WHY MEDIA PRESERVATION CAN'T WAIT: THE GATHERING STORM

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1.   Introduction

> *Once upon a time there lived a king and queen who ruled the land of Media. The kingdom of Media was a peaceful land. Its subjects — maybe we should call them objects — lived happy analog lives where preservation, access, and the means of production all revolved around the physical object. But the king and queen had felt the winds of change blowing across their lands. They had heard rumors of an unspeakable evil lurking about their borderlands and they knew that the old ways could not hold much longer…*

Media preservation has reached a crisis point for content carried on physical audio and video formats as the world has transitioned to the digital age. Archival media collections could soon be considered highly endangered. It might help to invoke the power of narrative to aid in understanding the critical issues facing media archives and to spark us to imagine solutions to seemingly intractable problems. Outside of the fairytale, in our own world, the signs are ominous. Witness these disquieting statements made in past years by the National Recording Preservation Board in the United States and by international colleagues in IASA:

> …it is alarming to realize that nearly all recorded sound is in peril of disappearing or becoming inaccessible within a few generations.[9]

> In the mid-to long-term there is a major risk that carrier degradation combined with playback obsolescence will defeat the efforts of archivists…[10]

Both of these are older statements and most media preservationists today believe that the potential peril is within less than a generation and that major risk lies in the near-to-mid-term. Add these statements to the fact that the Library of Congress has recently reported that "Audiovisual materials are the fastest-growing segment of our nation's archives and special collections"[11] and you have what appears to be a gathering of the perfect storm.

2.   What is the problem?

The problem can be effectively summarized with a few keywords: large numbers, obsolescence, degradation, high research value, and short time window. In other words, archives hold very large numbers of analog and physical digital recordings on obsolete audio and video formats that are actively degrading, some of which contain content with high research value. We have a relatively short time window to save these recordings. Briefly considering each keyword will shed some light on the basic issues. My focus in this article is on cultural heritage collecting institutions and materials since that is what I know best.

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9   Council on Library and Information Resources and the Library of Congress, sponsored by the National Recording Preservation Board, *Capturing Analog Sound for Digital Preservation: Report of a Roundtable Discussion of Best Practices for Transferring Analog Discs and Tapes*, accessed October 22, 2014, http://www.clir.org/pubs/reports/pub137.

10   Majella Breen, Gila Flam, et al (Ed.) International Association of Sound and Audiovisual Archives, IASA Editorial Group. *Task Force to establish Selection Criteria of Analogue and Digital Audio Contents for Transfer to Data Formats for Preservation Purposes*, accessed October 22, 2014, http://www.iasa-web.org/task-force.

11   Council on Library and Information Resources and The Library of Congress, *The Library Of Congress National Recording Preservation Plan. (Washington DC: December 2012)*, 6.

2.1 Numbers

UNESCO has estimated that world audiovisual holdings total some 200 million hours.[12] The Library of Congress in its national recording preservation plan estimated that U.S. libraries, archives, and museums hold approximately 46 million sound recordings.[13] There are recent indications that these numbers may be significantly low: a forthcoming study from the Northeast Document Conservation Center and AVPreserve reports that there are over 570 million audio recordings held by organizations within the U.S., 250 million of which are not digitized and are considered preservation-worthy.[14]

At Indiana University (IU) we have documented over 670,000 analog and physical digital audio, video, and film objects on the Bloomington campus alone, of which 41% are unique or thought to be rare. These recordings are held in over 80 campus units on more than 50 media formats. In a recent survey we were able to also account for approximately 2 million recordings held by the Committee on Institutional Cooperation (CIC) universities (at the time a consortium of 12 research universities in the U.S.). None of these institutions had a comprehensive or even close count of their holdings so the number of recordings on these campuses is likely to be substantially higher. Clearly, the work ahead to digitally preserve media recordings is massive and preservation strategies must scale to incorporate very large numbers. Small-scale, limited solutions may not be of much help.

2.2 Degradation

All analog and physical digital media objects are actively degrading, some catastrophically. Severity of degradation and the rate at which a recording deteriorates varies by format, the condition of any given recording, and storage conditions. For some formats degradation issues are critical. Lacquer discs, for example, are chemically unstable and rapidly deteriorating. At Indiana University, as in other places, we have seen lacquer discs delaminate before digitization can be performed. Other formats such as audiocassettes are deteriorating more slowly and can usually be played successfully. However, audiocassettes (like other analog and physical digital formats) are still degrading and there is no guarantee that future playback will achieve the same fidelity and accuracy as playback today. To achieve optimal playback, degradation processes and mechanisms must be mitigated before digitization. That means we need to come to terms with conditions such as sticky shed syndrome, cylinder efflorescence, fungus, shedding, crystalline residue, tape pack problems, oxidation, curling, binder breakdown, scratches, shell mechanical problems, and others if playback is to be successful and if the content is to survive with maximum fidelity and accuracy. Risks from degradation include catastrophic failure of a recording so that no content is recoverable, partial failure so that only parts of content are recoverable, or diminishment so that content is recoverable but at a lesser quality.

2.3 Obsolescence

Synonyms for the term obsolescence include elimination, end of life, and a thing of the past. All of these are appropriate to this discussion. All analog and physical digital recordings are now obsolete as signal capture has moved not only from analog to digital but specifically to digital file-based recording. Practically, obsolescence means that it becomes more difficult and expensive to find working playback machines for the various formats that must be digitized. It also becomes more difficult to source spare parts to refurbish and repair legacy machines. As obsolescence deepens, the knowledge of how to repair old players becomes scarce. Even the knowledge and experience required to successfully play a deteriorating obsolete recording on a legacy playback machine fades away. Finally, tools and supplies needed to sustain the machines

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12   See http://portal.unesco.org/ci/en/ev.php-URL_ID=2034&URL_DO=DO_TOPIC&URL_SECTION=201.html.
13   Council on Library and Information Resources and The Library of Congress, *The Library Of Congress National Recording Preservation Plan. (Washington DC: December 2012)*, 1.
14   Email communication from Chris Lacinak, AVPreserve, December 22, 2014.

and the formats themselves vanish. Some media preservationists believe that there may not be enough working audio and video playback machines left to digitize everything currently held in archival vaults.

We can point to a number of examples of obsolescence in action, highlighting issues that range from the unavailability of parts to manufacture of critical supplies by just one company to the phasing out of physical formats.[15] For example, the Technics SP-15 turntable — used by many institutions for preservation work — has a main bearing that is unavailable at any price. Sony PCM-70x0 series DAT machine capstan motors are unavailable at any price. Audio alignment tapes used to calibrate open reel tape machines are made by only one company while playback heads for the same format are also made by only one company. 1” video machines, parts, and playback expertise are scarce and a "new" 1” Type C head assembly from the manufacturer costs $16,000. Recently, Sony announced that they will cease making tape-based HD formats such as HD CAM at the end of 2014.

Examining the obsolescence situation for one format provides a meaningful illustration: machines, parts, and playback expertise for 2” Quad video have become very scarce. This is a standard professional format, not a niche part of the industry. It is the way that video was produced for many years. Some practitioners estimate that there may only be 100–200 machines left in the world, although this is unknown. These machines are in an unknown state of repair. Some parts for some machines are no longer available at any price, for example, a compressed air diaphragm for an Ampex AVR-1. If Quad machines are used on a daily basis for digitization, the playback heads must be replaced approximately every three months. There is one supplier for Quad heads and the technician with the knowledge of how to refurbish these heads is past retirement age. The company has difficulty obtaining some of the supplies needed for this work. In 2009, the cost for a new playback head was $3500. In 2012, the price was $5200. This is clearly a fragile part of our industry.

The overall point is that all analog and physical digital formats are on the same obsolescence slope. Some have slid further down that slope than others, some will last far longer, but they are all headed in the same direction. Here is one way to view this slope — what we might call the evolution of obsolescence:[16]

- End of manufacturing
- End of availability in the commercial marketplace
- End of bench technician expertise
- End of bench technician tools
- End of calibration and alignment tapes
- End of parts and supplies
- End of availability in the used marketplace
- End of playback expertise

This destructive and nefarious combination of degradation and obsolescence has prompted media preservationist Richard Wright, retired from the BBC, to state that "for video the problem is even sharper: complete disappearance of an (affordable) ability to transfer."[17] Wright further says, based on an analysis completed for PrestoCentre, that "75% of the analogue video held in Europe in 2006 will be lost by 2023 when video digitisation will simply have "ceased to be.""[18] According to digital preservation pioneer Clifford Lynch:

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15   Obsolescence facts in the following paragraphs are primarily from George Blood.
16   This evolution is from Chris Lacinak.
17   Richard Wright, Association of Moving Image Archivists list, Feb 17, 2013.
18   Richard Wright, *PrestoCentre Answers*, 2/5/2013, accessed October 22, 2014, https://www.prestocentre.org/answers/tv-radio-and-new-media-broadcasting/digital-master-archive-format.

> "These unique, rare, critical and fragile culture records are nasty, they're expensive to deal with and often inextricably connected to playback mechanisms that rely on long-gone technologies, and in many cases they are literally decaying before our eyes. Their stewardship requires very specialized and scarce expertise. They are in many cases footnotes within the broader national preservation strategies, which still tend to privilege the written word over other forms within the overall cultural record. I think they deserve urgent and very focused attention and investment. There is a massive disaster happening here."[19]

Either degradation or obsolescence is serious enough by itself. The combination of the two is a potent threat that severely undermines preservation efforts.

> *Reports of the first attacks on the border towns of Media were sketchy and difficult to understand. Soon it became clear that a force more powerful than ever seen before was moving swiftly into the kingdom. It was the evil twin-headed monster, Degralescence. The king and queen quickly realized that it was beyond their power to repel Degralescence. They called to the neighboring kingdom for help and within days Prince Codec rode to the rescue. When Degralescence heard this news he laughed and spat upon the ground. "I eat codecs for lunch," he cried! Which was true. But, Prince Codec was not particularly concerned for he wielded the sword of Migration and upon that he would rely. As Prince Codec and Degralescence ready themselves for battle, the sands of time continue to slip away…*

3.   How much time do we have?

A number of media preservationists, including myself, have stated for some time that we have a 15–20 year window of opportunity to digitally preserve legacy audio and video recordings. In its national recording preservation plan, the Library of Congress makes the same statement:

> "…many analog audio recordings must be digitized within the next 15 to 20 years — before sound carrier degradation and the challenges of acquiring and maintaining playback equipment make the success of these efforts too expensive or unattainable."[20]

The intervening years and the rapidly increasing pace at which obsolescence is proceeding have likely shortened this timeframe. Some believe that the window of opportunity is closer to 10–15 years. Some formats — lacquer discs and Digital Audio Tapes (DAT) immediately come to mind — may not last for even 10 years depending upon their current condition. One view of the endgame is that the combination of degradation and obsolescence will make it either impossible (degradation) or prohibitively expensive (obsolescence) to digitally preserve large holdings of audio and video recordings.

This conclusion necessarily depends upon a certain amount of crystal ball gazing. While we can see the endgame, it is difficult to predict when it will be realized and it is not yet current reality. Here is a useful analogy to help in understanding our current position: we have reached a plateau in our ability to digitally preserve analog and physical digital media formats. At the

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19   Clifford Lynch, Coalition for Networked Information, concluding conference remarks reported in Nancy Y Mc-Govern, *Aligning National Approaches to Digital Preservation*, (Atlanta: Educopia Institute Publications, 2011), 318. http://educopia.org/publications/anadp.

20   Council on Library and Information Resources and The Library of Congress, *The Library Of Congress National Recording Preservation Plan. (Washington DC: December 2012)*, 7.

end of the plateau is a cliff. We have not yet fallen off the cliff but we can see that we are moving inexorably towards it. The speed of our movement depends upon many variables and we cannot fully predict our speed in future years.[21] Unpredictable variables include such things as when a company will stop rebuilding or making playback heads, the speed at which format expertise will decline, and others.

10 or 15 years from now it will surely still be possible to digitize audio and video. Whether the means to *affordably* digitize *large* holdings will still exist at that time is an open question and one that must be seriously considered by those who have significant collections. Note that media digitization vendors and a few institutions (the Library of Congress, for example) are stockpiling both equipment and expertise in an attempt to push back this time window. Major digitization vendors have developed considerable capacity, some of which is unused at the current time.

How long will it take? Some years ago, the Indiana University Archives of Traditional Music calculated the time needed to digitally preserve their holdings using traditional workflows with one audio engineer digitizing one recording at a time. The answer — 58 labor years. Given that they had a single grant-funded audio engineer, this would assume a continuous stream of grants over a very long period of time. We ran the same analysis on the IU Cook Music Library which is the largest campus media-holding unit. The bottom line — 120 labor years. We simply do not have this kind of time. Our conclusion was that we needed solutions that were both rapid and massive in scale. I would add the word considered, as we do not intend to abandon preservation principles. However, an evaluation of the ways in which preservation principles are interpreted and applied may be needed.

3.1 Value

Of course, not every recording or collection of recordings is an appropriate candidate for long-term preservation. However, large numbers of media recordings are considered to carry significant local, regional, national, international, or institutional value. If these items are to survive they must be digitally preserved. Media holdings can usefully be analyzed in terms of their research, instructional, production, and experiential value although it may prove difficult to predict what future researchers will be interested in using.

3.2 Film

The analysis for motion picture film must be decoupled from audio and video because the physical media is quite different as are the relevant technical issues. An in-depth discussion of film is beyond the scope of this article. There is disagreement in the field with one camp arguing that film scanning technologies are in their infancy and not capable of adequately representing the source film content. This camp also tends to distrust digital technologies as a reliable means of preserving film-born content over the long-term. The other side argues that the technology cycle for high-end scanners will rise and fall quickly because the movie industry has little need for scanning services as it moves to all digital production. They question what market will support scanning companies and suggest that scanners capable of both high quality and high volume work may either not exist or be prohibitively expensive in as little as 10 years. In addition, they point to financial institutions and other businesses that have successfully managed high volumes of digital data for many years, concluding that this is a universal issue that is manageable.

> *And so the battle for Media commences. They kingdom is under full*
> *attack by Degralescence. Prince Codec has ridden to the field and*
> *joined the battle. The outcome is very much in doubt…*

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21   Thanks to George Blood for suggesting this analogy.

4.   What can be done?

A number of cultural heritage institutions with large media holdings are actively addressing the issues described above. Much media digitization work has been completed, for example, in Europe and Australia particularly within national institutions. Some have nearly finished digitizing their analog holdings.[22] Progress among cultural heritage institutions in the United States has been slower but the tide is beginning to turn. The Library of Congress built the Packard Campus for Audio-Visual Conservation to care for the world's largest collection of time-based media recordings.[23] Recent progress can also be seen at a number of U.S. universities that hold important collections. Because this is the sector that I work in and am most familiar with, I present below a short survey of selected U.S. universities and one large public library that are directly addressing media preservation concerns. It is designed to provide a high-level view of current movement in this arena as well as examples of a range of actions that other institutions might pursue. Three common threads run through the below illustrations: surveying or taking a census, planning for preservation, and implementing digitization.

In 2009, Indiana University (my institution) released the results of a media census that was conducted on its Bloomington campus.[24] This report not only explored numbers but also degradation, obsolescence, research value, and other issues relating to media holdings. On the strength of this work, a planning process was initiated with an official charge from the Provost, the head of the Bloomington campus. A task force was appointed to make recommendations to the campus, a smaller working group was convened weekly to carry out the basic research, and AVPreserve was engaged to provide consulting services. This planning phase lasted for three years and resulted in the publication (after the first year) of *Meeting the Challenge of Media Preservation: Strategies and Solutions* in 2011.[25]

These projects led to the 2013 state of the University address where IU President Michael McRobbie announced the creation of the Media Digitization and Preservation Initiative (MDPI). President McRobbie charged MDPI with digitally preserving all significant audio and video recordings on all IU campuses within five years, in time for the IU Bicentennial celebration. He also called for the development of an IU digitization master plan for all research collections including non-time-based formats such as still images and manuscripts. He framed the Initiative in the following way:

> "For over 25 centuries, the great universities of the world have always had three fundamental missions:
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> - the creation of knowledge (that is, research & innovation),
> - the dissemination of knowledge (that is, education & learning), and
> - the preservation of knowledge.
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> We tend, these days, to mainly associate the first two of these missions with a university. These have been my focus in my six previous State of the University speeches. However the advent of the digital age, with the development of the Internet and the World Wide Web, is giving renewed rapidly increasing focus to the importance of the third mission of a university — the preservation of knowledge — and is allowing us to think about it in

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22 For example, the Institut national de l'audiovisuel in France expects to complete digitization of 1.5 million hours of cultural heritage materials in 2017.
23 See http://www.loc.gov/avconservation/packard/.
24 This publication is available from http://www.indiana.edu/~medpres/documents/iub_media_preservation_survey_FINALwww.pdf.
25 This publication is available from http://www.indiana.edu/~medpres/.

completely new ways. Thus, in this speech, I want to dwell on this mission in some detail."[26]

Other universities are also moving forward in this area. Both planning and implementation are featured in current work at the University of North Carolina at Chapel Hill. The university's Southern Folklife Collection — a major U.S. sound archive — recently launched a one-year planning grant funded by the Andrew W. Mellon Foundation. The focus of this project is to identify the most effective way of undertaking large-scale digitization of archival audio and moving image holdings and instituting a long-term program at UNC. They also seek to improve and scale the management of digitization, preservation, description, discovery, and access workflows by harmonizing and automating many of the processes that support them. The Southern Folklife Collection has already implemented digitization, nearing completion of a National Endowment for the Humanities grant to digitize 1,650 hours of unique audio recordings.

Planning and implementation are also well underway at Cornell University. An AV Preservation Group was formed in 2012 as a collaboration between Cornell University Library, the Lab of Ornithology, and Campus IT, and included representation from key faculty members and other stakeholders. The group's charge is to explore the need for a larger preservation action plan for audiovisual materials. A pilot project was proposed to Cornell upper administration to undertake a campus-wide initiative, including a short digital survey, and to hire staffing for in-person, follow-up interviews. This was approved in 2014 and a half-time person was hired. The final product will be a synopsis of key holdings at Cornell with recommendations on how to move forward with a preservation plan. At the same time the preservation group was forming, a small AV preservation lab was created to digitize in-house collections and provide a digitization service point for the library.

Digitization led the way at New York University where the Barbara Goldsmith Preservation and Conservation Department in the Division of Libraries initiated work in media preservation in 2003 to safeguard the archival film, video, and audio collections. In 2005, NYU began developing an in-house preservation digitization lab for video and audio. Additionally, 35mm, 16mm, 8mm, and Super8 films held in NYU's Special Collections are identified, inspected, conserved, and prioritized for preservation. With playback obsolescence and media degradation looming over unique historic works, the foremost challenge is to prioritize collections for preservation. Understanding that it is impossible to save everything, and acknowledging there is only a small window of time in which to act, NYU Libraries reports that it must be strategic in how it approaches short- and long-term plans. With a newly-created Archival Collections Management Department in place at the library, there are plans to develop a comprehensive survey of the Fales Library, University Archives, and Tamiment Library/Wagner Archives media holdings so that decisions can be made based on format, condition, and historic/cultural/artistic value. The Media Preservation Unit is fortunate to work closely with NYU's Moving Image Archiving and Preservation program, from which many graduate students support the operations as interns and student workers.

At the University of Illinois at Urbana-Champaign Library, the Preservation and Conservation Unit's traditional book and paper focus was expanded in 2011 with the addition of a Media Preservation Program tasked with ensuring that media collections are maintained and preserved throughout the Library system. This constitutes the Library's first formal, directed approach to the long-term preservation and conservation of time-based media collections. This program completed a campus media census that documented more than 408,000 items held in 101 units across the campus. It is working with individual collecting units to establish media preservation policies, procedures and workflows and is driving the design and construction of dedicated preservation lab spaces for audio, video and conservation of analog media materials. Simultaneously, implementation of digitization is moving forward with the preservation refor-

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26   To access only the MDPI portion of this speech see http://mediapreservation.wordpress.com/2013/10/10/digitization-and-the-preservation-of-knowledge/.

matting of significant collections including 3,000 lacquer transcription discs of radio programs from WILL/Illinois Public Media. In addition, the Media Preservation Program is working to develop cross-library and cross-campus relationships that support media preservation objectives while investigating how the expertise they have developed can best be utilized at the campus level.

Stanford University Libraries' established the Stanford Media Preservation Lab in 2007, which has subsequently moved through three funding and development cycles. The Lab employs four full-time staff and has broad, high-quality capacity for playback and capture of the most common formats in the Stanford collections. It has digitized 14,000 items to date. A new initiative is underway to survey and reformat irreplaceable commercial VHS in circulating media collections. Once media is digitized, objects (content files plus metadata) are accessioned into the Stanford Digital Repository along with other digital collections. The metadata is then indexed to SearchWorks (library catalog) for discovery and access. Streaming access to digitized media content through the Avalon Media System is in active development, but already Stanford classes are making greater use of archival media collections. With all of this work, Stanford has learned that developing internal expertise and capacity for media preservation has enabled curators to attract new collections.

Finally, the New York Public Library has engaged in digitization for many years but recently completed a project to assess, prioritize, and develop long-term strategies for its audio and moving image research collections, which are among the largest in the world. With support from the Andrew W. Mellon Foundation, NYPL performed a deep, thoughtful, and comprehensive assessment of its media collections. The three-phase project consisted of: an onsite physical collection assessment and inventory; a preservation needs assessment for collections with recommendations for future action; and an assessment of NYPL's current facilities, equipment and workflow, with resulting time, staff and cost estimates for future action. The project looked at 810,753 items, with an estimated 522,402 hours of content spanning 60+ formats and four asset types. One third of the collections emerged as an urgent preservation priority. Recommendations were developed in key areas including storage conditions, processing and sustainable collection policies for each site and collection. Four distinct scenarios were developed by which NYPL can reformat and otherwise preserve priority items. Costs and assumptions for each scenario are comprehensive, including recommended processing and associated digital storage costs as well as the quantifiable costs of inaction. As a result, the Library's executive team has committed to the immediate reallocation of existing resources, including a new role explicitly responsible for digital preservation. Other existing resources have been reallocated to support media preservation work even more directly, including new lab staff positions, larger outsourcing budgets, and new positions to tackle processing. By facing up to the scale of the challenge and the ongoing threat of obsolescence and degradation, the Library is better positioned to save its most unique, distinctive, and mission-critical collections.

These are some of the more prominent U.S. cultural heritage institutions that are taking action to address media preservation concerns, but there are others. Each of these institutions is implementing digitization while the planning or census-taking process is in progress. They realize that they cannot afford to wait until planning is completed or everything is perfectly in place to begin work. They are not only getting ready, they are moving towards getting done.

> *The battle was long and it was hard-fought. Prince Codec suffered many setbacks in his attempts to bring down Degralescence. In the final hour Prince Codec, wielding the sword of Migration, succeeded in bringing Degralescence under control. Degralescence can never truly be vanquished but can be diminished and controlled using appropriate tactics and weapons.*[27]

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27   Although beyond the scope of this article, note that Degralescence remains a threat in the digital domain. Digital file-based repositories must be actively managed to enable long-term preservation.

That's the end of the story for Degralescence, Prince Codec, and the kingdom of Media. The end of the story for the institutions highlighted above and for your institution, however, has yet to be written. Media preservation issues must be addressed soon, before the storm envelops us, if we are to compose a happy ending.

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