Digital Media at the University

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Digital Media at the University

• Recent Trends
• Why do digital media pose long-term problems?
• What do we need to do to answer those problems?
• Reformating--why have we done it, and what can we learn from the audiovisual field? (and some lessons about audiovisual conservation)
• Pushing metadata gathering upstream
• Difference b/w libraries, museums, archives
• © impediments

Recent trends in University Media Management

• Centralized digital repository for most of the Campus' organized collections and faculty pre-prints
  - Usually managed by Computer Center, but sometimes by Library or other units
  - Often only a storage repository (w/o preservation)
  - Sometimes has no centralized access (access is through each individual collection)
  - Many handle only well-understood static formats (PDF, TIFF)
• Administrative merging of units that previously were independent
  - University Presses going to Libraries
  - Museums and Libraries into same reporting structure
  - Film Archives under libraries

Strategies for Re-Use

• content: quotations, citations, photos, clips, ...
• For Re-Use with
  - Papers
  - Articles
  - Course slides
  - Social media
  - YouTube
  - Re-contextualizations

The Short Life of Digital Info: Digital Longevity Problems-

★ Disappearing Information
★ The Viewing Problem
★ The Scrambling Problem
★ The Inter-relation Problem
★ The Custodial Problem
★ The Translation Problem

The Viewing Problem

★ Digital Info requires a whole infrastructure to view it
★ Each piece of that infrastructure is changing at an incredibly rapid rate
★ How can we ever hope to deal with all the permutations and combinations
The Scrambling Problem

Dangers from:
- Compression to ease storage & delivery
- Container Architecture to enhance digital commerce

The Inter-relation Problem

- Info is increasingly inter-related to other info
- How do we make our own info persist when it points to and integrates with info owned by others?
- What is the boundary of a set of information (or even of a digital object)?

The Custodial Problem

- In the past, much of survival was due to redundancy
- How do we decide what to save?
- Who should save it?
  - Mellon-funded E-Journal Archives
- How should they save it?

Migration

- Wordstar to Word 1 to Word 3, ...
- Tables and complex features often get corrupted
- Need to repeat every 4-5 years (maybe forever)
- We know how to do this ourselves
- If there’s a problem, we can catch it soon

Emulation

- Keep the Wordstar file format, but write emulators to make it work in newer environments
- A better chance of carrying over complexity
- Many more features can survive
- Problems may not be caught until it’s too late
- Specialists and a whole infrastructure of emulators required
- Serious © problems (reverse engineering?)

The Custodial Problem: How to save information?

- Methods for later access
- Refreshing
- Migration
- Emulation
- Issues of authenticity and evidence
The Translation Problem

Content translated into new delivery devices changes meaning
- A photo vs. a painting
- If info is produced originally in digital form in one encoded format, will it be the same when translated into another format?
  - Behaviors

Thinking of the Future (1/2)

- Screens will be different resolutions and different aspect ratios
- CRTs won’t exist
- A decade or 2 from now, today’s user interfaces will look like arrow-key navigation looks like today

Thinking of the Future (2/2)

- Today's streaming media are small windows, slow speeds
- As bandwidth increases, viewers will expect higher quality streams
- Creators may need to consider how they’ll be able to deliver higher-bandwidth streams
  - Delivery Derivatives vs. Masters encoded w/standards
  - May also want to re-edit the piece to take advantage of changes in technology, viewer expectations, society-

Screen Formats

- Responding to serious Longevity Problems
  - Previous formats required little ongoing intervention (remote storage facilities, Iron Mtn); digital formats require intense ongoing management
  - Key requirement is Ongoing Management:
    - Preservation Repositories
    - Preservation Metadata

Even newspapers in Alabama know about ongoing management
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

Standards, Metadata, & Best Practices to follow-

- Risk Management
- Best Practices for Reformatting
- Preservation Repositories & Metadata
- Other Metadata & Standards

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 (still images)

- 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/uses (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 bitoral actually are better represented with grayscale 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)

Preservation Repositories: Open Archival Info System Model

- High-level reference model describing submission, organization and management, and continuing access
- Conceptual framework for different organizations to share discussions with a common language
- Producers, consumers, management, actual repository
- SIP, DIP, AIP
- AIP consists of data objects plus representation info (Content, Preservation Description, Packaging, Descriptive)
- Originally developed for Space Science community
OCLC/RLG
Digital Repository Attributes
• Administrative responsibility
• Organizational viability
• Financial sustainability
• Technological suitability
• System security
• Procedural accountability
• Certification

Trustworthy Repositories Audit & Certification (TRAC): Criteria and Checklist

• Organizational Infrastructure
• Digital Object Management
• Technologies, Technical Infrastructure, & Security
  • The repository commits to continuing maintenance of digital objects for identified community/communities.
  • Demonstrates organizational fitness (including financial, staffing structure, and processes) to fulfill its commitment.
  • Acquires and maintains requisite contractual and legal rights and fulfills responsibilities.
  • Has an effective and efficient policy framework.
  • Maintains/ensures the integrity, authenticity and usability of digital objects it holds over time.
  • Creates and maintains requisite metadata about actions taken on digital objects during preservation as well as about the relevant production, access support, and usage process contexts before preservation.
  • Has a strategic program for preservation planning and action.
  • Has technical infrastructure adequate to continuing maintenance and security of its digital objects.

Trustworthy Repositories Audit & Certification: Criteria and Checklist (TRAC)

• OAIS-agreements
  • Agreement
  • Ingest
  • Store and manage/maintain
    – Refresh
    – Emulate/Migrate/others
  • Disseminate

Management:
Preservation Repositories: OAIS & agreements

OAIS-steps in the process

• Metadata
  • Containers/Packaging for SIP (METS)
  • AIP
  • Preservation (PREMIS)
AIP Metadata

- Preservation Description Info
  - reference info
  - context info
  - provenance info
  - fixity info
- Packaging Info
- Descriptive Info
- Content Info

PREMIS Data Model

- Item Pres. Metadata
  - About the creation of the item
  - Technical details about the item
- Relationship Pres. Metadata
  - Persistent Identifier
  - Objects relation to parts of the intellectual entity
- Migration Metadata
  - Items relation to its previous manifestation.

OCLC/RLG Efforts

PREMIS Data Dictionary Example

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Migration is a form of Re-formatting. Re-formatting is not a new idea.

What is Re-formatting?

- 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

Why do we Reformat?-

Brittle Newspapers (Australia Battye Library)

Film Decay

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
- A/V community has been forced into reformatting for a long time because of obsolescence issues-
Metal sound recording Disks
Casa da Barcino

Paper print (LC Dayton)

Record Turntables

Slide Projector
Old Video Formats (www.vidipax.com)

List of old Audio Formats

Limitations of Reformattting

Critiques of Reformattting

But if we don’t Reformat, we totally lose some kinds of works (particularly audiovisual works like film)
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...

Reformatting needs to be part of a 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

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-

Storing on CDs becomes a big problem over time

Consumers replace their CDs with a hard disk (& so should you)

Preventative Conservation-

- Facilities and infrastructure
- Monitoring micro and macro environments
- Collection Assessment tools
- Treatments (chemistry, physics, reformatting)
- Disaster recovery
Hampton Collection (atmosphere cntrl)

Academy-Atmosphere

Thermohygrograph

IPI Storage Guide

IPI Media Storage Reference Guide

IPI Preservation Index

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<td>100</td>
<td>50</td>
<td>25</td>
<td>13</td>
<td>7</td>
<td>5</td>
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</table>
Temperature & Humidity for Tape Storage

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

Ideal Temperature/Humidity

- Variance of less than 2°C and 5% RH per 24 hours
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  - 15°C (59°F) and 20-40% RH
  - 10°C (50°F) and 20-50% RH
- Never store below 8°C

Life Expectancy at various Temperature/Humidity

- Variance of less than 2°C and 5% RH per 24 hours
- Ideally 8°C and 25% RH
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  - 10°C (50°F) and 20-50% RH
- Never store below 8°C

Improving storage outside the Can

- 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

Improving storage inside the Can

- 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 (Assessment)

NYU University Archives Internship Collection Assessment

Acid Detection results/autocatalytic point readings

<table>
<thead>
<tr>
<th>University Archives Collections</th>
<th>Total # of Items</th>
<th>0 – 1.0 %</th>
<th>1.5 – 3.0 %</th>
<th>3.5 – 6.0 %</th>
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<tbody>
<tr>
<td>Audio Visual</td>
<td>100</td>
<td>95%</td>
<td>5%</td>
<td></td>
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<tr>
<td>Radnor Papers</td>
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<td>100%</td>
<td>0%</td>
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<td>Thompson Dept. Tapes</td>
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<td>95%</td>
<td>1%</td>
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<td>Max Y. Kohne</td>
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<td>54%</td>
<td>35%</td>
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<tr>
<td>Louise Miller</td>
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<tr>
<td></td>
<td>Total</td>
<td>400</td>
<td>325</td>
<td>75%</td>
</tr>
</tbody>
</table>

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)

Collection Assessment class projects

- Laurie Anderson
- Sonic Youth Video
- The Kitchen
- John F Kennedy (Gartenberg Media)
- Hemispheric Institute
- Cabinet Magazine Digital Content Archive
- AMNH Video Collection
- Robert Huller Collection (Anthology)
- New Museum of Contemporary Art
- Filmmakers Coop
- 16mm Films at Brooklyn Public Library
- John Watts Papers (Fales Library)
- Flaherty Film Seminar
- Richard Foreman Papers (Fales Library)
- MadalassaCollection
- Eyeball
- Frank Kuebler Films (Anthology)
- Art21 Archive
- World Music Institute Audio/Video Archive
- Ted Moser Collection (NYPL-Rodgers/Hammanstein)
- Third World Newsreel

Setting Collection Priorities

- You collection will always need more time than you can give
- Triage--setting priorities
Physical Properties of the medium -
• chemistry, physics, electromagnetism, ...

Film Layers
ScreenSound Film Preservation Handbook
• Topcoat
• Emulsion (content)
• Subbing Layer (adheres)
• Base (cellulose triacetate, cellulose diacetate, cellulose nitrate, or polyester)
• Backing Layer

Surface Physical Damage
• Perforation
• Scratches
• Water droplet damage to emulsion

Mold Damage
ScreenSound Film Preservation Handbook
• Usually in gelatin part of emulsion layer
• Interesting patterns

Shrinkage
ScreenSound Film Preservation Handbook

Vinegar Syndrome Deterioration
Image Permanence Institute
**Signs of Vinegar Syndrome**

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

**Film--Acetate Decomposition**

- cupping—Home Film Preservation Guide—filmforever.org

**Film--Acetate Decomposition**

- emulsion cracks—Home Film Preservation Guide—filmforever.org

**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 (e.g., an aluminum platter or a thin ribbon of polymer 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 slag
- Tape baking as one solution

Video Cleaning Machine

Longitudinal Recording

Van Bogart  http://www.clir.org/pubs/reports/pub54

Helical Scan Recording

Van Bogart  http://www.clir.org/pubs/reports/pub54

Tape Pack Problems

Van Bogart  http://www.clir.org/pubs/reports/pub54

Tape Pack Problems
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

Temperature & Humidity for Tape Storage

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

NDIIPP's Preserving Digital Public Television project

But much of the necessary metadata has already been gathered during production

- For each element/clip, production team usually notes source, date, place, people, and other descriptive info
- But this is treated as internal information, and often various parts of the info are distributed among the personal notebooks of different production assistants
- There is seldom a central location for this info, and the info is seldom turned over to the archive (which later tries to recreate much of it)

Pushing Metadata Gathering Upstream: The Problem

TRADITIONALLY...
- Very little metadata required for preservation accompanies an object to a repository.
- Archives, libraries and other repositories must create (or re-create) most of the necessary metadata.
- This requires many manual hours, and significant resources - both time and money.

IN THE DIGITAL WORLD...
- This doesn’t scale up. Repositories will be unable to continue in this manner, as more metadata than ever is required.
Similar issues w/other content types--E-Journals

• “The necessary or additional metadata cannot be effectively and satisfactorily produced either as an afterthought post-production process on the publisher’s side or as a pre-ingest conversion activity at the archive’s end. Approaching e-archiving in this fashion leads to distribution delays and a more complex production and distribution scenario, with all the accompanying potential to introduce production delays and errors.”

- Yale University, YEA: The Yale University Archive, One Year of Progress, 2002

We need to find ways to push metadata access upstream

• Digital requires even more metadata than Analog
  – As the workflow becomes file-based, the need for robust and accurate metadata will become critical. File relationships, video codecs, bit rates, and rights information must be explicit, accurate, and immediately accessible. This will require a much deeper level of metadata than is currently captured in tape-based archives.
  – We can’t continue to supply this metadata at ingest; that won’t scale
• Obtaining the necessary metadata at the end of production and broadcast life cycle is not feasible. Metadata will need to be systematically gathered during the production lifecycle and submitted with the programs to the preservation repository.

Examined Potential Points of Metadata Capture

Examined Potential Points for Metadata Capture

• Much of the necessary metadata for preservation is already generated by the production unit, but discarded after their internal use. This needs to be captured throughout the workflow.

• “Those in the production unit are the creators and have first hand knowledge of who, what, where, when, and why the content was created.” – Mary Ide and Leah Weisse, WGBH Archivists.

Proposed Solutions…?

• Preservation becoming a shared responsibility between content creators, distributors, curators, and preservationists.
• Partnerships are needed to come to unified solutions.
• Preservationists seek reliable metadata back upstream in the production workflow.

Libraries/Museums/Archives-

• Original objects
• Interpretation
• Metadata
• Reformatting

Museums have traditionally been much more elite than libraries

- Highly selective
- Highly interpreted (often favoring a single interpretation)
- Driven by curators
- Not particularly concerned by access issues

mid-1980s

mid-1990s

The Prints and Photographs Reading Room, Miriam & Ira D. Wallach Division of Art, Prints and Photographs, Center for the Humanities, Special Collections at the New York Public Library

Botanical Prints at Met Museum
Lilium Penduliforum (Canadian Lily, Wild Yellow), Amaryllis Josephineae (Josephine's March Lily), Haemanthus Cocineus (April Fool),

Robert Flaherty, 1922
Violating Copyright

Paradigms Shifts needed

<table>
<thead>
<tr>
<th></th>
<th>Old</th>
<th>New</th>
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<tbody>
<tr>
<td>Physical preservation</td>
<td>atmospheric cntrl</td>
<td>ongoing mgmt</td>
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<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>
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</tbody>
</table>

Digital Media at the University
Howard Besser, NYU Moving Image Archiving & Preservation Program

- http://www.nyu.edu/tisch/preservation
- http://dlib.nyu.edu/pdptv/
- http://www.iasa-web.org/tc04/
- besser.tsoa.nyu.edu/howard/Papers/vm_tng.doc
- http://besser.tsoa.nyu.edu/howard/Talks/