

*A11 - FINAL PROJECT*

*A SURVEY OF THE STATE OF MAGNETIC MEDIA IN ACADEMIC LIBRARIES*

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LIS 570 D

December 10, 2018

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## **Abstract**

*What is the preservation status of magnetic media collections in academic libraries, and to what degree are they endangered by degradation and obsolescence?* It has been almost 130 years since the first magnetic media recording was publicized—it was an audio wire recording, the first magnetic storage device. While it is rare to find any institution holding an item of that era, with the exception of the Library of Congress, most academic institutions are holding onto other audiovisual magnetic media such as VHS, cassettes, open reels, etc. There was a time when archivists and preservationists predicted the magnetic media had at least two generations of degradation before complete obsolescence. Recent institution-wide digitization and preservation initiatives have brought reality to this study and there is actually only fifteen to twenty years before media and equipment obsolescence. This study will include a quantitative approach to the status of the magnetic media collections held within the academic libraries in the United States of America. Numbers will reveal to what degree these institutions are at risk in losing their historical and cultural-rich mediums are due to the substandard environmental conditions and the rapid deterioration rate of the magnetic particles bound to the polymer tape. The data will also illustrate the urgency for institutions to allocate resources to the evaluation and assessment of existing magnetic media collections. This study will make institutions and their archivists well-prepared for the digitization and preservation processes before those twenty years fly by and the content on the magnetic media is just a scattered memory.

## **Keywords**

Archives management, digitization, preservation, magnetic media, audio/visual media

## Introduction

During the twentieth century, vast amounts of valuable historical and cultural information were recorded on magnetic tape—a recording medium made of “a thin layer capable of recording a magnetic signal supported by a thicker film backing.”<sup>1</sup> These items, known as “magnetic media,” include objects such as VHS, compact cassette, U-matic, 7-inch reels, and more. While cost-effective and accessible at the time, magnetic media has a limited archival lifespan. At the end of its life, the magnetic coating can begin to degrade and decay, especially when stored in suboptimal conditions, endangering the survival of its contents. Additionally, as these formats age, the availability of playback equipment and experts who can repair and maintain that equipment decrease with every year until they are completely obsolete. In a race against the clock, archival institutions are limited both by funds and time as they attempt to preserve valuable media before it degrades into unreadability. These institutions must carefully schedule and prioritize their digitization efforts, taking into account their mission, the contents of their collections, and the type of material which they accession.

It is widely recognized that archivists are facing a “magnetic media crisis,” but unfortunately, any existing quantitative literature on the issue is sorely lacking. Few attempts have been made to systematically assess the state of audiovisual (A/V) magnetic media collections. That quantitative gap is the focus of this project.

This study surveyed academic libraries and archives in order to gather quantitative data on collection size, format composition, and digitization percentage to evaluate the current state

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<sup>1</sup>John W. C. Van Bogart, “Magnetic Tape Storage and Handling: A Guide for Libraries and Archives.” Guide. CLIR Reports. Council on Library and Information Resources, June 1995.

of magnetic media collections. Several A/V archivists currently working in the field were also interviewed to gather a qualitative understanding of their collection management strategies and digitization workflows. Our results will illustrate the scope of the issue, helping archival institutions to better advocate for their preservation needs.

## **Background: What is Magnetic Media?**

Magnetic tape is a long, thin strip of material composed of several polymer layers. The “top coat” of the polymer contains magnetic pigments that encode audio or visual information, and it adheres to a “substrate” layer which supports the thin top coat (see Figure 1). On many tapes, especially those produced after the 1970s, a third layer of backing is attached to the other side of the substrate in order to reduce friction and static.<sup>2</sup> For recording, playback and storage purposes, the tape is generally wound around reels or rolled up inside specialized plastic cassettes. Into the early twenty-first century, magnetic tape was used by television broadcasters, artists and the entertainment industry, government and nonprofit organizations, educators, and countless private individuals; all of whom recorded nigh-endless amounts of cultural heritage.

Unfortunately, magnetic tape has several inherent vices that have led to a preservation crisis. Mike Casey calls the magnetic media crisis a “perfect storm,” because the collections are growing in size and importance (through acquisitions, donations, and requests) as they are simultaneously fading into obsolescence.<sup>3</sup> The problems that Casey identifies for archival institutions regarding magnetic media include “large numbers, obsolescence, degradation, high

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<sup>2</sup> John W. C. Van Bogart, "What Can Go Wrong with Magnetic Media?" *Publishing Research Quarterly* 12, no. 4 (1996); Richardson, Charles A. "The New 'Non-Baking' Cure for Sticky Shed Tapes: How Forensic Chemistry Saved the Annapolis Sounds Masters." *ARSC Journal* 44, no. 2 (2013). 220.

<sup>3</sup> Mike Casey, "Why Media Preservation Can't Wait: The Gathering Storm," *IASA Journal* 44 (January 2015), 14.

research value, and short time window.”<sup>4</sup> The first challenge archivists face is identifying just how much of the once-ubiquitous material exists. The next challenge is its limited lifespan. As magnetic media ages, the top coat and backing absorb moisture, causing the tape to become sticky and fall apart.<sup>5</sup> This condition is known as “sticky-shed syndrome” and can render the item unplayable, as well as cause damage to playback equipment.

Limited lifespan and large numbers make the magnetic media crisis daunting enough. However, not only are the old tapes degrading beyond readability, but the machines, hardware, and software needed to digitize valuable content are harder to come by and face obsolescence themselves.<sup>6</sup> Furthermore, as the tools used to work with obsolete magnetic media slowly fade into memory so do the skills and institutional knowledge needed to operate legacy platforms.

In some cases, the content on magnetic tapes represents the clearest picture of an event, person, or place in history, capturing speech patterns, rhythms, and even coughs as they sputtered out in real time. That information’s potential loss poses a serious threat to the historical record, if not addressed immediately.

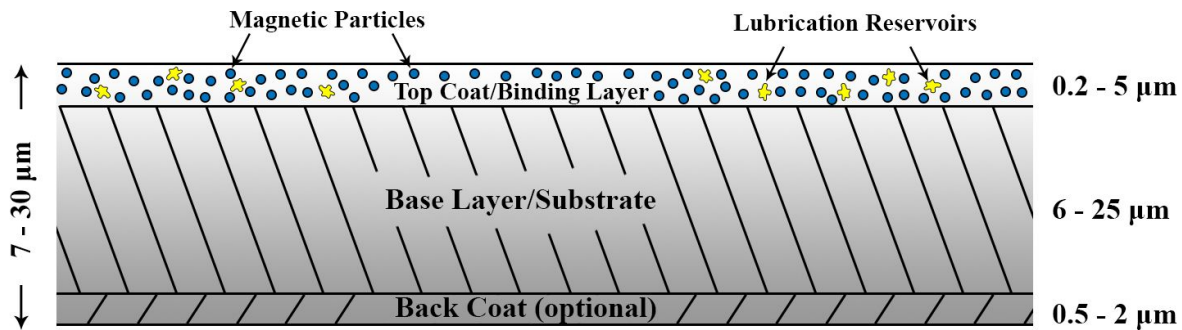
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<sup>4</sup> Ibid., 14.

<sup>5</sup> E. Cuddihy, "Aging of Magnetic Recording Tape," *IEEE Transactions on Magnetics* 16, no. 4 (1980).

<sup>6</sup> Dave Rice, “Digitization Software Obsolescence, Too?” *IASA Journal* 45 (October 2015), 1.

## Magnetic Tape Side View



*Figure 1. Magnetic Tape Side View<sup>7</sup>*

### Literature Review: Admitting There's a Problem

The literature on magnetic media preservation is extensive but suffers from significant gaps—most notably a lack of quantitative data about the scope and scale of the preservation crisis. It is widely known that magnetic tape degrades over time and that digitizing the information stored on tape, in preparation to preserve, is difficult and expensive. As a result, several institutions have begun to develop and publish preservation plans. However, there appears to be no general survey of how much magnetic media exists in academic libraries and what state the collections are in. Not knowing the scale of magnetic media collections that exist in libraries today makes it difficult to present a clear picture of the crisis to administrators who ultimately determine resource allocation.<sup>8</sup> Therefore, the researcher team sought to assess the

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<sup>7</sup> Graphic created based upon "Audio Guidance: Important Characteristics of Audio Formats," National Archives and Records Administration, accessed December 10, 2018, <https://www.archives.gov/preservation/formats/audio-important-characteristics.html>.

<sup>8</sup> Mike Casey, *Why Media Preservation Can't Wait: The Gathering Storm*, IASA (2015).

amount of magnetic media in academic library collections, the formats in which it exists, and the ratio of each collection that has been digitized versus the amount left to preserve.

Magnetic tape was a significant medium of information exchange for decades, and as such, is widely studied by archivists and industrial chemists alike. Detailed guides to identifying and preserving different magnetic tape formats are available for archivists accessioning new magnetic media.<sup>9</sup> Libraries and government-backed groups have published extensive surveys of tape's chemical properties and the potential negative reactions that it can undergo in response to age or poor storage conditions.<sup>10</sup> The physical characteristics of magnetic tape are well-established and inform the context of our research.

The literature also clearly speaks to the difficulties and high costs of digitization and preservation. For example, archivists at Indiana University Bloomington's Media Digitization and Preservation Initiative (MDPI) estimates that their video collections will amount to 39PB of data that will need to be stored and maintained for years to come.<sup>11</sup> That is almost two hundred thousand 2TB external hard drives; not to mention the labor, infrastructure to store the servers, preserved magnetic media, backups, and software tools associated with the entire digitization and preservation workflow. Basic magnetic media preservation requires, but is not limited to, these tasks listed in the Association of Moving Image Archivists (AMIA) *Videotape Preservation Fact Sheets*: "controlled temperature and humidity environmental conditions, contamination and demagnetization prevention, tape inspection, tape cleaning, equipment

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<sup>9</sup> Mona Jimenez and Liss Platt, *Videotape Identification and Assessment Guide*, Texas Commission on the Arts (Austin, TX, 2004).

<sup>10</sup> John W. C. Van Bogart, "What Can Go Wrong with Magnetic Media?" *Publishing Research Quarterly* 12, no. 4 (1996).

<sup>11</sup> "Meeting the Challenge of Media Preservation: Strategies and Solutions." Indiana University Bloomington, August 2011.

maintenance, rejuvenating unplayable tapes, staff training, and then the entire re-formatting and conversion to digital process.”<sup>12</sup> Within each top-level task, there are specialized tools, nearly-obsolete playback hardware, software, and meticulous techniques to conserve magnetic artifacts while digitizing the content to the “most faithful reproduction of an original work.”<sup>13</sup>

There are a variety of issues that result from magnetic material deterioration, one being sticky-shed syndrome (SSS), and few affordable and efficient troubleshooting techniques to address them. Many of these issues are barely irreversible. In the case of SSS, moisture and humidity break down the tape’s polymers that bind the magnetic particles, “causing the tape to become sticky or gummy”, leading to the tape shedding its magnetic coating and “results in loss of signal and therefore content.”<sup>14</sup> Alternative troubleshooting techniques have been proposed to address SSS without the need for losing the integrity of the magnetic tape and accelerating the degradation process, which is another issue from the most common baking technique when attempting to preserve signal and data loss from magnetic degradation.<sup>15</sup> A 2013 article by Charles Richardson claims to have found a miracle cure for the blight; however, there are inconsistencies with his work. First, his paper does not provide enough detail to properly reproduce the scientific study used to generate his data. He claims that archivists should not use heat or chemicals on magnetic tape, then describes a process that uses chemicals on tape. He asserts that the process does not damage the tape, but removing the back layer and cleaning the oxide layer may prove extremely destructive to delicate tapes. Finally, he states that baking

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<sup>12</sup> Jim Wheeler and Peter Brothers, *Videotape Preservation Fact Sheet*, Association of Moving Image Archivists (Hollywood, CA, 2002).

<sup>13</sup> Ibid., 11.

<sup>14</sup> Carmel Curtis, *John Jay College Special Collections Media Assessment* (New York, NY, 2014).

<sup>15</sup> Stefan Kaltseis and Anton Hubauer, Österreichische Mediathek, *Tape Dehydration as Part of the "Journale" Project: On Dealing with Sticky-Shed Syndrome*, IASA (2012); Eddie Ciletti, *Analog Tape Restoration: If I knew you were coming I'd Have Baked a Tape* (2011).



tapes is incredibly destructive; however, it is an industry standard that has been working for years.<sup>16</sup> Contradictory studies like these can muddy the waters and make it difficult to create an effective digitization and preservation plan.

With magnetic media at such a high risk for obsolescence and degradation, the first step in facing the crisis is to establish comprehensive preservation management solutions. Ross Harvey and Martha R. Mahard have attempted to establish best practices in their book *The Preservation Management Handbook*. According to Harvey and Mahard, the preservation management process is broken down into five steps. First, the archivist should conduct a survey of the facility that the collections are stored in to ensure proper temperature, humidity, and maintenance.<sup>17</sup> Second, the archivist should ensure that the facility is prepared for any natural disasters that may occur in the local area.<sup>18</sup> Third, the archivist should evaluate the collection using available collection management software such as UC Berkeley's CALIPR tool or Columbia University's AVDb software.<sup>19</sup> Fourth, the archivist should create a plan of action based on the assessment and available resources. Finally, the archivist should frame that plan to mesh with higher echelon institutional values and mission statements. While this is a broad overview of managing the preservation process, it is easier said than done.

While Harvey and Marhard's book appears to be comprehensive, the text lacks depth and actual guidance on how to manage a collection in practice. Furthermore, pages dedicated to each item format lack any information on what or how to prioritize items for preservation;

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<sup>16</sup> Charles A. Richardson, "The New 'Non-Baking' Cure for Sticky Shed Tapes: How Forensic Chemistry Saved the Annapolis Sounds Masters," *ARSC Journal* 44, no. 2 (Fall 2013).

<sup>17</sup> D. R. Harvey and Martha R. Mahard, *The Preservation Management Handbook: A 21st-century Guide for Libraries, Archives, and Museums* (Lanham, MD: Rowman & Littlefield, 2014), 43.

<sup>18</sup> *Ibid.*, 44.

<sup>19</sup> *Ibid.*, 46, 47.

arguably one of the most important facets of archival collection management. Even though the paper is from 2014, the recommended tools are already outdated and utilize prioritization algorithms that are tailored to the institutions that created them. Most importantly, the tools are not relevant in taking on new knowledge about the degradation and obsolescence of magnetic media into account. For example, Columbia University's AVDb software utilizes an algorithm which was based partly on Wheeler's handbook and considers the majority of magnetic media to be as stable as Blu-ray discs.<sup>20</sup> There is a huge flaw in the belief that magnetic media and even discs are stable preservation mediums—which is a completely separate research study—but as Jason Scott of the Internet Archive has repeatedly stated: disk storage is not more stable than tape. Each of these mediums requires a machine and energy to run in order to retrieve and process. All of these existing solutions have questionable dependencies to storage mediums that are increasingly becoming obsolete each passing year.<sup>21</sup>

In 2011, Indiana University Bloomington saw the failures in established preservation management paradigms and decided to become a national leader in creating a new standard. While managing preservation for their own institution, Indiana University Bloomington decided to write their *Meeting the Challenge of Media Preservation* report in such a way that any institution could implement good preservation management strategies modeled off of their example; this report includes digitization practices. Indiana University Bloomington's emphasis is largely based around film preservation, but the strategies and solutions provided in their report were purposely written to be inclusive to all items in an institution's collection. This

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<sup>20</sup> Marcos Sueiro, *Audio and Moving Image Survey Tool Instruction Manual*, report, Columbia University (Upper Manhattan, NY, 2008), 93, 94.

<sup>21</sup> Jason Scott, *All You Cared about Is Gone and All Your Friends Are Dead: The Fun Frolic of Preservation Activism*, *Joint Conference on Digital Libraries* (Washington, D.C., 2012).

comprehensive report outlines all of Harvey and Mahard's strategies, as they referenced the Indiana University Bloomington report in their literature, but focuses on the application rather than the theory. Any institution looking to properly address the magnetic media crisis could look to Indiana University Bloomington as a national leader and use what they have successfully implemented as a guide to their own institution-specific preservation and digitization management solutions.

The report describes how Indiana University Bloomington reached out to partners both on and off campus. Taking into consideration all stakeholders' rights and responsibilities to preservation is also recommended as best practice by Mary Feeney out of the University of Arizona.<sup>22</sup> Additionally, the report describes a workflow where minimal metadata is recorded during the digitization process.<sup>23</sup> Larisa K. Miller at the Hoover Institution Archives describes a similar strategy while digitizing manuscripts, separating the metadata workflow from the digitization workflow to increase efficiency.<sup>24</sup> Miller later described how digitizing with limited metadata could ameliorate the magnetic media crisis. The report by Indiana University Bloomington continues with numerous other strategies and solutions, establishing a standard that previously did not exist.

Even well-funded preservation projects can take several years to complete. The preservation management strategy that an institution has in place today can give researchers a good indication of where they will be a decade from now. If academic libraries do not have an actionable and solidified plan to digitize and preserve magnetic media at the time of our

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<sup>22</sup> Mary Feeney, "Towards a National Strategy for Archiving Digital Materials," *Alexandria: The Journal of National and International Library and Information Issues* 11, no. 2 (1999).

<sup>23</sup> *Ibid.*, 11.

<sup>24</sup> Larisa Miller, "All Text Considered: A Perspective on Mass Digitizing and Archival Processing," *The American Archivist* 76, no. 2 (2013).

research survey, they will likely lose a significant portion of their magnetic media to degradation or obsolescence. While Indiana University Bloomington's preservation program is more robust than any other institution in the United States, their preservation management strategies can be applied in varying degrees to any institution. These strategies will be considered best practices for the purpose of this study.

Good preservation management strategies have been established in a few institutions, but in order to implement them, archivists must be aware of the stakes. By determining the amount of magnetic media in archives, the ratio of the media that has been digitized, and the formats on hand, the true scope of the problem can be assessed. Allowing archivists to better determine the time and money needed to save these valuable collections, and to advocate for greater resources with which to do so.

## **Methods: Questionnaire and Interviews**

The study involved mixed methodologies to answering the research question: *What is the preservation status of magnetic media collections in academic libraries and archives, and to what degree are they endangered by degradation and obsolescence?* From a questionnaire fulfilled by a sample of academic libraries, quantitative data was gathered on collection size, format composition, and digitization percentage to evaluate the current state of magnetic media collections. Along with quantitative data, qualitative data was collected through interviews on preservation management strategies to evaluate institutions' responses to the magnetic media crisis.

## *Questionnaire*

The questionnaire was the primary data collection tool. Most, if not all, academic institutions maintain records of the items within their collections, and more often than not, they also track the formats of those items. These data were expected to be up to date and readily available to be collected through a short questionnaire the researchers could distribute electronically. If an institution does not track this sort of data, it is an indication that the institution does not have a comprehensive preservation management plan prepared to properly address the magnetic media crisis.

The first portion of the questionnaire asked for numerical values pertaining to the amount and breakdown of magnetic media the institution holds as well as the number of content hours that magnetic media contains. The second portion of the questionnaire asked the institution about current preservation management strategies in place, and how prepared do they feel in order to deal with the degradation and obsolescence of magnetic media. See Appendix A for the full questionnaire.

Questionnaire data collection focused on the quantitative specifications of the magnetic media landscape, which includes the number of magnetic media assets, players, funding, human-power, and bandwidth. This data provides a means to establish the preservation status of magnetic media using the following data-points: magnetic media quantity, digitized quantity, rate of degradation, and the current resources dedicated to preservation.

The survey was created and hosted through the online platform SurveyMonkey and disseminated through various electronic channels. These included SAA, ALA, and AMIA

listservs, Twitter, and emails sent to individual contacts. See Appendix B1-B2 for the full list of organization listservs contacted and the full tweet. As for individual contacts, email messages were adapted depending on the profession/personal relationships the researchers had with the individual librarians and archivists. See Appendix C for a sample of the email message sent to each channel. The questionnaire was initially circulated to all listservs on the night of November 7th and closed on November 21, 2018—a total of two full weeks. Throughout the two weeks in which the survey was open, individuals and institutional reference emails were messaged for continual outreach.

In order to incentivize community members to take time to complete the survey, anonymity and confidentiality were ensured when sharing data results. Contact information gathered for further follow-up and interview interest will not be shared widely. This is in hopes to provide librarians and archivists with hard data to present to managers and administrators to advocate for budget and bandwidth increases for a magnetic tape preservation program/project. Once the questionnaire closed, data was cleaned and processed using OpenRefine and Google Sheets.

### *Interviews*

Phone, video, and in-person interviews with various audiovisual archivists, digital preservationists, and library managers—practitioners and researchers—provided enhanced qualitative understanding of the preservation management strategies for institutions dealing with magnetic media collections. While the main focus was on the questionnaire for the quantitative effects, approximately thirty-minute conversations with several professionals offered more

in-depth conversations that could not be gleaned from a short online questionnaire. These interviews questions focused on topics such as:

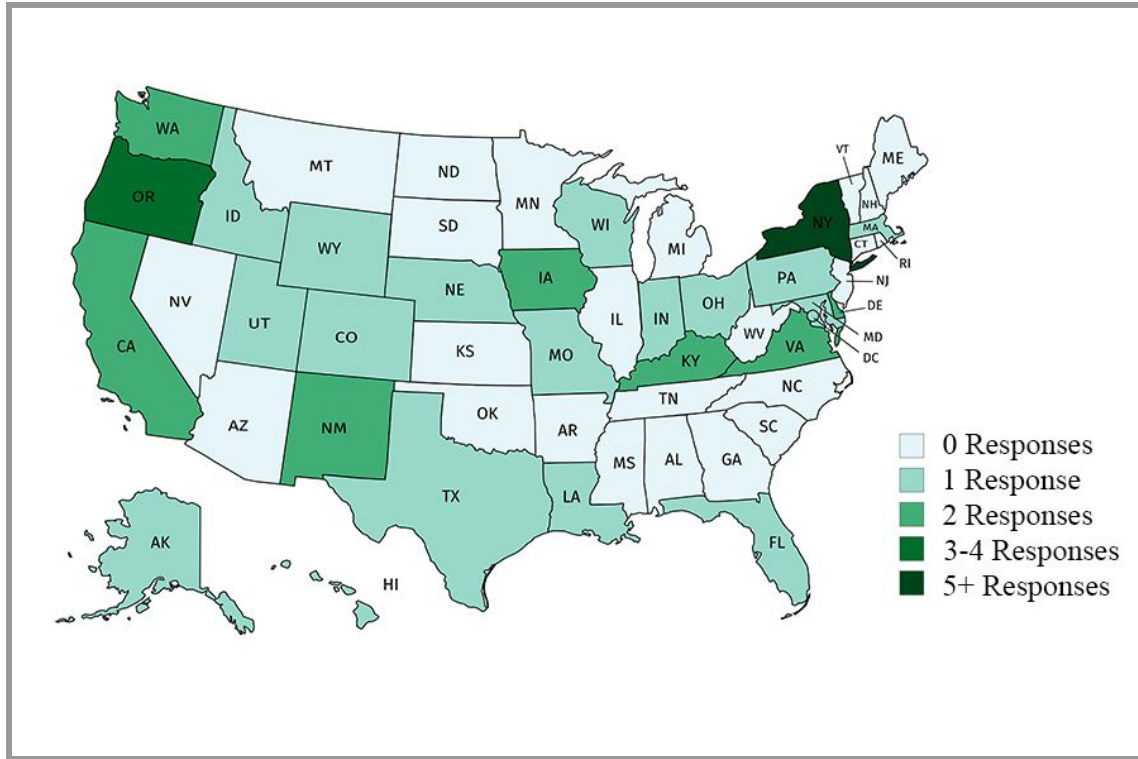
- How do institutions prioritize their collections?
- How are institutions staffed and budgeted?
- What resources are allocated to support the preservation program?

See Appendix D for the basic interview questions, although conversations often departed and exceeded this script. In total, six interviews were conducted—four with archivists at academic libraries, one with an archivist at a state historical society, and one with an independent expert on magnetic tape preservation.

Interview questions expanded on the obstacles archivists are facing in preserving magnetic media and offered more qualitative data-points on archivist's experiences. These data-points include individual institutions' successes and failures, challenges, actions institutions needs to make in order to address magnetic media obsolescence and degradation, etc.

## **Questionnaire Results: Numerical Data from the Stacks**

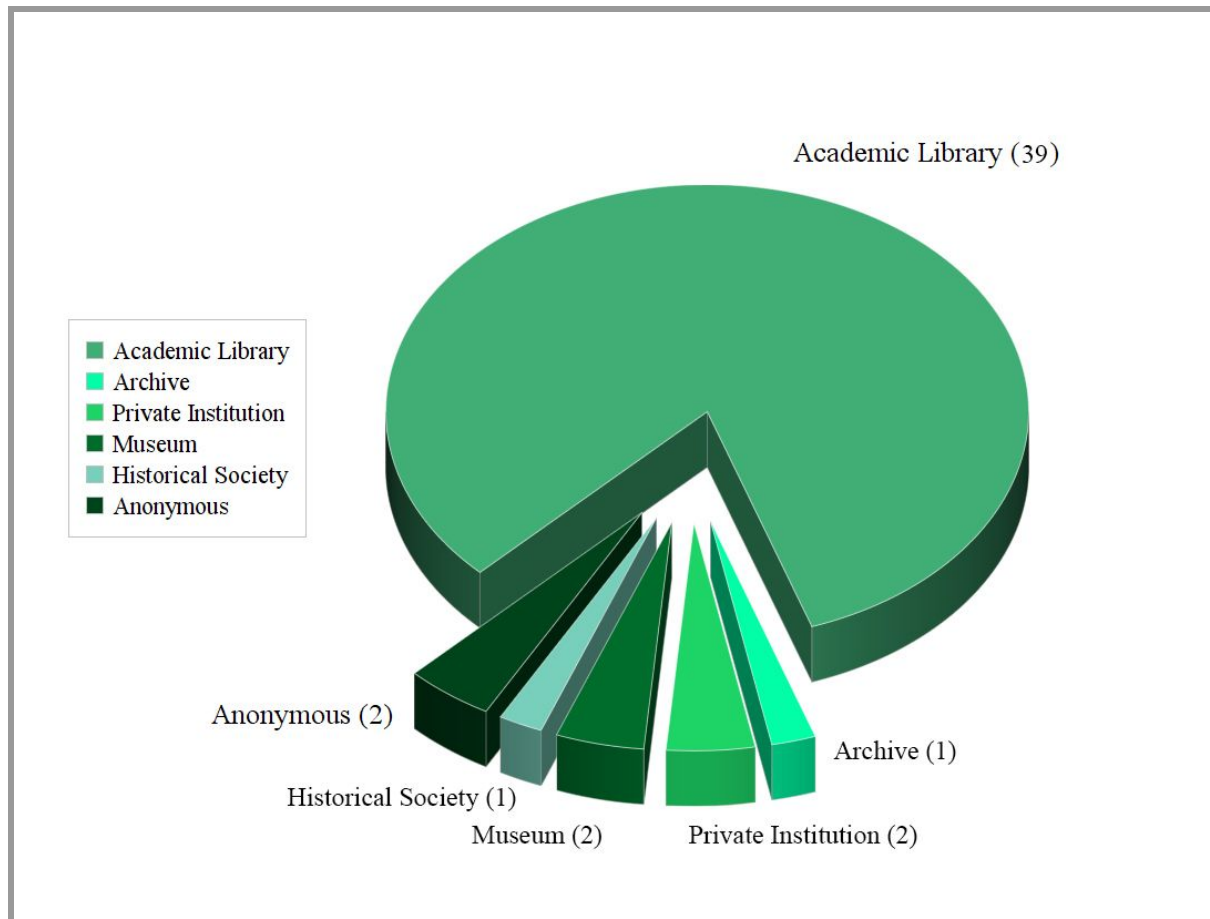
The graphs and charts below represent the data as-is, since margins of error may be too big for the data collected. See the *Reflection* section for more information about the margins of error and how data collection could be improved for more accurate results. Survey participants were encouraged to not answer a question if they did not have data available. Questions with less than forty-nine responses indicate that institutions were not able to answer the question with the data they had on-hand.



*Figure 2: Respondents by State*

In order to ensure a relatively generalized response, the study attempted to receive survey responses from all across the United States. While national listservs were used and emails prompting responses were sent out to all 50 states, responses were returned from 27 states distributed as seen in the diagram above. Not shown in this map is an institution from British Columbia, Canada who also responded to our survey.





*Figure 3. Respondents by Institution Type*

This research question specifically identified academic libraries as the main focus, but other archival institutions have enthusiastically participated in our survey. Despite a chunk of participants being non-academic libraries, the research scope did not change and data from these other institutions are not included in the final analysis. However, the data trends are interesting and can be applied to other institutions, there may be an opportunity for further research.

Institution Key	Open Reel Video	U-Matic	Betamax	VHS & S-VHS	Betacam & Betacam SP	Video 8 & Hi8	D2	D3	DVCAM	MiniDV	DVCPro	Digital 8	Open Reel Audio	Compact Cassette	Microcassette	DAT	DTRS	F-1	DCC	8-Track	Other
1	2%	2%	1%	64%								20%	10%								1%
2		1%		99%																	
3		2%		33%		1%			8%			21%	29%	4%	2%						
4				40%	2%			4%	20%			2%	30%		2%						
5	6%		1%	20%		2%			1%			30%	40%								
6																					
7		33%	5%	30%	12%	1%			2%	1%		8%	8%								
8		5%		75%	5%					5%			5%								5%
9	10%	15%	5%	15%	10%	15%		5%	10%		5%	5%	5%								
10	30%		5%	45%								2%	15%	2%						1%	
11	1%	2%	1%	11%	1%			1%	1%			36%	45%		1%						
12																					
13		10%		2%	40%			3%	7%						1%						37%
14	10%	20%		20%	20%							20%	10%								
15	30%	4%	4%	8%					4%			12%	8%	30%							
16	2%	6%	2%	21%	8%	1%		1%	2%			32%	20%		4%						1%
17		2%	1%	10%	1%	1%						80%	5%								
18		1%	1%	2%		1%							2%	2%	2%						89%
18		1%	1%	1%					1%			2%	5%	1%	3%						85%
20	2%	10%		45%	10%	8%		1%	7%			6%	10%		1%						
21	1%	6%		25%	1%	1%			1%			10%	54%	1%							
22		3%		75%	2%				5%			5%	10%								
23																					
24		2%		10%	75%								10%	3%							
25												10%	87%	1%						1%	1%
26				25%																	75%
27	50%												50%								
28	1%	8%	2%	20%	2%	3%						19%	45%								
29	2%	6%		12%	5%	1%			4%	2%		50%	16%		1%						1%
30				47%					36%				15%	2%							
31	10%	50%	1%	10%	25%	1%		1%	1%		1%										
32				100%																	
33																					
34	1%	3%	1%	12%	1%	4%		2%	4%			34%	36%	1%	1%						
35	25%	1%	1%	20%	1%	1%						1%	42%	1%	1%					1%	5%
36	1%	3%		45%	2%		1%	1%			1%	4%	30%	4%	4%		1%				3%
37	3%	21%		16%	18%	8%			2%	3%		7%	20%	1%	1%						
38																					
39	1%	10%	5%	35%	10%	2%	1%		1%			35%									
40	1%	6%		25%	36%							15%	16%	1%							
41	1%	26%	1%	9%	2%			1%	1%	12%		17%	10%								20%
42			1%	7%								30%	44%	5%	7%					6%	
42				80%		10%							10%								
43	3%	5%	2%	20%	3%							30%	35%	2%							
44	5%		1%	40%								25%	25%	1%							3%

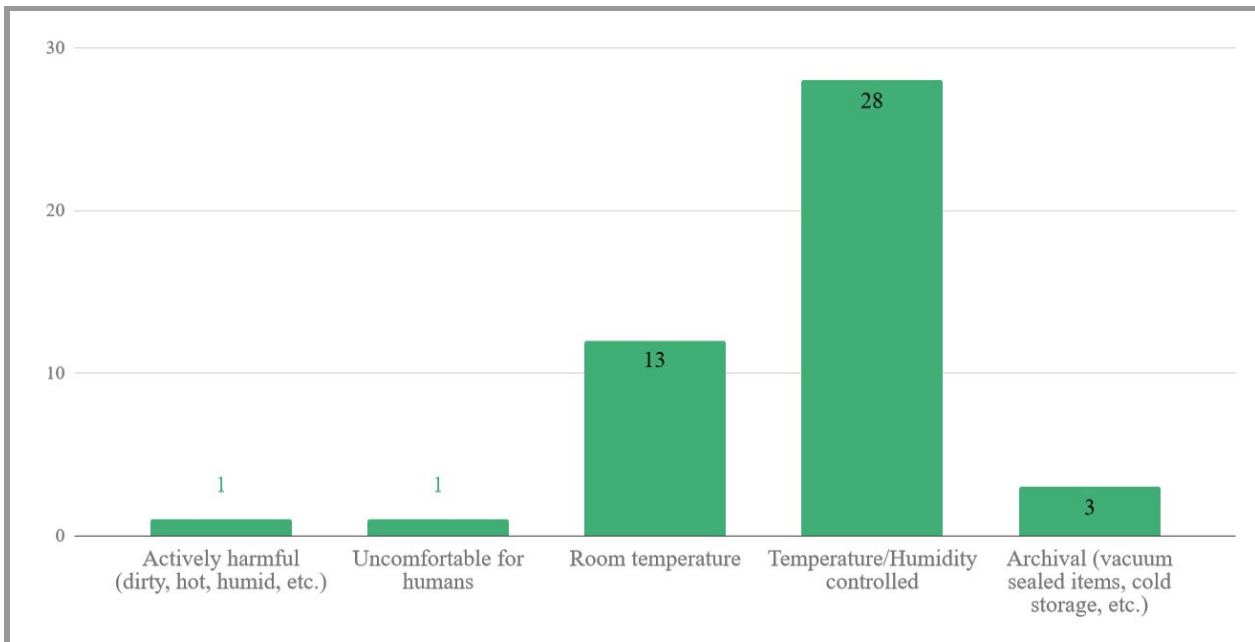
Figure 4. Breakdown of Magnetic Media Collections by Format

Format	Quantity	Risk
Open Reel Video	26,188	Extremely High
U-Matic	56,770	Very High
Betamax	7,930	Very High
VHS & S-VHS	163,616	High
Betacam & Betacam SP	74,963	High
Video 8 & Hi8	10,507	Very High
D2	175	Very High
D3	75	Very High
DVCAM	6,002	High
MiniDV	20,489	High
DVCPro	5,345	Very High
Digital 8	175	Very High
Open Reel Audio	186,842	Moderate
Compact Cassette	170,882	Moderate
Microcassette	3,627	High
DAT	14,174	Very High
DTRS	0	Very High
F-1	75	Very High
DCC	0	Very High
8-Track	983	High
Other	67,455	
Unallocated	735,000	
Total	1,551,273	
Rounding Error	3	

*Table 1. Total Quantity of Items Surveyed sorted by Format<sup>25</sup>*

The numbers compiled in Table 1 are calculations based upon an institution's total magnetic media collection and the breakdown of their formats based on percentage. There is a rounding error factored into the calculations, as indicated on the bottom of the chart.

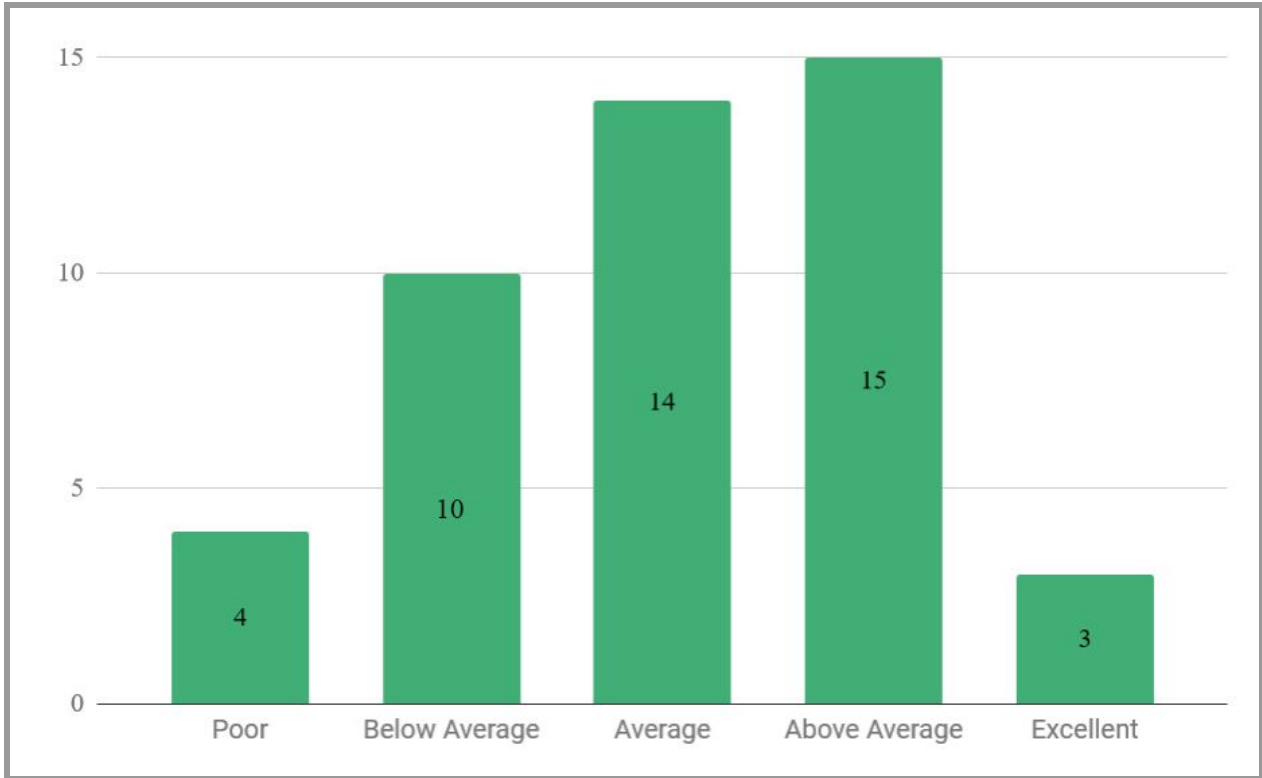
<sup>25</sup> Chart compiled with the assistance of Richard Hess



*Figure 5. Distribution of Institution Facilities Environmental Conditions*

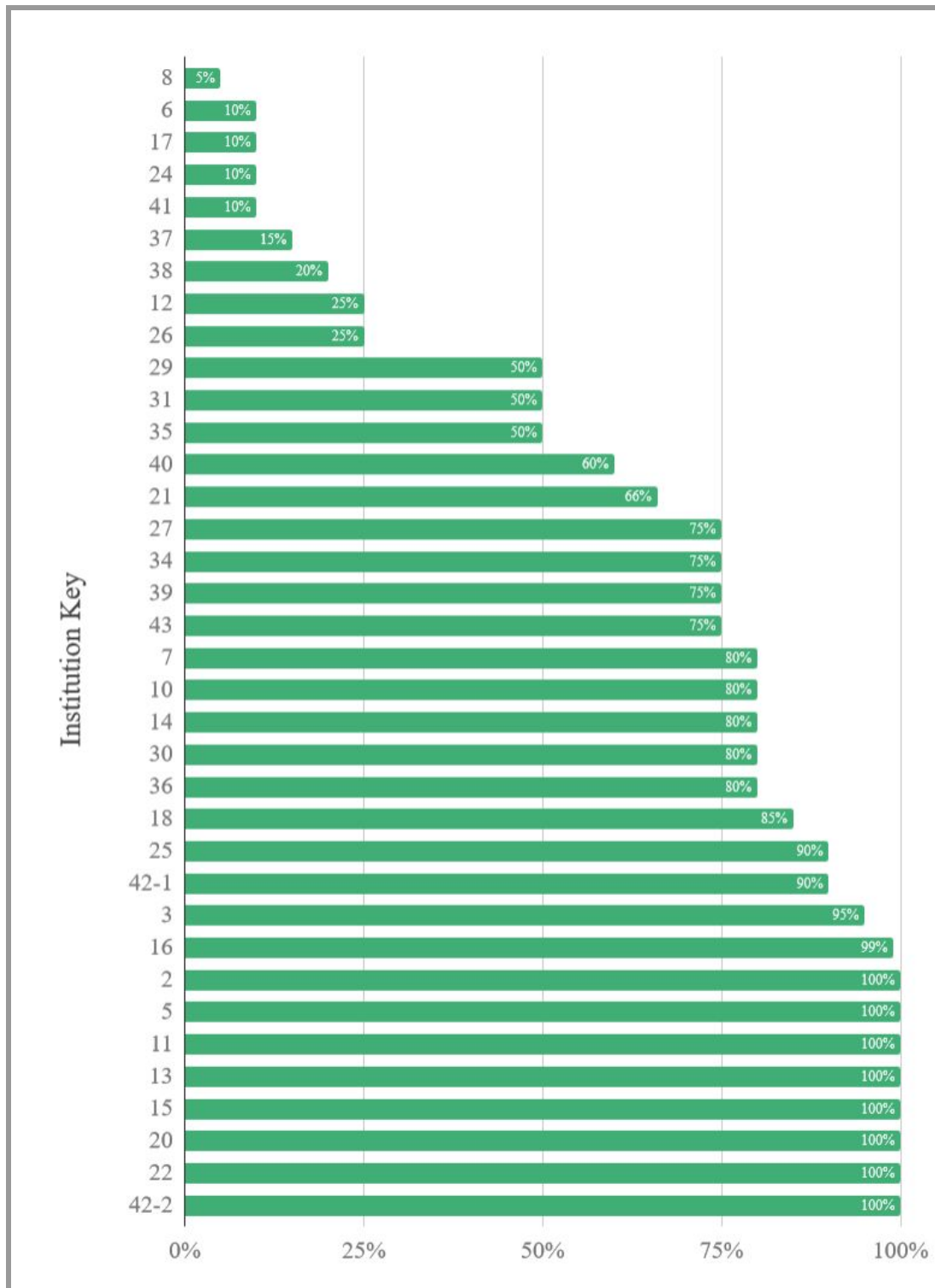
Each questionnaire participant was asked to self-grade the environmental conditions of the infrastructure which the magnetic media items are stored within. The different environmental archival levels are based on the *Video Preservation Fact Sheet* from AMIA.<sup>26</sup> While the majority of the participants boast to maintain “temperature/humidity controlled” for decent preservation of magnetic media, the lack of “actively harmful” and “uncomfortable for humans” environments is a huge indicator that the survey participants are self-selecting. Given the number of institutions who are unable to account for the number of items in their collection, this graph shows the study is missing input from the “lone ranger archivists.”

<sup>26</sup> Jim Wheeler and Peter Brothers. *Videotape Preservation Fact Sheet*, *The Association of Moving Image Archivists* (2018).



*Figure 6. Distribution of Institutional Self-Reflection on A/V Digitization Practices*

This graph of self-reflection on digitization practices must be taken with a grain of salt since it is considering the judgment of the archivist managing the collection itself. This is their job, and it is less likely for someone to openly and truthfully speak poorly of their place of employment practices, even if they are answering anonymously. On the other hand, it is encouraging to see a positive-skewed bell curve, showing hope and potential in institutions investment into A/V digitization practices.



*Figure 7. Institutional Estimate of the Percentage of Magnetic Media that will be Digitized  
before Estimated to be Unplayable*

Of the thirty-six respondents who chose to estimate how much magnetic material they would be able to digitize, eight—nearly a quarter—were confident they would process every item in their collection. However, almost as many institutions expressed doubt that they would digitize even a quarter of their collections before decay made their tapes unplayable. From a cursory examination, there does not appear to be a strict correlation between the size of the collection and the estimated digitization rate. Indiana University Bloomington, with 226,911 items, is confident they will digitize 99% of their holdings, while Wartburg College is bearish about the prospects for their 15,308 items, estimating they will only digitize 10%. Table 2: *Respondent Institutions' Digitization Progress Rates* lists institutions' current progress rate, calculated by their yearly digitization rate as a percentage of their total collection.

## Discussion

As seen in Figure 7: *Institutional Estimate of the Percentage of Magnetic Media that will be Digitized before Estimated to be Unplayable*, about 78% of the participating institutions reported that they expected to only digitize a fraction of their magnetic media items before the objects and hardware become obsolete. The results from the questionnaire, therefore, give quantitative support to common qualitative statements and technical reports about the scope of the crisis.<sup>27</sup> Archivists are right to be pessimistic; magnetic media collections are in serious danger with less than twenty years to save the historical and cultural content. More surprisingly, few institutions were confident in stating how much magnetic material is held in their

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<sup>27</sup>Christopher Prom, *Digital Preservation Essentials, Trends in Archives Practice*, Society of American Archivists (2016).

collections. This lack of certainty about the size of collections and how much work is left to be done makes drawing up preservation plans even more daunting than they already are.

From the open-ended explanations tied to the question: *Given your institution's current funding and resources, what percentage of the total number of magnetic media items do you estimate your institution will digitize before the material becomes unplayable? Explain if necessary.*, it is clear that the digitization rate is dependent on many other variables not mentioned in existing literature. Recurring themes revolving around these explanations are inconsistent funding, administration buy-in, applying for grants, duplicate items, prioritize by patron requests, foregoing the archival practice of provenance, minimal/unreliable staffing, and digital storage solutions. Here are quotes from participants reasoning their estimated digitization rate:

- *Many items in the collections are duplicates... we don't plan to digitize. The main problem is the huge volume of magnetic media still in private hands that continues to come in.*
- *... different players required for each additional format.*
- *I am getting volunteer/intern help to do a digitization push...*
- *... A/V digitization is driven by researcher requests/funding.*
- *I don't expect digitization to be prioritized by the school's administration.*
- *... we are focusing on known, highly requested items nearing the end of the lifespan*
- *The lingering question of resources was more around acquiring adequate digital storage to digitize the remaining ~50% of unique items.*
- *Funding varies from year-to-year. The number of videotapes entering our collections varies from year-to-year (though is rising in general).*
- *What is going to be lost will be items that will become deemed of marginal value compared to the expense of digitization - such as items that are poorly shot, have questionable provenance, are "orphan" productions, are poorly labeled, and items that remain undiscovered because they are not cataloged in detail or because researchers have not requested access to them. I foresee that many production elements (b-roll, raw interviews, and edit versions) will also be lost because we will consider the final production the most valuable item to save when decisions have to be made about where*



*to expend resources. This will be a shame because often the raw footage and interviews contain very historically valuable information.*

- *Our magnetic media digitization is slow because we're concentrating on our lacquer discs which are in more danger.*

On the other hand, the situation is not so bleak at all institutions. A handful of the open-ended responses and interview conversations show that institutions' administration and funders are in the midst of the assessment phase, have been approved to receive funding, and are just waiting for the new fiscal year to start the project. Many institutions see the importance of further investing in the digitization and preservation of their magnetic media since "the University has invested a great number of resources to build up a quantity of material in time-based formats. It isn't something in the matter of having optional extra material, it's a matter of investing in existing material and not losing that investment."<sup>28</sup>

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<sup>28</sup> Patrick Feaster, post-questionnaire phone interview, Indiana University Bloomington (2018).

Institution Key	Number of Items	Average Number Digitized per Year	Percentage Digitized per Year
1	1,315	109	8.29%
2	4,000	500	12.50%
3	6,357	1048	16.49%
4	3,000	50	1.67%
5	3,000	300	10%
6	4,000	23	0.58%
7	5,000	200	4%
8	6,000	6	0.10%
9	1,000	5	0.50%
10	1,300	50	3.85%
11	70,000	1000	1.43%
12	726,000	750	0.10%
14	20,000	250	1.25%
15	600	0	0%
16. Indiana University Bloomington	226,911	59250	26.11%
18-1	35,000	200	0.57%
18-2	1,000	50	5%
20	2,000	400	20%
21	7,500	200	2.67%
22	40,000	300	0.75%
23. Ohio State University	5,000	202.5	4.05%
24	5,000	25	0.50%
25	12,901	100	0.78%
26	350	0	0%
28	3,500	217.3	6.21%
29	75,377	1000	1.33%
30	3,542	100	2.82%
31	5,000	500	10%
34	27,000	300	1.11%
35	50,000	50	0.10%
36	7,500	400	5.33%
39	10,000	5000	50%
40	1,834	50	2.73%
41	15,308	30	0.20%
42-1	5,675	700	12.33%
42-2	300	25	8.33%

*Table 2. Respondent Institutions' Digitization Progress Rates*

Encouragingly, over 68% of the institutions have been able to store their magnetic media collections in a “temperature/humidity controlled” or “archival” space. Only two institutions rated their environments “uncomfortable” or “harmful.” See Figure 5.

Just as concerning as the uneven progress towards digitization, however, is the lack of knowledge reported by many institutions. Thirty-seven of the forty-nine archives that responded to the survey could not report a precise count of their magnetic media items—75% of respondents offered estimates—while 8% of respondents did not report numbers at all. That eight percent indicated in written responses that they either had no numbers or could not access them. Many respondents blamed the lack of hard data on the physical dispersal of their magnetic media and the fact that items and personnel managing the collections are scattered between different departments or libraries on a campus. Aggregating an accurate count of their materials, assessing their collections, is a lengthy project within itself.

Many funders like the Council on Library and Information Resources (CLIR) fully support the digitization and preservation of A/V magnetic materials. However, there are significant barriers to entry. Applying for the grants is a time-intensive process (the University of Utah, for instance, compiled 221 pages of proof for a \$20,500 grant) in order for institutions to receive a grant from \$5k to \$50k.<sup>29</sup> This grant does not guarantee administrative labor to be funded, as seen in the requirement that the digitization process cannot happen in-house, which make employment and institutional dedication difficult to maintain when the work is being done off-site and short-term.

Further observations include:

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<sup>29</sup> CLIR Recordings at Risk grant <https://www.clir.org/recordings-at-risk/applicant-resources/>

- Although the initial call and instructions asked for academic institutions' data, about 16% of submissions came from public or private companies, archives, historical societies, and museums. It seems that many institutions have an interest in the digitization and preservation of their magnetic media assets. On another note, this might be an important indicator to see how many academic institutions are prone to join listservs—is there a different academic and archive-only listserv that was missed?
- It was clear from response rates that many participants were interested the moment they received the survey announcement in their inboxes on Friday morning. Within less than 24 hours after the survey was announced, twelve submissions were made. After a final call to participate on all of the same channels, it was encouraging to receive more submissions and a kind and supportive email from an archivist.
- Figure 2, *Respondents by state*, reveals the regional bias in networking that the researchers (also identifying as students and workers) have. There is a heavy concentration of respondents from the West coast and New York since the researchers' main networks (home and work communities) are based there.
- Figure 4 and 5, *Breakdown of Magnetic Media Collections by Format* and *Total Quantity of Items Surveyed sorted by Format* display that U-matic, VHS/S-VHS, Compact Cassette, and Open Reel are the most common magnetic media formats in the participants' collections. The distribution may indicate which types of playback hardware and digitization software archivists should focus on obtaining, building, and maintaining.

## Conclusion: Evaluate Now

While the data comes from a limited pool of academic archives and therefore cannot speak for all archives, the data can still serve to indicate what may be expected. Additional research addressing the preservation status of magnetic media collections in academic libraries, and to what degree are they endangered, could only make a stronger case for funding proposals. However, even without further research, it is imperative to report that archivists must begin by conducting assessments and evaluations of their collections in order to allocate resources to digitize their magnetic media collections. This is a crucial first step that needs to happen now, not later during the institution's five-year plan. Moreover, this study illustrates that many institutions have not taken this first step.

The majority of archives have not adequately addressed the critical step of surveying and evaluating their collections. In fact, only nine of the forty-nine questionnaire participants were comfortable in report accurate numbers when asked how many items held in their collections. This is problematic because the first step to preservation is evaluation.<sup>30</sup> Comprehensive evaluations that include exact item, format, content, and condition must be undertaken in order to determine what is most valuable, what will be digitized first, and what material may be lost due to resource limitations. Institutions that are not aware of their inventory are beginning the digitization and preservation race well after the starting gun, which means they have a high risk of losing large portions of their collection to the uncompromising hand of decay. Identifying the content stored on the magnetic media, with functioning playback

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<sup>30</sup>Christopher Ann Paton, *Preservation Re-Recording of Audio Recordings in Archives: Problems, Priorities, Technologies, and Recommendations*, *The American Archivist* (1998); Christopher Lewis and Molly Hubbs, *DIY VHS preservation: planning for video digitization at the American University Library*, *Computers In Libraries* (2016).

hardware, is crucial because it can dictate what has priority for digitization and preservation according to each institution's mission statements and service priorities. Unfortunately, many archives do not have access to playback equipment (e.g. VCR's, reel-to-reel tape decks, etc.). This makes it more difficult to make informed decisions about what to save.

While it is not uncommon to find research advocating for collection and resource evaluation, this particular quantitative approach to the status of the magnetic media crisis further demonstrates the need. Even with a quantitative method approach the data continues to prove that many institutions are still in the dark about the number of items in their holdings, supporting the existing literature focus on the narrative use case approach. Dedicating time and resources now to a thorough assessment of the collection of magnetic media is a reliable selling point that the digitization and preservation process can be done with just human-power and time.

What is the status? How much are they endangered? The proportion of archives with accurate statistics on their materials was low. This harsh fact is compounded by the material lifespan itself; magnetic tape is deteriorating and there has not been a solution to reversing the effect. Richard Hess and other A/V archivists predict magnetic media "tape that is not digitised by 2025 will in most cases be lost forever."<sup>31</sup> This aging process is sped up by sub-optimal environmental storage conditions including humidity, heat, light exposure, and handling. If institutions began the evaluation process *now*, by their own predictions the majority of them will lose a significant portion of their material. In fact, roughly half of the survey respondents expect to lose a quarter of their information saved to magnetic media and nearly half of those

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<sup>31</sup> National Film Sound and Archive, *Deadline 2025: Collections At Risk* (Australia, 2017).

expect to lose seventy-five percent or more. This represents a huge potential loss to the historical and cultural knowledge base, of which it is impossible to accurately gauge. Worse yet, it will be impossible to undo the damage because the loss of unique cultural information contained on a fully deteriorated tape is irrevocable if it is a singular master recording.

Looking at these sobering numbers, there is hope for individual archives to have the power to assess their own collections, within the broader profession by determining how much is held in their respective collections, how many staff hours can be dedicated to preservation, and how much content will be lost on the current trajectory. From there, prioritizing what resources are needed to save, all or at the very least the most valuable content, and identifying the deficit between the two paths. The personnel cost for adequately evaluating collections is not going to be insignificant. Funding a staff member dedicated to an assessment project is costly, and allocating an existing employee from another project can leave other work and services undone. Conversely, the cost of avoiding evaluation is the loss of magnetic media collections and the cultural value stored within them. Institutions must implement strategies to manage resources while ensuring that surveys are done. Part-time student employees have the potential to fulfill this role, as many open-source survey tools exist today, and require relatively less specialized knowledge of A/V materials. Resources such as Indiana University's FACET tool or the University of Utah's AVST tool, built off of Columbia University's AVDb database can make starting a survey now possible for many institutions with limited resources.<sup>32</sup>

Preserving and digitizing magnetic media is difficult, time-consuming, and expensive, but the gratifying return of investment is that *the material lives on*.

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<sup>32</sup> "AVST Survey Tool," University of Utah Audio-Visual/Digital Preservation Assessment & Planning Project, accessed December 9, 2018, <https://sites.google.com/view/u-of-u-avdp-assessment/introduction>.

## Reflection

### *The Good*

Throughout the data collection stage, it was clear that our existing networks and knowledge of accessible online communities surrounding magnetic media gave a simple initial push for submissions and contributions. Being able to access authoritative online communities of practitioners, researchers, librarians, and archivists allowed us to impactfully reach out to the larger community in a timely manner. This became apparent the morning after the initial listserv emails were sent when we received a handful of submissions before the midday lunch bell.

It was encouraging to know that the relationships with librarians and archivists we have built in our own personal networks (through work, school, or patronage), were willing and interested to help out by participating and/or sharing the survey to their own connections. Their enthusiasm reflects well on the library and archival fields in general, and we are grateful for it. We received personal email replies and feedback wherein a number of archivists noted that they were unable to offer data but would “forward the research and survey to colleagues holding a position in this work.” A few encouraging and humbling examples of personal feedback and support from the communities we reached out to include:

- An “audio tape restoration, repair, and mastering” veteran and retiree, with multiple publications about magnetic media preservation practices contacted us directly to express support for the quantitative angle of our study, share further resources that might help our study, and gave feedback on pitfalls that the survey might have in the media type granularity.



- A Yale archivist sent a gratifying email to us, expressing excitement for the quantitative approach and potential the study could offer to the field as a whole.
- A New York City community college librarian sent a direct message through Twitter to offer raw data from their own assessment, just recently conducted by an NYU graduate intern.
- The sheer number of survey participants, 84%, who signed up to receive final data results, was encouraging to ensure this study was accurate and fulfilling to the community. More than half of the survey participants were also open to take time for an in-depth interview.

In order to gather qualitative data within this course's deadlines, we were also diligent on scheduling and conducting follow-up phone interviews with the willing participants. Despite the short notice and holiday leave, we were lucky that the respondents were eager and willing to carve out time to speak immediately.

### *The Not-So-Good*

On the other hand, there were many aspects of this data collection process that could have been done better. As usual, time and bandwidth were the main issues. Scheduling between researchers and the participants was difficult. While the nature of this course limits the amount of time we could dedicate to this project, community engagement and feedback proved that there is potential to continue flushing out the research, with the goal of eventually publishing our results and enriching the community.

One oversight was not explicitly asking how much of their magnetic media collection is already digitized. We can somewhat extrapolate that information from each institution's

answers to the survey question: *How many years has your institution been actively digitizing magnetic media? And what is the annual average amount of magnetic media items your institution has digitized within those years?* However, there is a significant margin of error in this method and our research could have been stronger with a solid answer to how much of each collection has been digitized.

It is also important to note that while the invitation to participate was sent out to the community-at-large, the data does make a case that the sample of participants was self-selecting. For example, given many institutions are unaware of their exact statistics, it would be more telling if the hundreds of smaller institutions who are nowhere near even touching the dusty, moldy collection of magnetic media in the basement boiler room had participated to just claim “unknown.” Most of these types of institutions probably have a solo full-time or even part-time archivist, so it is understandable that the overworked librarian or archivists would not have time to participate in such a survey.

#### *What We Learned about Research and the Research Process*

While the majority of emails we received from archivists expressed nothing but interest in the project, several participants had questions or concerns about our survey. These highlighted a few issues:

- There is a definite need for archives to thoroughly evaluate their collections in order to make informed collection management decisions. We were surprised by the number of institutions that simply had to estimate their holdings.
- A lack of clarity surrounding our focus on academic institutions. Several private and nonprofit archives, unaffiliated with academia, participated in the survey. Many of them

included a note or emailed separately to tell us about their interest and want to see the results while acknowledging that their data might not fit our needs.

- A lack of clarity on the definition of magnetic media. One participating museum included external hard drives in their item count, making their number a dramatic outlier and difficult to compare with the other data. A more thorough definition of A/V magnetic media could have been helpful to keep submissions consistent; this will be necessary to keep in mind if we do further data gathering.
- Participant reluctance to estimate the percentages of each magnetic media format. A number of participants emailed to follow up, claiming that they did not feel comfortable estimating their amounts because they felt it would be a “lie.” In the future, we should have emphasized the importance of participation, even if the number is zero, unknown, or represents a rough estimate.
- Knowing how many institutions do not know the size and content of their holdings is extremely valuable because the first step in preservation and digitization is assessment. Therefore, if an institution does not know what they have they are not adequately prepared to preserve their collection. For this reason, further data collection would benefit from institutions being able to specifically indicate “unknown” for the makeup of their collections.

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## Appendix A: Sample of survey questions

### *First page*

By submitting to this form, you are agreeing to allow our team to use this data for research on magnetic media preservation. Completing this survey implies consent. The data will be confidential and research findings will be shared openly and freely with participants. We are interested in publishing the results to help archives advocate for more resources.

If you cannot provide an exact number or well-educated guess for the following survey questions, leave the answer blank. A blank answer will be interpreted as "not enough data to provide an accurate answer."

Please contact Jared Nistler (jmnistl@uw.edu) for any questions or concerns.

Thank you for your time and contributions!

### *Second page*

1. Name of your Institution. (open text field)
2. What is the total number of individual magnetic media items in your institution's archive? (number)
3. What is the total number of hours of magnetic media in your institution's archive? (number)
4. How many of each format of magnetic media do you have in your collection? Please estimate by percentage. Must add up to 100%. (number for a predetermined list of media)
  - Open Reel Video
  - U-Matic
  - Betamax
  - VHS & S-VHS
  - Betacam & Betacam SP
  - Video 8 & Hi8
  - D2
  - D3
  - DVCAM
  - MiniDV
  - DVCPro
  - Digital 8
  - Open Reel Audio

- Compact Cassette
  - Microcassette
  - DAT
  - DTRS
  - F-1
  - DCC
  - 8-Track
  - Other
5. How would you rate the environmental conditions of the facility in which you store magnetic media? (multiple choice)
    - Actively harmful (dirty, hot, humid, etc.)
    - Uncomfortable for human
    - Room temperature
    - Temperature/Humidity controlled
    - Archival (vacuum sealed items, cold storage, etc.)
  6. How many years has your institution been actively digitizing magnetic media? And what is the annual average amount of magnetic media items your institution has digitized within those years? (e.g. # of years, 500/year) (open text field)
  7. Given your institution's current funding and resources, what percentage of the total number of magnetic media items do you estimate your institution will digitize before the material becomes unplayable? Explain if necessary. (open text field)
  8. How would you rate your institution's audio/visual digitization practices? (multiple choice likert scale)
    - Poor
    - Below average
    - Average
    - Above average
    - Excellent
  9. Interested in receiving a report of our findings? Enter your email and we will send you the final results. (open text field)
  10. If you would be interested in being interviewed by a member of our research team for a few follow-up questions, enter your information below. (open text fields)

## **Appendix B1: Organization Listservs Contacted**

1. The Association of Moving Image Archivists (AMIA)
2. ALA College Library Section
3. ALA Digital Preservation
4. ALA Film and Media Round Table
5. ALA Collections Management
6. SAA Archives Management Section
7. SAA Audio and Moving Image Section
8. SAA College & University Archives Section
9. SAA Museum Archives Section
10. SAA Preservation Section
11. SAA Research Libraries Section
12. SAA Students and New Archives Professionals Section

## **Appendix B2: Public Tweet to Spread Awareness of the Questionnaire**

“#askarchivists #librarians Are you currently digitizing/planning to digitize magnetic media?  
I'm attempting a quantitative study on the #preservation status of magnetic media for an #mlis  
course. Please take + share this survey if this is relevant to you!”



## Appendix C: Sample email for listservs, individual calls, and forums

Subject: Seeking survey participants for magnetic media research

Hello [insert name of person/community],

We are four MLIS candidates (University of Washington) surveying archivists for our study on the preservation status of magnetic media collections in academic libraries. The focus is on the **quantitative degree to which magnetic media are endangered by degradation and obsolescence**. We will share results from the confidential survey data with the community freely and openly. Our hope is that this quantitative analysis of magnetic media collections and the degradation rate will provide further support for libraries and archives to advocate for more resources.

If you are an archivist or librarian planning to or are currently working on digitizing magnetic media collections, please take [NUMBER] minutes of your time to tell us about your institution's magnetic media assets and archive at this [survey host name] link: [URL]

The survey will close on [DATE]. Please share this with you relevant networks who might be able to participate.

More information:

After surveying more than eighty resources and performing a thorough literature review, we've found that the existing literature around the degree of the magnetic media crisis has not been quantitatively measured. We will analyze the data from this survey and follow-up interviews to offer quantitative data and data visualizations to help us all understand the preservation status of magnetic media collections in academic libraries and to what degree is the degradation and obsolescence rate endangering these materials.

Questions or concerns? Please feel free to contact [NAME] at [EMAIL] or [NAME] at [EMAIL].

With much appreciation,

Brian Click, University of Washington

Michael Kuster, Mid-Columbia Library System

Sarah Nguyen, Dance Heritage Coalition and Preserve This Podcast

Jared Nistler, J. Willard Marriott Library, University of Utah

## **Appendix D: Sample of interview questions**

We intend our interviews to feel like open-ended conversations, so we haven't drawn up a specific script for each interaction; additionally, our questions to each interviewee will be informed by their responses to our survey. Nevertheless, there are several points we would like to touch upon in each discussion:

1. As an introductory question: Tell me a little bit about your magnetic media. What's on the tapes?
2. How many full-time and part-time employees in your department deal with magnetic media?
3. What is your institution's magnetic media preservation/digitization workflow/program? How did you design your magnetic media preservation/digitization workflow/program?
4. What are the strengths of your preservation/digitization workflow/program? What needs to be improved?
5. Do you have sufficient funding to meet your magnetic media preservation/digitization needs? Is magnetic media preservation/digitization a high priority compared to other preservation efforts at your archive?
6. What obstacles or challenges do archivists face when trying to achieve institutional buy-in for dedicating sufficient resources to magnetic media preservation/digitization? What do you think is the greatest challenge in the preservation/digitization of magnetic media?