Preserving Difficult Electronic Works: Moving Images, Electronic Art, Websites

Howard Besser
NYU Moving Image Archiving & Preservation Program
http://besser.nyu.edu/howard
http://www.nyu.edu/tisch/preservation/

Paradigms Shifts needed

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Electronic Art in general is not like canvas paintings

- May include
  - Moving image materials
  - Multimedia
  - Interactive programs (including hypertext novels & games)
  - Computer generated art
- Most electronic art works share some common characteristics with other "strange" works like
  - Performance Art
  - Conceptual Art
  - Site-specific installations
  - Experiential Art

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 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 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

- 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

We have this problem with other older media that is machine-dependent-

Metal sound recording Disks

Casa Rui Barbosa

Record Turntables
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

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.
Limitations of Reformatting

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

But if we don’t 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 newreels, 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…

Issues with new works-

- What is the work?
- Complexity of rich media
- Difficulty of making the work last

LeWitt: Wall Drawing 340

Installing LeWitt
LeWitt Install Directions

LeWitt: What do we save?
- The installation?
- Documentation of the Installation?
- The directions for the Installation?
- What is the goal of our documentation and preservation?

Sep Kamvar & Jonathan Harris: I want you to want me
- Harvests data from online dating sites
- Was part of MoMA’s 2008 Design and The Elastic Mind exhibit
- Is now out of date
- http://www.iwantyoutowantme.org/

Sep Kamvar & Jonathan Harris: I want you to want me

ECI - Imagespace (early 80s)
ECI - Hole in Space (both)

ECI - 84-locations

ECI - 84-Community Memory

ECI - 84-kids

ECI - 84-MOCA

ECI - 84-Annotationg Video
Complex Works-Dig Preserv, Feb 2019

Complexity of Rich Media

• Works often have artistic nature (including video games)
• Enormous number of elements can, at times, be very important to preserve (pacing, original artifact, elements used to construct the artifact)
• Too complex to save every one of these aspects for every type of material
• Importance of saving documentation

Complex Works-Dig Preserv, Feb 2019

Special Characteristics of Electronic Works

• What Really is the Work?
• Disappearing software
• Enormous number of elements can, at times, be very important to preserve (randomness, interactivity, pacing, color, format, original artifact, elements used to construct the artifact)
• Pieces and Boundaries
• Recontextualization (Postmodernism)—which rendition to save?
• Dynamic & Lack of Fixity (evolving works)
• Interactivity
• Historical context
• Difficulty of authentication over time

Complex Works-Dig Preserv, Feb 2019

Documentation & Preservation: What are we trying to do?

• Show the work the way people saw and interacted with it when it was first created
• Show documentation of the work and people interacting with it when it was first created
• Reinstall/Recreate/Reinact the work

Complex Works-Dig Preserv, Feb 2019

Media Archivists make interpretations during reformatting—

Complex Works-Dig Preserv, Feb 2019

Grading Example (1/3)

www.brianpritchard.com

Complex Works-Dig Preserv, Feb 2019

Grading Example (2/3)

www.brianpritchard.com

Complex Works-Dig Preserv, Feb 2019
Grading Example (3/3)
www.brianpritchard.com

Typical Reformatting Paths
• Quad to EIAJ to U-Matic to Beta to VHS
• U-Matic to DVD to digital file
• VHS to digital file
• Digital file to digital file (since now most “video” is shot in digital)

Video Art-
• Caveats
• Display devices
• Automatic reformatting issues
• Our educational program

Caveats
• I’ll only discuss single-channel
• I won’t really discuss complex installation pieces

Display devices
• Issues of aspect ratio
• Issues of color of light
• Issues of whether light actually projects out of the work
• Sculptural issues

Old TVs
This meant eliminating part of the frame.

How do we save widescreen?

Pan and Scan example


Eliminating even in famous scenes

Anamorphic (wikipedia)
The Translation Problem

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

Thinking of the Future

- 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

Screen Formats

Automatic reformatting issues
TBC & Waveform Monitor as part of auto process

Works that look like they have a bad video signal

Gary Hill, Mirror Road
Seth Price, Effects

Bill Viola, Information


Eileen Maxson, Grand Opening (2005)

Works that look like they need more contrast

Eileen Maxson, Protected Witness (2006)
Special Effects and Intentional use of visual elements that look like decay

Gary Hill, Mirror Road

Gary Hill, Mirror Road

Gary Hill, Electronic Linguistic
(1977, 3.5min)

Seth Price, Holes

Vasulkas, Decay
Gary Hill, Soundings (1978, 18 min)

Gary Hill, Mirror Road (1976, 5 min)

Serious Issues in automatically reformatting video art works

• Bad signal
• Contrast
• White segments, black segments, flash frames
• Special effects
• Sound levels
• Intentional use of visual elements that look like decay

What can we do specific to Electronic Art?

• Works themselves may no longer even exist; in many cases, what we can save amounts to forensic evidence
• Enormous number of elements can, at times, be very important to preserve (pacing, original artifact, elements used to construct the artifact)
• Too complex to save every one of these aspects for every type of material
• Importance of saving pieces, representations, and documentation
• Involve the artists to capture their intentions
• Importance of Standards
• Familiarize ourselves with recent conservation developments (Who Knows?, TechArcheology, Tate, IMAP)

Incorporate parts of Functional Requirements for Bibliographic Records (FRBR)

• work
• expression
• manifestation
• item

Standards for encoding artists intentions (group efforts w/i Cult Heritage community)

• 2004 Seeing Double: Emulation in Theory and Practice Exhibition & Symposium
• Variable Media Initiative
• IMAP
• TechArcheology: A Symposium on Installation Preservation (SFMOMA)
Ongoing Work

• 2003-201? Matters in Media Art (http://www.tate.org.uk/about/projects/matters-media-art)
• AIC/EMG (http://cool.conservation-us.org/coolaic/sg/emg)
• CoOL (http://cool.conservation-us.org)
• Presto Centre (https://www.prestocentre.org)

AIC Emerging Media Grp (EMG)-

• Resources
• Workshops
• Seminars (TechFocus)
• AIC Conference sessions
Paradigms Shifts needed

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Archiving websites containing streaming media

- The Problem with Heritrix and Archive-It
- Two approaches to solutions
  - WebRecorder
  - Our Technical Collaboration
    - Our Collaboration with Content Creators & restrictions
    - Architectures & Workflows
    - How things may look
    - Evaluation
- Impact beyond this Project
- Caveat: I am not involved in system architecture & hand-offs, so may not be able to answer detailed questions in these areas

PROBLEMS WITH HERITRIX AND ARCHIVE-IT

 Archive-It

- The leading application/service for curated web archiving in North America
- Run by the Internet Archive, and is much more targeted and curated than their WayBack Machine
- Is based on Crawler software developed by IA (Heritrix) in 2003-2004
- Can’t deal well with anything triggered when a page is displayed (javascript)
- Is very poor at capturing streaming audio or video as well as inserting it properly into a composed web page-

Archive-It Issues w/Streaming Media

Not in Archive

The page requested has not been archived in Archive.

This could be for a number of reasons:

• That links the pages you are requesting was outside of the crawler's scope. Try another request or click to see other pages from oklahoma.granicus.com.

• It is also possible that this page is currently being crawled and the archived pages are not yet available in the WayBack Machine. If so, it may take up to 24 hours after a page has been completed for the site to appear in the WayBack Machine. Please try again after the shortest time.

You can also try searching for oklahoma.granicus.com/ViewPublisher.php?view_detail on the Live link, in the global WayBack Tiers, or in the General Archive at the Internet Archive at internetarchive.org.
Archive-It Issues w/Streaming Media

La Policía dispersa a los manifestantes durante el toque de queda en Ferguson

Archive-It screenshots generated as part of our project-

- By Lorena Ramirez-López

Archive-It Issues w/Streaming Media

Firefox version 39.0. Screenshot of Tarik O’Regan’s site taken 2015/10/05

Archive-It Issues w/Streaming Media

Firefox version 39.0. Screenshot of Tarik O’Regan’s site taken 2015/10/05

Archive-It Issues w/Streaming Media

Firefox version 39.0. Screenshot of Ted Hearne’s website taken 2015/10/05

Archive-It Issues w/Streaming Media

Firefox version 39.0. Screenshot of Ted Hearne’s website taken 2015/10/05
Some sources of streaming issues

- Problems with capturing resources residing on 3rd party services (YouTube, Vimeo, Soundcloud)
- Problems with how faithfully the A/V materials are captured and placed by Archive-It
- Problems with websites generated through site building platforms such as Squarespace

Other Issues we’re trying to solve

- Discovering URLs generated by Javascript

Two Approaches

- Record the Web interactions (WebRecorder)
- Replace Heritrix with an improved web crawler (Brozzler)
  - Composers Web Crawling project-

ARCHIVING COMPOSERS WEBSITES PROJECT (BROZZLER)
Archiving Composer Websites

- Collect, preserve, & make available Websites of Composers
- $480,000 grant from Mellon in 2015 to NYU Library/MIAP/Internet Archive
- Dealing with the issue that contemporary composer websites go up and down (and also incorporate relationship-building btw composer and fans)
- Addressing the problems of collecting streaming media
- Also selectively collecting high-quality versions that are used to generate the streams, and allowing future researchers to see/hear the higher quality versions

Some methods used

- Began with NPR’s list of 100 important composers under 40, and augmented the list with faculty and librarian suggestions
- Identified website infrastructures encountered and created a classification matrix

Project Team

- Jefferson Bailey (Internet Archive)
- Howard Bisner (MIAP)
- Lori Bressler (Internet Archive)
- Lila Espinosa (NYU Libraries)
- Nicole Greenhouse (Lib/ACM)
- Curt Kessler (LIRHT/CTS)
- Scott Lockwood (MIAP)
- Donald MacGregor (Lib/ACM/CTS)
- David Milligan (LIRHT/ITS)
- Jim Phipps (Internet Archive)
- Robin Price (LIRHT/CTS)
- Lorena Ramírez (MIAP)—special thanks!
- Michael Stillman (Lib/C&RS)
- Kent Underwood (Lib/AFC)
- Chela Scott Weber (Lib/AFC)—departed

Website Infrastructure encountered

- Develop good and ongoing relationships btw Libraries and Composers
- Select Trust
- for developing collections, and continuing to add to them
- for Policy reasons
- Examine what type of errors take place
  - how faithfully audiovisual materials are being captured
- how resources that reside on third-party web-services (YouTube, Vimeo, SoundCloud) are (not) displayed within Archive-It’s interface
- Issues w websites generated through site building platforms such as Squarespace
- Find ways to fix those errors

OUR TECHNICAL COLLABORATION:
CRAWLING
Traditional Crawlers

- Archive-It and other web archives use Heritrix
- Follow links, capture most web content
- Less successful with streaming video and dynamic content executed in the browser
- Umbra helps

Brozzler Model

- **job**: collection of seeds
- **seed**: principal unit of crawl configuration
  - one browser works on one seed at a time (politeness)
  - seed has its own configuration, also inherits from parent job
- **page**: atomic unit of crawling from brozzler perspective
- **url**: only browsers, warcprox have to deal with every url
**Warcprox:**

WARC-writing http proxy

- man-in-the-middle for https
- asynchronous: WarcWriterThread
  - writes warc records
  - saves deduplication info
  - updates statistics

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**Other pieces**

- python wayback
- Rethinkdb (distributed document store)

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**Stream capture relies on Youtube-dl**


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**OUR COLLABORATION WITH CONTENT CREATORS, IP ISSUES**

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**Young Composers Corpus**

- Began with NPR’s 2011 list of “100 Composers Under 40”
- 91 of 100 have own self-contained sites
- Within a year of starting we had written agreements with 165 Composers (25 of them from NPR’s list)
- Planned to recruit 10 of them for enhanced archiving (uncompressed; better than what is on website)
  - This will require an added appendix to contract/agreement (which may involve dark archiving and/or restricted access)

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**Building relationships with Composers**

- Engage them with the idea of preserving their Website
- Are they willing to give us richer versions of content on their site?
- Are they willing to make all (or just part) of the content freely accessible? Do they want to embargo some content in a dark archive?
- Donor Agreement/Contract-
Donor Agreement/Contract

- Worked on this with lawyers for well over a year
- Have had fairly stable language in it and many contracts already signed and returned
- Does default to allowing us complete rights for reformatting and for allowing researchers to see/hear all high quality versions at minimum on-site
  - And thus far all Composers contacted have agreed to those principles (but not necessarily to the contractual language)

Elements in the Contract

- What is being acquired
- Terms of Transfer
- Terms of user Access
- Rights & Responsibilities (both NYU & Composer)
-Appendix describing each item (format, content, amount, other pertinent descriptors)
- Appendix with Access Restrictions

Contract Intro

- NYU and Composer wish to establish long-term preservation of the materials listed at the highest possible quality. The Parties wish to enter into this Agreement to establish guidelines and standards with regard to ongoing and future library processes related to such preservation.

Tentative pieces of the Contract

- The uncompressed master files of Materials licensed for inclusion will be made available to the Libraries to enable the research and development of higher quality tools and processes for archiving on the Web and successor technology. The resultant high-quality copies of Composer’s website—incorporating the best quality media files—will be preserved as historical documents in the archive, which will be accessible worldwide on the Web or successor technology as a storehouse of cultural memory and a vehicle for research and scholarship. Composer retains existing rights to his or her Materials, subject to the license granted in this Agreement.

4 possible Levels of Streaming Access

- Available for copy-protected streaming from the NYU Libraries’ website with unrestricted access by the general public.
- Available for copy-protected streaming from the NYU Libraries’ website
  - with access limited to registered NYU faculty and students and
  - to external researchers with eligibility to use NYU Libraries’ archival resources according to NYU Libraries’ general access policies, with password authentication, on or off campus.
- Available for copy-protected streaming on NYU Libraries premises, at designated workstations, with access mediated by NYU Libraries personnel.
- Not available for streaming until a designated future date.

Tentative pieces of the Contract

- non-exclusive worldwide, perpetual, irrevocable, royalty-free right to produce, use, copy, and distribute Derivative Works
- strictly limited to reformatted digital files or to excerpts and abridgements (such as thumbnails) created for the technical purposes of building, preserving, and providing access to the Web archive over the World Wide Web or its successor
- may be used only for the non-profit educational and research purposes provided under this Agreement
- Agreement does not affect or transfer any copyrights or other intellectual property rights
ARCHITECTURE & WORKFLOWS

The Finding Aids are generated from ArchiveSpace (which contains rich metadata).

There is an overall Composers Finding Aid, as well as a separate Finding Aid for each composer (listing inventory and web archives, and link to assets).

Web archive is stored in Archive-It; richer content in NYU Repository.

Connections built off of ArchiveSpace back-end API Demo Site.

Software & Service Components

- IA’s Archive-It
- NYU digital library internal components
  - Aeon for workflow management
  - ArchiveSpace
  - EAD

Unfinished Development work

- Supplying a separate audio player?
- Still working on precise forms of navigation btwn ArchiveSpace, Archive-It, and richer content within NYU’s digital repository
- What will be on the workstation for items that need to be looked at on-site?
- Issues with streams that were not captured
- Example of work done on IA’s API-

Interim work on API to IA

- What IA needs from NYU API
  - API URL
  - Credentials(username, password) → Authentication Token()
  - Repository ID
  - Resource ID
- What IA will return as JSON array
  - Unit Title
  - Creator
  - Data Expression
  - Extent Statement
  - Tech Characteristics
  - [Something Based on Access Restrictions: i.e. can it be played??]
- We Speak Etruscan, 1993 May 21, 23.5 MB, 1 AIFF file Stereo uncompressed 16 bit/44.1K
- The Dream Of Innocence III, 1998 March 26, 150 MB, 1 AIFF file Stereo uncompressed 16 bit/44.1K

HOW THINGS MAY LOOK
Query paths still under development

One option for User Queries
- User browses through Archive-It
- User sees that A/V content exists (and in some cases, it will include richer content, but some of that might be access-restricted)
- Archive-It hands off user to NYU (either directly to A/V content, or to Finding Aid)

One option for Queries

One option for high quality content
- On archived website page listing composer’s content, user sees a message that higher quality content is available, with:
  - Access restrictions, if applicable
  - Link to relevant finding aid
  - (looking like following image)

Demo from API side
http://composers.dlib.nyu.edu/
From any direction, user might need to authenticate

**Evaluation for Improvement**

- Composers and their satisfaction with the ways in which audiences will be able to view archives of their websites (improving usability)
- Researchers, and whether the content and functionality of these web archives works for them (content presentation)
- Tweaking what we do in order to better serve Creators and Researchers
- Finding out whether captures really worked

**SOME OTHER INTERNAL TRACKING**

**Crawl Records**

**EVALUATION**
Findings still being analyzed

- Streaming captures appear more successful, but we still experience some streaming capture problems.
- Need further exploration to see the precise cause of the crawler/capture issues (& rectify them if possible).
Crawler Issues (broken video links)

Complex Works-Dig Preserv, Feb 2019

Crawler Issues (audio not captured)

Complex Works-Dig Preserv, Feb 2019

Crawler Issues (audio failure & anchor problem)

Complex Works-Dig Preserv, Feb 2019

Crawler Issues (partial capture failure)

Complex Works-Dig Preserv, Feb 2019

Crawler Issues (incomplete loading)

Complex Works-Dig Preserv, Feb 2019
Crawler Issues

- Campjulie.com:
  - Any capture date: If very slow load time, hard to tell if was working or not, so some subjects gave up. Site owner says this is inherent to site, so might not be a capture problem.
  - Discrepancies between when one hop out is captured or not.
- Kmariekim.com:
  - Sep 26, 2017 capture (most recent): Attempts to play music from archived Tumblr page from various platforms (youtube, soundcloud, etc.)
- Bitrosie.com:
  - All capture dates: Links take roughly 5 minutes (assumed broken at first)
- Adelefournet.com/video:
  - Sep 12, 2017 capture: Video error after roughly 10 seconds. Stops playing "Barranco District, Lima, Peru" and starts playing another video with opening title "Barranco District, Peru"
  - Link to "Barranco District, Lima, Peru" on the Internet Archive also plays incorrect video
- Michael Robinson archived website: Error message

Evaluation Results

- The subjects were basically satisfied with the captures, but had very many suggestions for improvements with labeling, searching, display, and performance. Most also wanted additional functionality.
- Many of the subjects were confused between captured sites and the Finding Aids for them. In addition, the words “Papers of” in collection titles baffle people when they were looking for recordings, not papers.
- Both users and site owners were unclear about the scope of content that had actually been collected. One site owner expressed disappointment that reviews that they linked to were not captured. And only one subject figured out how to navigate to a suggested “live web” page that had not been archived.

Functionality requested by users

- Most subjects wanted more metadata displayed. Examples included:
  - Displaying a description of the Composers Project and likely contents on the initial start page: display of audio/video run-time instead of file size;
  - Display of audio/video run-time instead of file size so that they could decide whether or not they really needed to make a site visit;
  - More fields shown in various displays (both in lists and in links to essence);
- Both site owners responded positively to the idea of providing a site map with a collapsing menu of links.
- Most subjects wanted a search box. And most wanted to be able to immediately sort a multi-column display list by any column of their choosing.
- One site owner found it misleading when a restricted object linked to a new page.
- One site owner preferred that their digital objects be organized by project, rather than in an undifferentiated list of every digital object on their site.

Functionality requested for local workstations

- Ability to take screen grabs
- Access to additional browser window
- Preview frame when scrubbing (fast forwarding) through video material
- Use of their own laptop or another window
- Display of time code
- And 2 subjects specifically requested the:
  - Ability to slow video/audio file to transcribe
  - Ability to drop pin/attach notes to specific point in video/audio file
IMPACT BEYOND THIS PROJECT

Complex Works-Dig Preserv, Feb 2019

Impact Beyond this Project

- There will be an alternative to Heritrix for crawl-based capturing of streaming media, and Archive-It will ideally be able to better handle streaming media, and display it in proper context
- We will have architectures and workflows for Archive-It to interact with richer local resources (as well as examples of how interaction and navigation can proceed btw Archive-It, ArchiveSpace, Finding Aids, and an internal digital repository)
- Models for interaction btw creators and collecting organizations will have been developed (incl donor agreements)
- We have preserved 100+++ websites of young composers

What this project didn’t address

- Out-dated software (particularly browsers) that might render the content differently than originally intended
- For that, we need to rely upon Emulators – like Freiberg/Rhizome’s Emulation As A Service [http://eaas.uni-freiburg.de/]

Archiving websites containing streaming media: the Music Composer Project

- [http://besser.tisa.nyu.edu/howard/Talks/]
- [http://archive.org/~nlevitt/reveal jc/]
- [http://composers.dlib.nyu.edu/]
- [https://rg3.github.io/youtube-dl/supportedsites.html]

Preserving Difficult Electronic Works: Moving Images, Electronic Art, Websites

- [http://www.nyu.edu/tisch/preservation/]
- [http://www.ptvdigitalarchive.org/]
- [http://www.iasa-web.org/tc04/]
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Other Standards/Metadata Areas

- Synchronicity between media/streams
- Performance Archive & Retrieval Working Group
- Performing Arts Data Service (PADS)
- Persistent IDs
- Website mgmt
- Technical Imaging Metadata
- Structural & Administrative Metadata
- Complexity of formats (storage & compression)
- Crosswalking Metadata

Persistent IDs--the Problem

- Need to separate work ID from work location
- URNs probably won’t be ready until 2003
- Becomes a business process issue when one organization maintains the resource and another organization references it (ie. licensed from vendors or managed by separate administrative structures)

More Persistent IDs--the Approach for today

- PURLs
- Handles
- HTTP redirects
- And worry about costs now and conversion costs when URNs become feasible

Website Management

More issues with referencing IDs

- References for mirror sites
- References for back-up sites when main site is down or bottle-necked
- References for off-site copies and archival copies

NISO/DLF Technical Image Metadata Workshop--4/99

(Z39.87-2002 draft)

- create metadata needed to manage images in digital repositories over long periods of time (full life-cycle mgmt)
- document image provenance & history
- ensure that the images will be rendered accurately on any output device