understand and enjoy the visual arts of our time" (MoMA 2015). While originally tasked with collecting and exhibiting traditional art forms of painting, drawing, and sculpture, the museum quickly realized that it needed to both collect and exhibit what many saw as "the" art form of the 21st century—the moving image. Responding to this in 1935, the Film Library was established and the first film exhibition program was exhibited in 1939 when the museum opened its permanent home on 53rd Street in Manhattan. At the same time, the first film curator at the museum, Iris Barry, began actively acquiring film into the museum's collection, which now contains over 25,000 titles.

As new moving image technologies were being utilized by artists, the museum kept pace with the exhibition and acquisition of these emerging art forms. In 1968, the exhibition *The Machine Seen at the End of the Mechanical Age* opened at MoMA and is seen largely as the beginning of video entering the museum's purview. This marked the first time that video was present in the gallery, namely Nam June Paik's (1932-2006) *Nixon Tapes* (1965), *McLuhan Caged* (1968), and *Lindsay Tape* (1967). This landmark exhibition was followed by another Manhattan exhibition in 1971 at the Howard Wise Gallery, *TV as a Creative Medium,* which was the first exhibition in New York City dedicated solely to works created for television and video (Electronic Arts Intermix 2015).

Concurrent to the Wise Gallery exhibition, curator Barbara London was working in MoMA's Department of Prints and Illustrated Books. Barbara was focusing on artist's books that were cheap, mass-produced material, which fit into the same curatorial context as *The Machine Seen at the End of the Mechanical Age*, drawing largely from Walter Benjamin's theoretical work on art and mechanical reproduction. In 1973, London took advantage of a National Endowment of the Arts grant that was awarded to the museum to purchase a video deck and two monitors and began exhibiting early video works by Paik, Lynda Benglis (b. 1941), and others (Cook 2001). In 1974, the museum dedicated a specific Projects gallery to the presentation of video art and continued this interest in video by starting the lecture series *Video Viewpoints* in 1977. Largely spear-headed by London, the museum began to actively acquire video artworks into its collection as a result of exhibitions both in the Projects gallery and programs for *Video Viewpoints* in the newly rechristened Department of Film and Video in 1980. London would continue to build the collection over the next decades, creating a significant permanent collection containing over 1,500 landmark works.

In 2006, the museum recognized the growing trend towards both analog and digital media works and established a new curatorial department to respond to these newly emerging forms, the Department of Media and Performance Art (MPA). As a result of this, the video material that was housed within the Film and Video Department was branched off and now constituted the bulk of this newly formed curatorial department's collection. Klaus Biesenbach, the first chief curator of the MPA department, began to build the collection by acquiring more installation-based media works. When Mr. Biesenbach left this position to become the chief curator of MoMA PS1, Sabine Breitwieser was appointed chief curator with a goal to continue building and contextualizing the fledgling department's collection. In 2010, Breitwieser made it one of her missions to "…draw a more complete narrative of media and performance art through its representation in videos and photographs in MoMA's collection and exhibitions" (Breitwieser 2012). Recognizing the fact that MoMA's collection of over 1,500 single-channel pieces was only accessible to the public either in gallery rotations or on request within the Media and Performance Art department's Study Center, the idea was hatched to make this material available to the general public "to hand the curatorial power over to the audience" (Breitwieser 2012).

Fig. 1. Installation view of the MoMA Media Lounge, 2012. Photo by Thomas Griesel. Courtesy of MoMA.

MEDIA LOUNGE

To achieve Breitwieser's goal of presenting the large collection of single channel media works to the public, the media lounge was conceived as a permanent exhibition on the museum's second floor. She drew inspiration from Dan Graham's (b. 1942) *Interior Design for Space Showing Videotapes*, which was a series of glass cubes that formed "a functional exhibition design and an optical artwork, displaying both the video image and the spectators' reaction to the video-viewing process in the social space of the video exhibition situation" (Generali Foundation 2013). The function of the space had three goals: rendering the video collection accessible and interactive, hosting departmental exhibitions, and creating a space for interaction. The Media and Performance Art Department had artist Renée Green (b. 1959) design the space, which used wooden scrims to build viewing stations on the second floor of the museum, which she called "media bichos" or isolated viewing stations (fig. 1).

Each video booth or viewing space utilized Dotronix DNR Series 27 in. Cathode Ray Tube (CRT) monitors to display the video, with a custom-designed Apple iPad interface (fig. 2). The interface contained curatorial information about the works in the collection and allowed the user to browse either the entirety of the collection or specially curated sections that were assembled from different themes presented by curators, artists, or scholars.

MIGRATION OF ANALOG MATERIAL

A critical component allowing the media lounge initiative to function was the mass migration of original analog material to a digital preservation file and, subsequently, an access derivative for the public to view. In 2006, Glenn Wharton joined MoMA's conservation department to focus on the time-based media in the collection and survey it for conservation needs. A result of Wharton's survey was an awareness of the increasing risk of video and audio technological obsolescence, which increas-

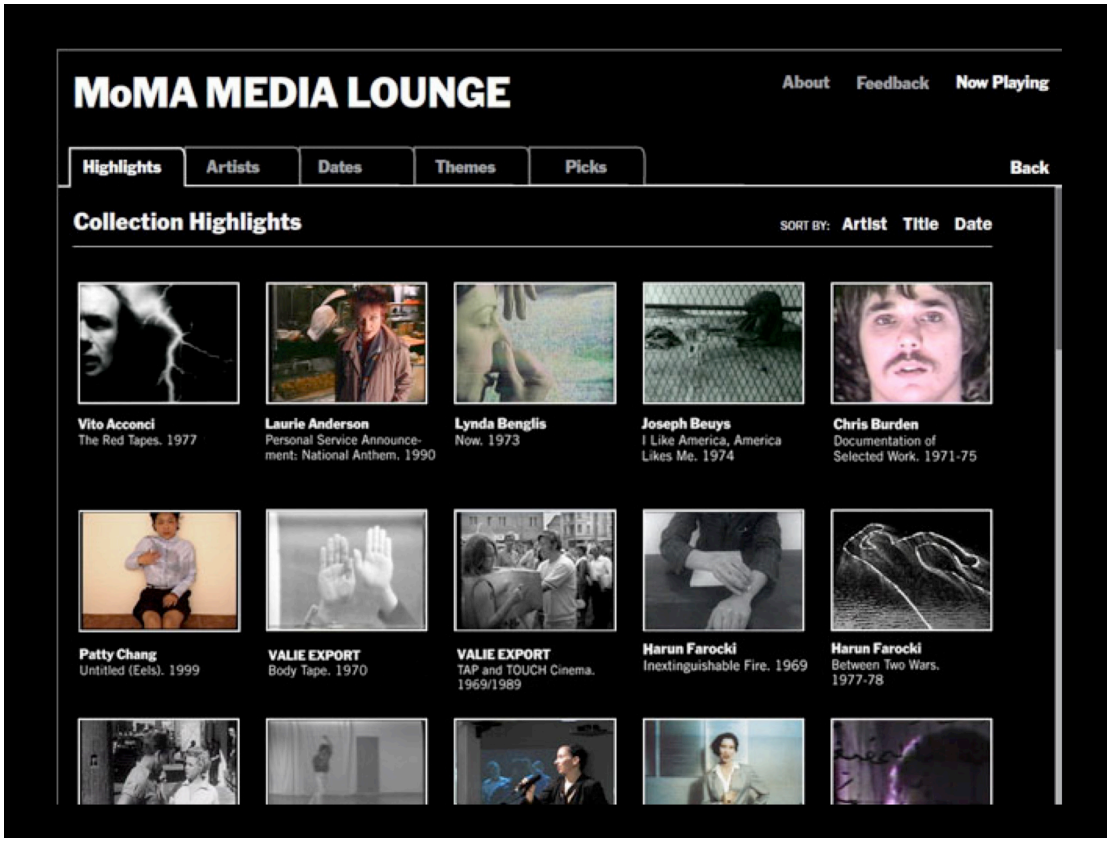

Fig. 2. Media Lounge iPad interface, 2012. Courtesy of MoMA.

ingly threatened the accessibility of the magnetic media in the collection. As media production technology has advanced, the older playback equipment is no longer manufactured and, as a result, the equipment necessary for playback of these legacy formats has become unavailable. Because of the history of MoMA's media collection, all video formats are accounted for in the collection with either immediate or near immediate conservation concerns relating to the playback of this material. If the collection's obsolescence issues were not addressed in the near future, this material would effectively be lost. Recognizing this, the museum committed to a large digitization effort to migrate this material to a digital preservation format.

The best practice for the preservation of analog video material is migration to a new signal carrier. In the past, this was accomplished by migrating the original analog tape to a newer, higher resolution format. MoMA's collection was largely cared for in this manner throughout the 1980s and 1990s by migrating U-matic tapes to one inch tape, for example. U-matic tape has an inherent resolution of approximately 250 lines and migrating it to one inch, which has a resolution of over 300 lines, allows for the entirety of the signal to be preserved on this new analog format (resolution in analog video is measured by the height of the picture). However, inherent to this process is the inevitable signal loss caused by analog copying. The signal loses a bit of its strength every time it gets copied from format to format, due to the loss of electrical impulses. This loss was mitigated as new technologies emerged and effectively diminished with the introduction of digital tape formats such as the Digital Betacam. Digital Betacam converts the analog video signal to a digital data stream, which does not suffer from the same generational loss that analog video does.

As technology has progressed and analog tape formats have become partially or completely obsolete, the current best conservation action for original analog material is to migrate the signal to a digital file format for long-term preservation. This allows the material to be captured without any generational loss and for the entirety of the signal to be preserved in a digital format. The best practice for digital migration of analog material is to apply little-to-no compression to the original signal, known as a lossless encoding process. For analog, standard definition material, all of the signal characteristics can be effectively captured faithfully by encoding the video signal to with no compression and a bit depth of 10 (also known as uncompressed, 10-bit) and the audio signals to pulse-code modulated (PCM) audio at a sample rate of 48Khz and a bit-depth of 16. MoMA has adopted this conservation strategy for its analog video material.

DIGITIZATION WORKFLOW

Starting in 2011, work began on the large-scale preservation of the single-channel video works within the Media and Performance Art collection. Working closely with DuArt, a film and video post-production facility in New York City, Glenn Wharton began planning to systematically assess and migrate over 1,500 works in the collection. Maurice Schechter, Preservation Engineer at DuArt, assisted greatly in designing the workflow of the migration process and lent his significant experience and knowledge to the endeavor.

Since the collection spans nearly the entire history of video art, many, if not all, video formats are present in the collection. In addition, many different formats may be present for a single piece. The need to assess each iteration, or format, of the work before migration was deemed critical to get as close to what the artist considered the master. This is specifically important as subsequent generations of a piece would exhibit degradation and signal loss, not only from possible wear and tear on the tapes, but also because of the loss inherent in analog migration. This generational loss and degradation becomes a part of the signal the further away you get from the master. These visual and aural anomalies could be misidentified as part of the work. To allow MoMA's conservation team to properly assess each videotape, Schechter and the other engineers at DuArt designed and installed a video assessment workstation at MoMA (fig. 3). This station consisted of the following:

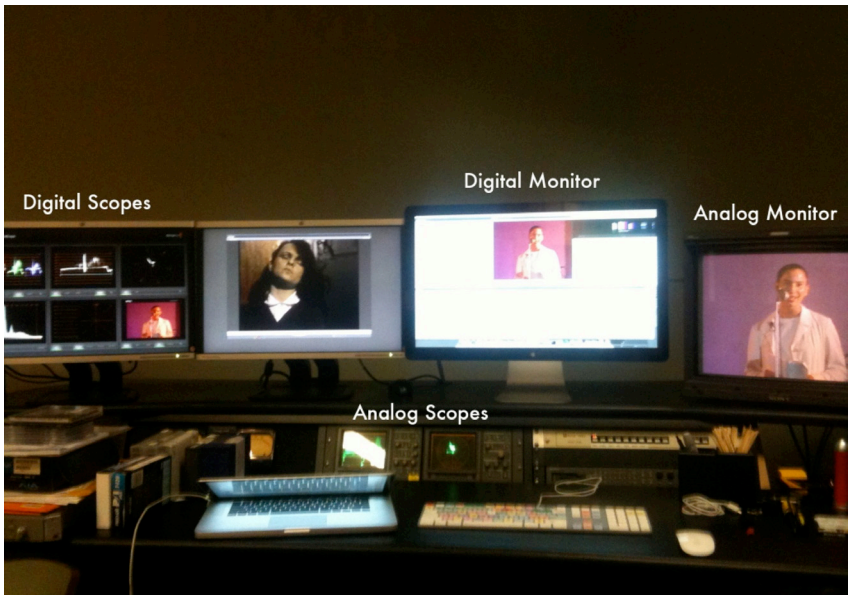

Fig. 3. Media Conservation Assessment Station, 2012. Courtesy of MoMA.

- Apple Mac Pro computer
- Blackmagic Multibridge
- Blackmagic Digital Scopes
- Tektronix 1620/1630 Waveform monitor and vectorscope
- SDI, component, and composite PAL/NTSC Sony CRT Monitor
- Genelec 8020b audio monitors
- J-30 Digital Betacam deck
- Sony U-matic Deck
- Samsung multi-standard VHS deck
- Pioneer Laserdisc deck
- DVD deck

It was necessary to hire an assistant media conservator to manage the migration process and perform all of the necessary assessments. The assistant media conservator (full disclosure, the author of this paper) brought on had a background in video engineering and system design and integration. This background and familiarity with both analog and digital video characteristics was critical in the proper assessment and management of the digitization process.

In conversation with the curatorial, conservation, and registrar departments, a workflow was devised for the project to allow for the systematic assessment and migration of the single-channel video works in the collection, as well as a timeline to populate the media lounge interface.

STEPS OF THE WORKFLOW

To begin the migration process, the curatorial department began researching each work in the collection to determine how, and how accurately, this material was catalogued, whether any preservation work had been already carried out by the artist or gallery, as well as determining the rights held by the museum in terms of exhibiting the work. It was determined that a new non-exclusive license (NEL) from each artist represented in the collection was needed to allow for the digital migration of their original analog video material. As most of this material was acquired well before the technology and methodology existed for this type of conservation action, this new license was necessary to both conserve and exhibit the work in a digital form.

The returning NEL agreements from the artists dictated the priorities for the migration workflow. Because the entire collection was targeted for migration, no other priorities were considered. Once a significant amount of NELs arrived to the curatorial department and the catalogue records were updated, a list of initial works was built for shipment to media conservation. All video material was stored off-site at MoMA's Celeste Bartos Film Preservation Center in Hamlin, PA, which necessitated batches of tapes to be called in at one time. The Film Preservation Center is geared towards the long terms storage and preservation of both film and magnetic media material, with an HVAC system that is regulated to each format's preservation needs. All of the magnetic material is stored in vaults at a temperature of 60 degrees Fahrenheit with a relative humidity of 30%, which aligns with the ISO standard for the storage of magnetic media (Bigourdan 2012, 7). While the collection constitutes approximately 1,500 works, this equates to roughly 5,000–6,000 total tapes. The conservation and curatorial departments determined that about 200 tapes at a time could be safely called in to be assessed and sent out for migration.

The registrar department coordinated the shipment of the material to media conservation on a climate-controlled truck. This material was then unpacked and sorted by conservation at MoMA's offsite storage in Queens, NY. Each tape was labeled and sorted to get an accurate picture of each work. For example, Laurie Anderson's (b. 1947) *Sharky's Day* (1983) was present in the collection on five U-matic tapes, each with an unknown provenance. These were all re-labeled according to the museum's revised cataloguing system and the catalogue entries edited if there were discrepancies between the record and the actual tape format. These multiple tapes were then assessed and viewed to determine the highest

quality version. The assessment process consisted of first visually inspecting the tape to make sure the integrity of the shell was intact and there were no cracks or integrity issues that could compromise the playback of the tape. All record tabs were removed if present on the tape. The backflap of the cassette was then opened and, using a wood surgical swab, the tape was carefully inspected to make sure that there was no residue on it and that it transported smoothly without any sticking or resistance.

Once the tape was assessed and determined to be in good condition for playback, it was inserted into the proper deck and assessed visually. If any damaged was noticed during this inspection, it was flagged for further conservation treatment. As of this writing, zero tapes exhibited any damaged or necessitated treatment.

In the workflow discussion with DuArt, it was determine that they could accommodate two tapes from each work to determine the best possible source for migration. In the case where the museum had multiple tapes (often in multiple formats) of a work, each tape was viewed to determine which two would be best to send to migrate. However, when works consisted of formats that we could not pre-assess (mainly one inch open-reel), conservation would use descriptive metadata on the containers (such as labels, markings, etc.) to try and determine the best source to send for transfer.

At DuArt, the tapes were then viewed again by the experienced eyes of video engineers Maurice Schechter and Erik Piil, to compare visual quality. In conversation with MoMA, DuArt would make a decision on which tape to migrate. During the migration process, DuArt would perform "full set-up" for each tape. This consists of calibrating all equipment used in the signal path prior to migration using SMPTE reference bars and a 1 kHz tone. Once calibrated, the tape being migrated would be inserted into the deck and adjustments would be made to bring the tape within legal limits to prevent any signal loss during the digitization process. This is a critical step

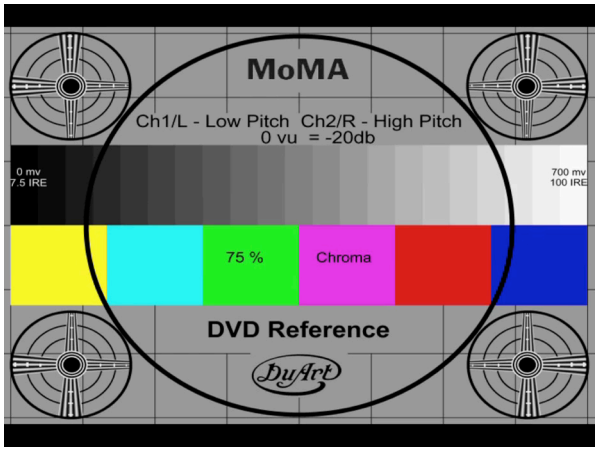

Fig. 4. MoMA's visual reference for video migrations, 2012. Courtesy of MoMA.

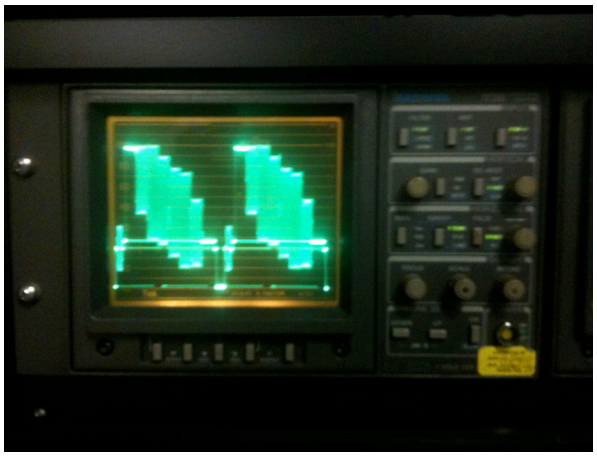

Fig. 5. Waveform monitor oscilloscope used for assessment of luminance information in the video signal, 2012. Courtesy of MoMA.

in analog media migration, as there is far less latitude in the digital realm versus the analog realm, so any luminance, chrominance, or audio information that was either above or below the acceptable limits of the analog to digital converter were adjusted using a processing amplifier.

This was all documented within the actual digital video stream using a calibration tape that DuArt developed for MoMA (fig. 4). To observe and document the changes, MoMA uses their own copy of the tape to compare that signal with the signal on the transferred digital file. All adjustments to the transfer (raising or lowering the luminance and black, adjusting the phase and hue, etc.) can be seen and quantified by this comparison (fig. 5) and

then documented in a written conservation report, which is filed in MoMA's artwork records.

Once the preservation file was created on DuArt's local hard drive, an MD5 checksum value was generated to track the fixity of the file after copying onto external hard drives for delivery to MoMA. A Digital Betacam was also generated from this file as a protection element, so that two copies of the preservation master were created. The Digital Betacam data stream is equivalent to the uncompressed, 10-bit nature of the digital video stream so it is a 1:1 copy (Poyton 2003). Upon completion of a batch of tapes, DuArt would retain the original material on-site while MoMA's media conservators were able to assess each file and confirm that the migration process was accurate and true to the original source material. If any discrepancies were noticed in the transfer on MoMA's side, the tape would be re-assessed by DuArt and re-transferred if necessary.

MoMA's conservation assessment was two-fold once the analog material had been migrated. First, the assistant media conservator would confirm the fixity of each file by matching the checksum value that was created for the file. The file's characterization metadata was confirmed using MediaInfo software to ensure that the digital video and audio streams were encoded properly according to the collection policy specifications. After these processes were run and confirmed manually, the file was then watched in its entirety, played back via Apple Final Cut Pro 7 on a calibrated CRT monitor, while monitoring the signal levels on both analog and digital oscilloscopes to make sure the signal was captured faithfully and no digital clipping or loss occurred during the process. Any visual or digital anomalies or errors were noted by conservation and either confirmed to be inherent to the piece or required further investigation to determine the origin of the error and any possible corrections or re-transferring needed.

The second critical assessment was performed by media conservation with Barbara London, who was responsible for the original acquisition of a large portion of the collection. This assessment was completed to both confirm that the transfer was done accurately and to add any contextual or curatorial information to the artwork files to further document the provenance, visual characteristics, and any other relevant information that could be useful to the collection in the future.

All of this information was gathered and entered into The Museum System (TMS), which is the museum's cataloguing and database software for the collection. Different surveys were populated in three categories:

1. *Conservation assessment:* Where any visual or technical characteristics of the work were recorded.
2. *Migration:* Documented who performed the transfer and the signal chain used for each transfer, noting the make, model, and serial number of each piece of equipment used in the transfer.
3. *Curatorial:* Any information gathered from viewing the piece with a member of the curatorial department, specifically Barbara London.

IN-HOUSE TRANSFERS AND DERIVATIVE CREATION

Shortly into the migration process described above, it was realized that this workflow could not be sustained financially and within the timeline of the exhibition. However, it became clear that with a relatively small investment in additional video equipment, transfers could be performed on-site at MoMA by media conservation. It was agreed upon to purchase a Leitch DPS-290 time-based corrector, a BVU-950 U-matic deck, and a DVW-A500a Digital Betacam deck (fig. 6). These three pieces of equipment, when installed into the system that DuArt had originally designed for MoMA, allowed the museum to perform its own migration of analog material. The project was then readjusted to focus on sending to DuArt only material that fell outside of the technical capabilities of this new transfer station, mainly open-reel video formats and any material recorded in the PAL format.

Fig. 6. U-matic and Digital Betacam decks with out-board Time Base Corrector (TBC) in MoMA's video assessment and migration set-up, 2012. Courtesy of MoMA.

As the installation of the Media Lounge exhibition drew near, the focus shifted to creating the exhibition files for each piece that would be exhibited in the first iteration of the Lounge. Working with the Manhattan-based firm 3Byte, who designed the user interface for the Lounge, the exhibition files had to fit within the technical capabilities of both the iPad interface and the media players that would stream files to the monitor, as well as the IT infrastructure of the museum. Because the system had to allow for up to eight streams of data to be played back at any given time, a suitable compression codec and data rate had to found that would faithfully reflect the artwork while also allowing for a flawless exhibition.

Numerous tests were conducted with various players and it was decided that an H.264 compression with a data rate of 8 Mbps was suitable for the parameters of the equipment and was visually comparable to the original material for exhibition. All of the preservation masters were then manually prepared by media conservation, sometimes requiring that bars, production slates, or any other superfluous material either before or after the tape was removed. These were then batch compressed using the compressor software and encoded using a Matrox hardware encoder PCI card to allow for a significantly shorter encode time, coupled with the benefits of a more agile encoding algorithm. All of the exhibition files generated were kept in their original standard, frame rate, resolution, and scanning method.

CONCLUSION

As of this writing, the digitization of the single-channel artworks is nearly complete with over 1,400 works digitized and documented. The level of access this project allowed has not only provided the public with the ability to look at an enormous collection of video art, but has also brought a new curatorial interest to exhibiting this material throughout the museum. Because this content

is now easily accessible for curatorial consideration, new connections can be made, and exhibitions now regularly incorporate this material when before it would have been cost prohibitive to do so.

A significant result of this migration process has been the increased technical capabilities that media conservation now has at its disposal. This has resulted in an increased commitment to the digitization of analog magnetic media material that originally fell outside of the initial digitization initiative. In addition, because of the storage requirements necessitated by the generation of terabytes of digital collections, a trusted digital repository is currently in development to house and monitor this precious material.

Finally, the most positive outcome of this project has been the complete digitization of the museum's single-channel analog video material. This has allowed the material to be assessed and conserved properly, which has made the museum's significant collection secure for future researchers, curators, and the public to experience.

REFERENCES

Bigourdan, J. Reilly, J. Santoro, K. Salesin, G. 2006. *The Preservation of Magnetic Tape Collections: A Perspective.* Rochester Institute of Technology. Rochester, NY.

Breitwieser, S. 2012. What is the MoMA Media Lounge? www.moma.org/explore/inside_out/2012/11/14/what-is-the-moma-media-lounge (accessed 01/10/14).

Cook, S. 2001. An Interview with Barbara London. http://www.crumbweb.org/ (accessed 01/10/14).

Electronic Arts Intermix. 2011. TV as a Creative Medium. http://www.eai.org/webPage.htm?id=1004 (accessed 01/10/14).

Generali Foundation. 2013. Dan Graham: Video Architecture/Performance. http://foundation.generali.at/en/info/archive/1997-1995/exhibitions/dan-graham-videoarchitectureperformance.html (accessed 01/10/14).

MoMA. 2015. Mission Statement. http://www.moma.org/about/index (accessed 07/02/15).

Poyton, C. 2003. *Digital Video and HDTV.* Oxford, UK.

Peter Oleksik
Assistant Media Conservator
MoMA
11 W 53rd Street
New York, NY 10019
peter_oleksik@moma.org