Video & Audio: Preventive Conservation

Howard Besser, Director
Moving Image Archiving & Preservation Program
NYU’s Tisch School of the Arts
http://www.tisch.nyu.edu/preservation

• Review & Extension
  – Repositories and collections
  – Physical Deterioration
  – Obsolescence
  – Reformating & Ethics
• Preventative Conservation
  – Facilities and infrastructure
  – Monitoring micro and macro environments
  – Collection Assessment tools
  – Disaster recovery
• Summary

Videotape Repositories-

Univ of GA
Walter J Brown Media Archives

Univ of GA
Walter J Brown Media Archives
Storage-Smithsonian History Museum

Hogan Jazz Archive Tulane Univ Library

Cinemateca Brasileira (video storage)

Hampton Collection (interviews)

Various Formats Intermixed (Hampton)

Vidipax Storage
Video Storage (Paper Tiger)

MIAP Projects (Paper Tiger)

MIAP Projects (Paper Tiger)

Amer Museum of Natural History

Orphan Works

Home Movies--Emanuel Goldberg
Amateur Film-- UGA  
Walter J Brown Media Archive  
• Athens GA, 1947  
• Shows contrast btwn White and African-American neighborhoods  
• [http://www.libs.uga.edu/media/collections/homemovies/housing.html](http://www.libs.uga.edu/media/collections/homemovies/housing.html)

Wolfson Florida Moving Image Archive  
• [http://youtube.com/watch?v=vhWa307csQ0](http://youtube.com/watch?v=vhWa307csQ0)

Palmour Street (1957)  
• Gainesville, GA  
• [http://www.youtube.com/watch?v=VpgWZceHX30](http://www.youtube.com/watch?v=VpgWZceHX30)  
• Educational film from Southern Educational Film Production Service  
• Prelinger Archives

Physical Deterioration

Technical Composition & Deterioration of Video & Audio Tapes-

Structure of Tape  

- Binder—Functions as a carrier for the recording material & bonds it to the substrate
- Substrate—Base material on which the recording material is coated (eg: an aluminum plate or a thin ribbon of polyester film)
**Tape Substrate**

- Early tape used cellulose acetate
  - Moisture/hydrolysis
  - Vinegar syndrome
- More recent tapes are polyester terephthalate (PET) or polyethylene naphthalate (PEN)
  - Chemically stable
  - Resist hydrolysis and oxidation

**Magnetic Particles**

- Store recorded information
- Change in magnetic properties can result in loss
  - Magnetic remanence - ability to retain a magnetic field
  - Coercivity - ability to resist demagnetization
  - Magnetic deterioration of the metal particulate and chromium dioxide materials

**Binder Layer**

- Holds the magnetic particles to the base
- Where the problems are likely to occur
  - binder-base adhesion
  - oxide shedding
  - dropoff
  - hydrolysis
    - sticky shed
    - magnetic head clog
- Tape baking as one solution

**Video Cleaning Machine**

**VidiPax Video Preservation**

**Longitudinal Recording**

Van Bogart  
http://www.clir.org/pubs/reports/pub54
Packing problems can lead to playback problems

- Tracks for helical scan can be skewed

Storing Tapes

- Tapes should be stored fully wound in one direction or the other
- Store tapes upright (like a book)
- Do not store near potential magnetic fields
- Storage cases should be opaque and kept away from source of light and humidity
- Do not store tapes in plastic bags
- Exercise the tape every few years
Signs of Vinegar Syndrome

• sour smell
• Shrinkage
• buckling of the emulsion
• the appearance of crystals that obscure the image

Tape-Sticky Shed Syndrome

Lost Tapes, Found SoundsExhibition
Harold Schellinex

Lost Tapes, Found SoundsExhibition
Harold Schellinex

Lost Tapes, Found SoundsExhibition
Harold Schellinex

Color Restore (VidiPax)
Obsolescence

Difficult Materials become obsolete relatively quickly

• The physical carriers decay or become obsolete
• The technology required to view the carriers changes frequently
• The encoding formats needed to decode the content shift

Obsolete or deteriorated Physical Carriers

Obsolete Carriers & Info Techn

Obsolete Carriers

Obsolete Carrier viewing Technology?
**Kodak stops making some films**

**List of old Audio Formats**

<table>
<thead>
<tr>
<th>Format</th>
<th>Description</th>
<th>Years in Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wax Cylinder Records</td>
<td>2- or 4-minute formats, wax or wax compound</td>
<td>1888 – 1929</td>
</tr>
<tr>
<td>Removable Wax Records</td>
<td>(Direct or Acetate Disc) 16, 25, or 30 revolutions per minute (rpm). Generally on a paper, glass or metal base</td>
<td>c. 1925 – 1955</td>
</tr>
<tr>
<td>Recording Wire</td>
<td>Spool of wire, usually 55 or 60 minutes long, one per minute (rpm).</td>
<td>1945 – 1955</td>
</tr>
<tr>
<td>Open Reel Recording (78s)</td>
<td>1 7/8 – 30 inches per second (IPS) speeds</td>
<td>1945 – Present</td>
</tr>
<tr>
<td>Compact Cassette</td>
<td>10 – 30 minutes, 1 7/8 – 30 inches per second (IPS) speed</td>
<td>1965 – Present</td>
</tr>
<tr>
<td>McPherson Microcassette</td>
<td>Very small 2-4 cm cassette tapes</td>
<td>1977 – Present</td>
</tr>
<tr>
<td>Digital disk, MP3, and other digital recorders</td>
<td>Audio recorded directly in digital files to optical discs or internal hard drives</td>
<td>2000 – Present</td>
</tr>
</tbody>
</table>

**Old Video Formats (www.vidipax.com)**

**RCA-WBTV**

Jeff Martin—The Dawn of Tape

**Douglas Edwards News**

Jeff Martin—The Dawn of Tape

**Early Quad tape was easy-to-use**
Reformatting and Ethics

What is Reformatting?

- A form of copying
- Usually copied onto a medium having different physical characteristics than the original physical strata
- Examples
  - Document on acidic paper onto non-acidic paper
  - Newspaper microfilming
History of Conservation & Preservation Reformatting

- In ancient times, in the library of Pamphilus at Caesaria, badly damaged papyrus manuscript pages were replaced with parchment (which was stronger) - Saint Jerome
- The Bible was hand-copied for millennia
- 1964 - US Newberry Library (Paul Banks) began 1st US institutional preservation program
- 1987 - US NEH begins funding massive microfilming of brittle paper (mainly newspapers)

Why do we Reformat?

- Because we cannot sustain the original object (its physical characteristics are deteriorating too fast)
- Because continued access and handling of the original object will rapidly decay its physical characteristics (so we create a surrogate for users and store the original in very good conditions, away from users)
- Because viewing the work requires some kind of technology, and we can’t keep that technology working very far into the future.
Metal sound recording Disks

Paper print

Record Turntables

Slide Projector

Limitations of Reformatting

• Authenticity issues (more later)
• User behaviors (newspaper, book, video game, …)
• Users mistaking the reformatted work for the original

Critiques of Reformatting

Mainly User Behaviors

• Can’t view outside the library
• Only sequential access
• Viewing and studying is awkward
• …
But unless we Reformat, we totally lose some kinds of works
(particularly audiovisual works like film)

- 50% of all titles produced before 1950 have vanished (approximate number as of late 1970s)
- This reflects full-length features; survival rates are much lower for other types (studio newsreels, shorts, docs, independent, …), and these “orphans” are particularly in peril
- Fewer than 20% of features from 1920s survive in complete form; survival rates of 1910s is <10% (& none of these are negatives)


And sometimes we have to reformat because of technology changes

- We don’t have video players to play tapes made 25 years ago
- We don’t have 8-inch floppy disk drives, syquest drives, zip drives
- We don’t have Windows 3 operating systems
- But this is something that conservators have always dealt with…

Authenticity Issues with reformatting:

- Is the work what it purports to be?
- Commercial reformatting examples
- Media archivists and interpretation
- Beyond Film & Video

Churchill Speeches

- The voice of Norman Shelley?

Commercial Reformatting Issues: PR at 1967 re-issue of GWTW

- “Spherical Blow-Up”
- “In the Splendor of 70mm. Wide screen and full stereophonic sound!”
- “For the thousands who remember its unparalleled drama, action and romance! For the new thousands to whom the wonders will be revealed for the first time! Breathtaking spectacle, inspired acting by the greatest cast ever assembled! The screen’s most exciting love story! The most-talked about picture ever made!”

But most people didn’t know that 70mm widescreen is different shape than 35mm normal
Change in Aspect Ratio forces cutting

Pan and Scan example


This meant eliminating part of the frame

Eliminating even in famous scenes

But the re-release wasn’t governed by artistic concerns

- Intellectual Property is owned by MGM, not by Fleming or Selznick
- MGM is motivated maximizing profit, not in maintaining artistic integrity
- Bigger is always better

- Not radically different than another blow to artistic integrity/originality in Atlanta 20 years later…

Atlanta was also home of 1980s Colorization movement
Sometimes even the Director wants to go back and change their original film

Someone needs to maintain the integrity of artistic works

- This means preserving original versions
  - even when commercial interests want to replace the older version with something new and fancy
  - even when the “artist” wants to use more recent technological developments to “improve” their work

Media Archivists

- Preserve original works
- Provide access to older versions
- Maintain the integrity of the “original” in any restoration process
- Champion works that do not have commercial entities pushing for their preservation and distribution
- Try to make sure that works are viewed within their original context

Be concerned about ©

- For preservation you may need to re-format, but with recent changes in copyright laws, you may not have the right to re-format
- Intellectual property rights are very difficult, particularly considering that most films and videos have extensive underlying rights that you could never get prior permission for (stock footage, historical footage, music composition, music performance, …) [“Eyes on the Prize”]
- And even if you have the right to re-format for preservation, you might not have the right to show what you have preserved
Possible endless need for reformatting implies

- Possible loss with each generation
- Requires managed environment
- Can lead to © violations

Managed Environment

- More than temperature & humidity control
- Periodic monitoring of the works
- Periodic monitoring of the technical environment for viewing the works (software, systems, hardware)
- Trusted repositories

Preventative Conservation

- Facilities and infrastructure
- Monitoring micro and macro environments
- Collection Assessment tools
- Disaster recovery

Hampton Collection (atmosphere cntrl)

Academy-Atmosphere

IPI Storage Guide
IPI Media Storage Reference Guide

Temperature & Humidity for Tape Storage

- Variance of less than 2ºC and 5% RH per 24 hours
- Ideally 8ºC and 25% RH
- Other options
  - 20ºC (68°F) and 20-30% RH
  - 15ºC (59°F) and 20-40% RH
  - 10ºC (50°F) and 20-50% RH
- Never store below 8ºC

Ideal Temperature/Humidity

- Lowering temperature and/or relative humidity can help reduce the rate of acidification in degrading film
- Trying to remove acid within the can does not outweigh the benefits of low temperature and humidity
- The greatest improvements in chemical stability can be achieved with cold temperatures
Monitoring Micro & Macro Environments

Improving storage inside the Can

Jean-Louis Bigourdan, AMIA 1998

- zeolites, silica gel, and low relative humidity preconditioning help mostly by reducing moisture content
- acid adsorbents retard further decay
- acid adsorbents do not reduce the acid content of degraded film
- the use of cardboard disks is not recommended

IPI A-D Strips

Acid Detection Strips at NYU Library (Internship)

NYU University Archives Internship Project

Acid Detection results/autocatalytic point readings

<table>
<thead>
<tr>
<th>Collection</th>
<th>Total # of Items</th>
<th>Acid</th>
<th>Alkaline</th>
<th>Neutral</th>
<th>Acid</th>
<th>Alkaline</th>
<th>Neutral</th>
<th>Acid</th>
<th>Alkaline</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Archives (Audio)</td>
<td>45</td>
<td>38%</td>
<td>15%</td>
<td>47%</td>
<td>14%</td>
<td>15%</td>
<td>47%</td>
<td>14%</td>
<td>15%</td>
<td>47%</td>
</tr>
<tr>
<td>Audio Visual</td>
<td>103</td>
<td>25%</td>
<td>54%</td>
<td>21%</td>
<td>25%</td>
<td>54%</td>
<td>21%</td>
<td>25%</td>
<td>54%</td>
<td>21%</td>
</tr>
<tr>
<td>Miscellaneous Papers</td>
<td>15</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>Non-still Video</td>
<td>8</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>Dept of Athletics</td>
<td>12</td>
<td>50%</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Printed Alfresco</td>
<td>2</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Nitto Soundtrips</td>
<td>17</td>
<td>59%</td>
<td>18%</td>
<td>23%</td>
<td>23%</td>
<td>18%</td>
<td>59%</td>
<td>23%</td>
<td>18%</td>
<td>59%</td>
</tr>
<tr>
<td>Stern &amp; Brown</td>
<td>1</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Miscellaneous Films</td>
<td>2</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

External Affairs            | 7                | 34%  | 28%     | 38%     | 34%  | 28%     | 38%     | 34%  | 28%     | 38%     |

Audio Visual                | 2                | 100% | 0%      | 0%      | 100% | 0%      | 0%      | 100% | 0%      | 0%      |

NYU University Archives (Audio)

Total # of items

- University Archives (Audio): 45
- Audio Visual: 103
- Miscellaneous Papers: 15
- Non-still Video: 8
- Dept of Athletics: 12
- Printed Alfresco: 2
- Nitto Soundtrips: 17
- Stern & Brown: 1
- Miscellaneous Films: 2
- External Affairs: 7

Acid Detection results/autocatalytic point readings:

- Acid: 0 – 1.0
- Alkaline: 1.5 – 3.0
- Neutral: 0 – 1.0

Thermohygrograph
Setting Collection Priorities

- You collection will always need more time than you can give
- Triage—setting priorities

Methodology for Setting Priorities

Identify different groupings within your collection

- By sub-collection
- By age
- By where they’ve been stored
- By video format

Methodology for Setting Priorities

Survey a Random Sample in each grouping

- Physically inspect each of the random samples, looking for metal oxide, tape packing problems, breakage, edge damage, stretching, curling, housing damage, or other signs of deterioration
- [play each tape]

Methodology for Setting Priorities

Analyse the data you gathered

- Extrapolate from your sample to project how many total tapes in each category are likely to have each problem
- Combine this data with other information (relative value of each sub-collection, replace-ability of particular groups of tapes, how unique certain groups are, © issues with reformatting, special funding available for certain sub-groups
- Set priorities based on the above

Collection Assessment Tools

- New York University Visual and Playback Inspection Ratings System (ViPIRS): Tool for Evaluating Audiovisual Magnetic Media
  [http://library.nyu.edu/preservation/movingimage/vipirshome.html](http://library.nyu.edu/preservation/movingimage/vipirshome.html)
- Columbia University Libraries: Audio/Moving Image Survey Database
  [https://www1.columbia.edu/sec/cu/libraries/bts/preservation/projects.html](https://www1.columbia.edu/sec/cu/libraries/bts/preservation/projects.html)

Other policy issues

- Limit on what you agree to accept (numbers, conditions, uniqueness, rights issues, …)
- Access issues
  - Who can view; how often; restricted items?
  - When can copies be made (& under what conditions)?
  - What should be available online?
### Other important resources for collection maintenance (1/2)


### Planning for the future

- Track where field is going
- “Environmental Scans”
- Technological Obsolescence

### Storage Media

- Removable media (like CDs) is not a long-term answer
- The long-term answer requires ongoing management, and involves regular migration or emulation. This solution is only viable with storage on spinning disks.

### Today, peoples’ home collections are increasingly digital

- Storing on CDs becomes a big problem over time
Consumers replace their CDs with a hard disk (& so should archives)

Plain DVDs are no longer the latest format

Which should be reformatted to digital today?
- Born digital--need to be kept in digital form
- Video--probably; at least soon
- Film-Not very soon
- A guessing game; we need more R&D, as well as education

New distribution:
- iTunes-U UCB Oral Histories
- iTunes-U UCB Campus Events
- iTunes-U Duster Video
Do we trust iTunes to preserve these?

The Re-Mix generation

Dueling Videos: Scholar Creates Remix of Another Academic’s YouTube Hit


Chronicle report on Center for Social Media Re-Mix project


Some Re-Mix Videos

- Baby Got Book
- Bush vs Zombies
  http://www.youtube.com/watch?v=IoXgRtDysLY
- George Bush Don’t Like Black People
- Victory in Iraq
  http://www.youtube.com/watch?v=904m0Dz9e5g
- Fox News Edits a Democrat to Make Him Look Worse
  http://www.youtube.com/watch?v=0e7TohFaZqyY
- xx

Born-digital images

- Where is the “original”?
Born-digital works are both easier and harder to preserve than analog works

- + With a born-digital work, we don’t have to worry so much about the “original artifact” (there really isn’t one)
- - We know that digital works face a whole range of obsolescence problems, so they must be reformatted at least once per decade

New technologies will let us do new things

Phonautograph

- Invented by Édouard-Léon Scott de Martinville
- Recorded sounds onto paper, blackened by smoke from an oil lamp
- But there was never a method for playing these back

“Researchers Play Tune Recorded Before Edison” (NYT 3/27/08)

Phonautogram

- Using archival sources (letters, patents, old laws), LBL researchers decypher patterns in the 1860 blackened paper and create a “virtual stylus” to play it
- Au Clair de la Lune (1860) - oldest known recording
- Lesson--don’t throw away blackened paper!
Previous LC/LBS research interpreted record grooves, allowing us to play broken records.

But new technologies require us to figure out how to handle and preserve new things.

Ideal Sound Format

- WAV files at faster bit-rate for music than for speech
- Store on spinning disks and have a long-term migration plan
  - avoids the problem of managing too many removable media, but requires rigorous long-term planning

What can you do now?

For both Film & Video

- Label elements as well as you can
- Try to keep things at a low humidity and temperature
- Limit the number of formats as much as possible
- Save important production elements

Risk Management

- We can’t say definitively that we can make every digital work persist
- What we CAN say is that the more a digital work conforms to standards and best practices, the greater the likelihood that we can assure persistence
- Our preservation repositories can even accept deposits of non-conforming works, but the less they conform, the less likely that they’ll be salvageable
- Persistence is most likely for works that share standards, metadata, and best practices

Reformatting Best Practices

- Think about users (and potential users), uses, and type of material/collection
- Scan at the highest quality that does not exceed the likely potential users/use/material
- Do not let today’s delivery limitations influence your scanning file sizes; understand the difference between digital masters and derivative files used for delivery
- Many documents which appear to be bitonal actually are better represented with greyscale scans
- Include color bar and ruler in the scan
- Use objective measurements to determine scanner settings (do NOT attempt to make the image good on your particular monitor or use image processing to color correct)
- Don’t use lossy compression
- Store in a common (standardized) file format
- Capture as much metadata as is reasonably possible (including metadata about the scanning process itself)
So, with electronic works, the focus should be less on stable temperature
(Helsinki underground vaults)

And less on the construction of Vaults
(Helsinki underground vaults)

Disaster Recovery-New Orleans

http://www.nyu.edu/tisch/preservation/research/

We looked at preventative techniques & their limitations

Univ of New Orleans Library Special Collections
Some General Observations

- New Orleans damage was more from electricity being off than direct water damage
- Works in institutional collections survived; works in private collections and smaller community organizations didn’t
- Most Disaster Preparedness plans assume that the larger infrastructure stays intact (phones and email will work, cultural workers will be able to enter the building soon after the disaster, etc.)
Your Challenges as an Archivist

• You are custodians of our Heritage
• You need to make sure that that Heritage endures (preservation)
• You need to make sure that that heritage can be used for research, education, etc. (access)
• We live in a media-saturated era, and media records pose continuing challenges for us

So, with electronic works, the focus should be less on stable temperature (Helsinki underground vaults)

And less on the construction of Vaults (Helsinki underground vaults)
Paradigms Shifts needed

<table>
<thead>
<tr>
<th></th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>atmospheric cntrl</td>
<td>ongoing mgmt</td>
</tr>
<tr>
<td>preservation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What to save?</td>
<td>artifact</td>
<td>idea + ancillary material &amp; documentation</td>
</tr>
<tr>
<td>Cataloging</td>
<td>Individual work in hand</td>
<td>FRBR</td>
</tr>
<tr>
<td>Later access</td>
<td>Artifact &amp; documentation</td>
<td>Restaging, ancillary material &amp; documentation</td>
</tr>
</tbody>
</table>

Video & Audio: Preventive Conservation

Howard Besser
NYU Moving Image Archiving & Preservation Program

http://www.tisch.nyu.edu/preservation

- http://www.amianet.org/
- http://www.clir.org/pubs/pub54/
- http://sunsite.berkeley.edu/Longevity/
- http://www.imagepermanenceinstitute.org/

Archivists in the News

Giant puzzle exposes Germany's communist secrets

http://afp.google.com/article/ALeqM5h_UQJgTk-R2vP9Yh4H4NLOZiwGMQ

- BERLIN (AFP) — It is painstaking work, almost a labour of love, but help is close for the nine people who have spent years sticking together millions of pieces of paper to decipher the workings of East Germany’s once-feared Stasi secret police.
- Almost two decades after the fall of the Berlin Wall in November 1989, the actions of the communist government still fascinates and scares Germans. Who worked with them? And why?
- Stasi employees started to destroy their secret files as the Berlin Wall fell. Initially they shredded them. But as the machines broke down under the strain, they were forced to tear documents by hand.
- The waste was to be pulped or burnt, but “citizen committees” stormed Stasi offices across East Germany, seizing millions of files, along with 15,500 bags of torn-up documents.
- “One of the main reasons why the citizen committees occupied Stasi offices was to prevent the destruction of these archives,” said Andreas Petter, a chief archivist at the office now responsible for their preservation.