CONTENTS

43RD ANNUAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION OF SOUND AND AUDIOVISUAL ARCHIVES (IASA)

IN TRANSITION: ACCESS FOR ALL

New Delhi, India
7 – 11 October 2012

On behalf of the **AIIS Archives and Research Centre for Ethnomusicology**, we invite you to New Delhi for the 43rd IASA Annual Conference.

It is a great honour for us and our hosting partners to have you in India for IASA 2012. We are certain that this will be a very stimulating and interesting conference, with the opportunity of meeting old friends as we do at all IASA conferences, but in a location that is quite different, getting to know India through new friends that we hope you will make, and interacting with new challenges.

This will be a very important event for those of us who work in the field of audio visual archiving in India, and we will do our best to make this not only professionally exciting but to have a great time!

We believe that the theme of our 2012 Conference is relevant to all of us, the wider IASA membership and our situation in India. We are at a crossroads (and have been for a while!). It is a period of transition with which we in India as in many other countries are struggling with.

New technologies, changing standards, challenges of digitization, finding financial support for preservation etc. The aim is of course 'Access for all' and that is the biggest challenge.

As we work towards the conference in the weeks and months ahead we will be finalizing the themes for the conference.

Please see the Call for Papers at:
http://2012.iasa-web.org/call-presentations

Please find all conference information on the conference website at:
http://www.2012.iasa-web.org/

For any further information or questions please contact the Organising Committee and the conference administrator through enquiries@iasa-conference.com

International Association of Sound and Audiovisual Archives
Internationale Vereinigung der Schall- und audiovisuellen Archive
Association Internationale d'Archives Sonores et Audiovisuelles
Asociación Internacional de Archivos Sonoros y Audiovisuales

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Dear Readers,

It's time once again for another issue of the IASA journal. My first issue as editor! I feel very lucky to have the opportunity to work with the current board members on issues that not only concern the membership but the preservation field as a whole. I've already learned so much from their experience and knowledge.

As always I present to you an exciting and informative journal issue. Brecht Declercq writes an interesting companion piece to my own article from issue 38. He focuses on error statistics within a large collection of DATs as they pertain to age and brand. The research strives to ascertain whether it is necessary to assign a priority to certain DATs to be ingested and if so, how do you decide this priority? Does age and brand fit into these preservation/digitization criteria? Brecht compiled the research during the ingest of the VRT's Dive Project.

Kurt Deggeller's article was not only presented at the last IASA conference in Frankfurt but also at the annual conference of SEAPAVAA and the meeting of the Co-ordinating Council of Audiovisual Archives Associations in March 2011 in Kuala Lumpur. He explores the benefits of networking and co-operation between Audiovisual Archives and International Organizations. During his time as convener of the Coordinating Council of Audiovisual Archives Associations, Kurt saw not only how important networking is for our community but also how splitting our already small community into 6 associations can limit our power within the larger archives, library and museum organizations. The organizations discussed include UNESCO, The International Committee for the Blue Shield (ICBS), the World Intellectual Property Organization (WIPO) and the International Organizations of Libraries, Archives, Museums, Monuments & Sites (LAMMS).

Siobhan Hagan and Jacob Nadal did not present at the Frankfurt conference but are in the beginning stages of developing an audiovisual program at the University of California Los Angeles. I feel that many members can benefit from reading about the challenges and solutions they find while building an audiovisual program from the ground up.

I will admit that Bertram Lyon's Report on the Survey of Memory and Cultural Heritage Resources in Lucas do Rio Verde was one of my favorites. I enjoyed taking a peek into the repositories of this small area in Brazil. It was a chance to examine cultural preservation from a different perspective. Bertram explores questions about the nature of documentation, about how young towns develop cultural heritage infrastructure, and about what the answers to such questions contribute to assumptions about historical documentation and to the larger international discourse on preservation and access to records of the past.

Dave Rice asks us to reconsider the checksum for audiovisual preservation. So many archivists either don't fully understand checksums or take for granted that simply creating a checksum will be enough safeguard their digital files. Dave provides a systematic approach to what to do when the checksum has changed. Follow-up questions include: Does the change affect the presentation of audiovisual data? Where is the change? How extensive is the change? Do these two different files present the same audiovisual data, i.e. is one file a lossless representation of the other? Furthermore, he questions very nature of using checksum as best practices for large audio files.

Finally, Toby Seay assesses the migration workflow for analogue multi-track audiotapes and discusses media assessment, playback preparation, digitization, file management, ephemeral document capture, and metadata entry in the context of both technical and time resources. Each track is a unique element with its own metadata requirements. How are these unique elements preserved and managed in relation to the whole and each other, and how much time should an archivist set aside for the entire process from digitization to file management?

I hope you all enjoy this journal issue! Please don't forget that the annual conference will be here before we know it. It's a chance to learn from experts in the field, reconnect with old friends, and meet new ones. New Delhi will certainly prove to be an exciting adventure for us all. See you there!

Yours truly,
Cassandra Gallegos
Editor IASA

It is my honor and privilege to announce that the new constitution has been accepted with a resounding YES! Of those who voted, more than 99% voted for the adoption of the new constitution, less than 1% voted against it.

This result clearly tells us that the work of the past few years that went into developing the constitution, sharing it and debating it with the membership has resulted in this version that now has the full support.

A resounding YES also means a resounding thank you to our two most recent Past Presidents, Richard Green and Kevin Bradley for navigating our organization through this process in an open, transparent and democratic manner – and to the membership at large for participating in the process first by airing and debating the issues in a timely manner, and secondly giving a voice to your support by voting.

The new constitution will now enable this and future boards to respond to the challenges of the 21st century. This provides IASA with a constitution that will allow the board and the organization to respond to the changes the current environment brings.

It gives us a very clear mandate to move IASA ahead with the registering of IASA as a limited liability company. This will both give a secure ground for the board members, as well as the legitimacy necessary to participate in projects and cooperations that require a legal status, and even operations as basic as opening a bank account.

One of the new challenges that the 21st century brings is the ease of accessibility. When I started as an archivist 25 or so years ago, digital media and computer were in their infancy, archives were still protecting their contents with shut doors and multiple-copy applications. Around the turn of the century (millennium!), the biggest debate at the JTS was whether CD-R's or DATs were the medium of the future, or indeed neither: Tomorrow, we are likely to walk around just about anywhere in the world with access to the World Archive in our pocket – or perhaps a device will be implanted in one of our teeth? Please forgive this humoristic oversimplification of the quantum leap in information accessibility that the world has undergone in half a career's time – but we are in the middle of a snowballing transition between virtually no access to virtually all access – how are we going to deal with this?

Accessibility to information is today a fact and ease of access is on the increase. It brings with it a wealth of possibilities, enablement, choices and irresistible temptation. It's been said that access to information is the pillar of freedom – but it's also been said that freedom comes with responsibility.

What else is coming? What does it really cost? And who is paying that price? Is intellectual property a thing of the past? Does access to information increase the digital divide? Can you control a technological tidal wave? Where do we draw the line? Where does IASA fit into all this?

It's easy to welcome new technology – but we cannot afford to sweep the dilemmas under the rug, to hush the dichotomies and to ignore the debilitating damage that not addressing these issues may engender.

IASA's strength is based on a strong set of ethics and a fearless willingness to shed light on issues, debate these openly and inclusively, and mould them into constructive world-recognized guidelines. Richard Green made a famous speech at the London conference in 2001 about raising the bar. I'm proud to say we've collectively done so. Now, I'd like to build on that and ask: how are we going to keep raising that bar – and what kind of bar do we want to raise in the face of access and all its derivative issues?

The next IASA conference this Autumn will shed light on many of the facets of access – as Access for All is the main theme of the conference. The conference will take place in India, in a region that is very much in the eye of the storm of transition.

It is with great pleasure that I invite you to join me and the hosts of the conference in New Delhi, India. I am absolutely convinced that it will be a memorable conference!

Yours *soundly*,
Jacqueline von Arb
President IASA

DAT-ERROR STATISTICS: AGE AND BRAND CORRELATIONS AS REGISTERED IN VRT'S DIVA-PROJECT1

Brecht Declercq, VRT, brecht.declercq@vrt.be

1. Introduction

Digital Audio Tapes, commonly known as DAT, are of huge importance to audiovisual heritage because large parts of radio station archives (among others) in the nineties were stored on this kind of media. Recording quality was very high and many broadcasters bought at least some DAT-players and recorders. Often these machines recorded radio programs from a central control unit between studio and antenna. DAT was also commonly used to make witness-recordings (e.g. at DR in Denmark) for the purpose of the right of reply, legal deposits or concert recordings in situ. Nearly parallel to the CD, the introduction of DAT as a production standard meant for many radio broadcasters the entering of the first digital recording era as well as the last non-file-based one.

Recording quality might have been high (48kHz was feasible and quite exceptional at the time), early enough it appeared that demagnetisation and an irreparable loss of signal (*Block Error Rate*, BLER) made the DAT a support of no use for long-term archiving. Moreover, Sony stopped selling DAT devices in December 2005, officially making DAT an obsolete medium. As a result, somewhat paradoxically considering its young age, a special focus on DAT appeared in audio collection digitisation projects of audio collections from 2007.

Is it possible, or even necessary, to assign a priority to certain DATs to be ingested (transferred to files) and if so, what should be the criterion? Are age and/or brand significant factors? Is there a risk of losing valuable content by setting wrong ingest priorities within your DAT collection? Considering the large numbers of DATs still to be ingested worldwide, does the DAT sound quality degradation advance in a straight line with age? Do certain brands represent a higher risk? The relevance of this issue might even become clearer when compared to the analog domain. A lot of studying has been done on the brand and age related degradation of analog audio and videotapes. Among the results is the infamy of e.g. 'red Ampex' in many audiovisual archives and the fame of Richard Hess's 2008 article.[2] Without the slightest ambition to reach Hess's writings in quality or eminence, this article tries to provide a first, partial answer on the questions above.

2. DAT ingest in VRT's DivA project

The DAT collection of Flemish public broadcasting service VRT is, to West-European norms, quite exceptional in its size. VRT purchased its first DAT-machines and tapes in 1986. The experimental phase took about five years, but from 1991 it became a particularly popular support for recording radio programs and concerts. Between 1991 and 2006, six DAT-recording devices were part of a so-called *automatic recording unit* where radio programs were recorded directly between studio and broadcast antenna. Most of the radio programs had a standard length of one or two hours; DAT was considered a perfect support for this purpose. For this reason a collection of ca. 44,500 DATs grew, with a total duration of ca. 71,200 hours, including about 32,000 DATs with radio programs (58,700 hours) and 12,500 DAT with music (13,700 hours).

In a mass digitisation project named DivA (Digital VRT Archives, 2008-2011) the threat of the sound quality on short term was decided to be a first rate selection criterion for digitisation

1 This article is an extended version of the paper ***DAT-error statistics: typology, risk-analysis and correlations as registered in VRT's DivA project,*** as presented on IASA 2011 in Frankfurt A.M., Germany, September 8th 2011. Kindest acknowledgments go to VRT archivists Lieve Vanhamel, Thomas Eyskens, Els De Vuyst and Klaas Janssens and IASA editor Cassandra Gallegos.

2 HESS, Richard. 2008. Tape degradation factors and challenges in predicting tape life. *ARSC Journal XXXIV* (2): 240-274.

and considering audio, DAT was chosen as the focus support. But as resources for ingesting the complete DAT collection were not available, a second selection step had to be defined: which DATs needed priority and for which ones digitisation would be postponed? Although sometimes very interesting on other DAT related questions, literature provided little answer, so we had to find clearer indications in the VRT collection itself.

The solution we figured out for this problem was twofold: on one hand we had the quality of the signal of a reasoned sample of our DATs tested on different criteria by a specializing company, which also compared the results of our collection to their large experience from ingesting DATs. Although this survey provided us with interesting results and a far better understanding of the mechanisms of signal loss, there was no clear one to one relation of any of the audio signal parameters with audible errors in the file. In other words: some peak values appeared to be false positives while listening and some clearly audible errors were not reflected in any of the signal graphs. The assessment results proved to be indicative, but not clear enough to serve as a base for a solid sound degradation analysis.

The other part of the solution consisted of a straightforward ingest of a long-running radio program, recorded on a diversity of DAT brands. A full-length sound quality check was done by a team of cataloguers trained on recognizing typical DAT-errors as a symptom of degradation. With a growing number of DATs ingested and fully checked, a quantitative analysis of these error reports became ever more significant. Doing so, we were able to draw some first conclusions about the relation between the sound quality, age and brand.

3. Research method

The researched sample consisted of exactly 1,000 fully recorded 120 min DATs, each with one episode of the Monday to Friday radio show *Het Vrije Westen* (VRT Radio 1), recorded from January 8th 1992 until May 2nd 1996. In the absence of any further possibility to know the exact production date of the DAT, this record date was as close we could get. The 1992-1996 period was also at the very heart of the era of the use of DAT at VRT.

The research sample contained 327 Sony tapes, 549 BASF tapes and 134 Ampex tapes. 218 DATs were recorded in 1992, 224 in 1993, 256 in 1994, 216 in 1995 and 86 in 1996, as represented in fig. 1.

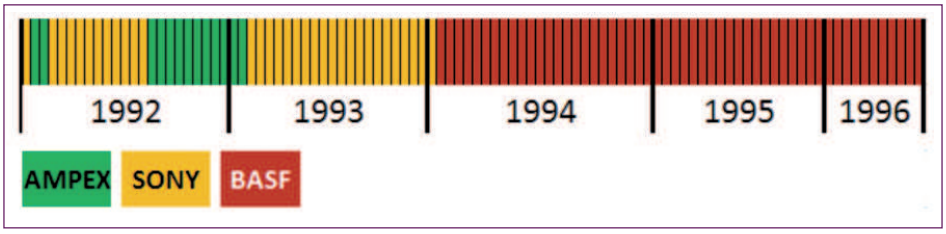

Fig. 1: brands and record years in the sample.

The transfer to file of these 1,000 DATs took place from August 24th 2009 until November 11th 2009, using six Sony PCM-7040 DAT-devices, digitally connected to an Intel Duo E8400 (3.00 kHz) standalone core, running Steinberg Nuendo 4.2.2 recording and editing software. Before ingest, all tapes were fast forwarded and rewound on a standalone Tascam device. The reading heads of all devices were regularly cleaned for 10 seconds with a cleaning cassette.

During the ingest, the DATs were controlled on physical tape problems such as broken tape or blockage in the machine. The ingest operators also performed a quick visual scan of the waveform, checking for major drops or peaks and documented these in the workflow files of the ingest process. Later on, documentalists were asked to pay special attention to all kinds of

audible errors while cataloguing the content during the full listening process (from November 18th 2009 until March 1st 2011). They documented the kind of artifacts they heard and included the length and time codes where these errors occurred. Every DAT in which the sound file contained at least one audible error was double checked to make sure that this error was already present on the DAT and not an unintentional result of the digitization process. All errors were taken into account and only after this full listening check were the affected DATs given a rerun with a Sony PCM-R500, connected to the same computer.

4. Results

4.1. Age

Out of 1,000 DATs 81 or 8.1% contained at least one audible error in the sound file. Fig. 2 reports the numbers of DATs affected, grouped according to their record year.

RECORD YEAR	DATs AFFECTED	TOTAL # OF DATs	PCT
1992	25	218	11.4
1993	24	224	10.7
1994	17	256	6.6
1995	14	216	6
1996	1	86	1.1
TOTAL	**81**	**1000**	**8.1**

Fig. 2: DATs containing at least one audible error, per year.

When represented graphically (fig. 3) we see clearly that figures drop over the five consecutive years in the sample. 1996, the last year, shows an exceptionally low number of only one affected DAT out of 86 in the sample, or 1.1%. However, when we consider all DATs recorded in 1996, of whom the major part is indeed out of the sample, the result is 5.4% of affected DATs, a figure more in line with the previous years.

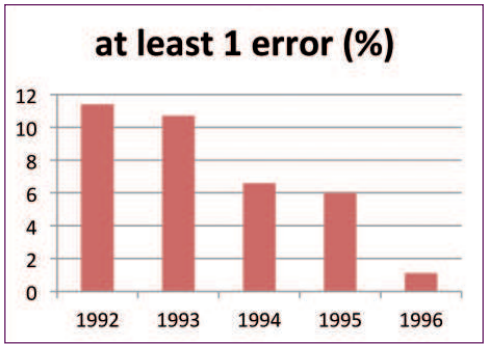

Fig. 3: DATs containing at least one audible error, per year (%).

Although a far lower result than originally feared at VRT, 8.1% of DATs affected may also seem high to some. Therefore it is useful to go beyond these first figures and have a look at the total time of audio affected. The research sample contained 120.000 minutes of audio, of which 1,211 minutes or slightly more than 1% was affected (fig. 4).

RECORD YEAR	1 SEC		2->10 SEC		11 SEC -> 1 MINUTE		1 MINUTE -> ENTIRE DAT		ENTIRE DAT	
	#	%	#	%	#	%	#	%	#	%
1992	6	2.7	15	6.8	2	0.9	1	0.5	1	0.5
1993	6	2.6	7	3.1	4	1.7	2	0.9	5	2.2
1994	7	2.7	7	2.7	3	1.1	0	0	0	0
1995	4	1.9	4	1.9	3	1.3	1	0.5	2	0.9
1996	1	1.1	0	0	0	0	0	0	0	0
TOTAL	**24**	**2.4**	**33**	**3.3**	**12**	**1.2**	**4**	**0.4**	**8**	**0.8**

Fig. 4: Total duration of the affected audio within the DAT, per year.

The difference between the total number of DATs affected and the total duration of affected audio is logically explained by the fact that most errors have a short duration. In every record year in the sample, most errors have a duration of one to ten seconds (fig 5). Only the number of the *one-second errors* and the *two-to-ten-second errors* tend to decrease in the researched period. The longer kinds of errors show no very clear tendency.

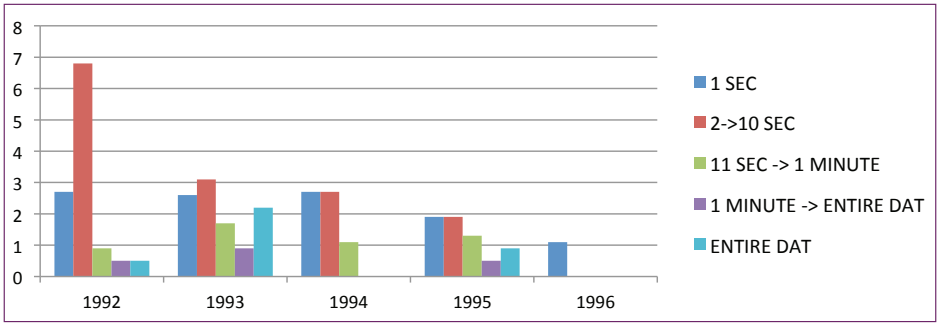

Fig. 5a-e: Total duration of the affected audio within the DAT (%), per year.

DATs with completely corrupted audio, a case widely feared for amongst audio archivists, proved to be quite exceptional in our sample. From only one (a SONY recorded in 1993) out of eight completely corrupted DATs did the full length sound had to be considered lost because even multiple reruns with different machines did not result in a better readout. Of the remaining seven the audio signal was captured with a Sony PCM-R500, not with a perfect result, but still far better.

4.2. Brand

A first examination of the brand results concludes a clear ranking lead by BASF (5.6% of DATs affected), followed by Sony (9.7%) and Ampex (12.6%) (fig. 6). Nevertheless a complicating factor is the fact that in our sample (and at VRT) not all brands were in use simultaneously. The fact that the BASFs, the youngest in the sample, are also the least affected, raises the question if and to which extent age and brand interfere as deterioration factors.

BRAND	# DATs IN SAMPLE	# DATs AFFECTED	% DATs AFFECTED
SONY	327	32	9,7
AMPEX	134	17	12,6
BASF	549	31	5,6

Fig. 6: DATs containing at least one error, grouped by brand.

The correlation between the brands of the DATs with the length of their errors (fig. 7) provides us with the argument that the older the DAT is, the longer its errors tend to be. When grouping the errors by length (fig. 8), the BASFs, youngest in the sample, have fewer errors and these even tend to be shorter than the errors of the Ampex and Sony cassettes. And even with some irregularities, two other facts confirm this indication: Sony cassettes typically have far more *two-to-ten-second errors* and the entirely corrupted audio comes most often from Ampex cassettes.

BRAND	1 SEC		2->10 SEC		11 SEC -> 1 MINUTE		1 MINUTE -> ENTIRE		ENTIRE DAT	
	#	%	#	%	#	%	#	%	#	%
SONY	6	1.8	18	5.5	5	1.5	3	0.9	1	0.3
AMPEX	6	4.4	5	3.7	1	0.7	0	0	5	3.7
BASF	12	2.1	10	1.8	6	1.1	1	0.2	2	0.4
TOTAL	**24**	**2.4**	**33**	**3.3**	**12**	**1.2**	**4**	**0.4**	**8**	**0.8**

Fig. 7: Total duration of the affected audio within the DAT, grouped by brand.

BRAND	1 SEC		2->10 SEC		11 SEC -> 1 MINUTE		1 MINUTE -> ENTIRE DAT		ENTIRE DAT	
	#	%	#	%	#	%	#	%	#	%
SONY	6	1,8	18	5,5	5	1,5	3	0,9	1	0,3
AMPEX	6	4,4	5	3,7	1	0,7	0	0	5	3,7
BASF	12	2,1	10	1,8	6	1,1	1	0,2	2	0,4
TOTAL	**24**	**2,4**	**33**	**3,3**	**12**	**1,2**	**4**	**0,4**	**8**	**0,8**

Fig. 8: Total duration of the affected audio within the DAT (%), grouped by brand.

4.3. Point in timeline

With the number and the duration of all errors indicated with time codes, it also became possible to obtain some interesting statistics about when in the audio timeline these errors occurred. The experience of radio technicians and archivist already allowed us to presume that the first and the last minutes of the audio were the most vulnerable. The figures from VRT's DivA project confirm these presumptions (fig. 9). The number of errors per minute is by far the highest in the first minute. Gradually it decreases to a very low level between the sixth and the 114th minute. The last five minutes show again more errors, but not as much as the first five.

MINUTE	1	2 -> 5	6 -> 114	115 -> 119	120
YEAR	errors / minute	errors / minute	errors / minute	errors / minute	errors / minute
1992	6	1	0,08	0,5	1
1993	8	3,5	0,1	2	6
1994	2	0,25	0,1	0,25	0
1995	4	0,75	0,06	0,25	1
1996	1	0	0	0	0

Fig. 9: Errors per minute in the audio timeline, per year.

Here again, this effect seems to be reinforced by the age of the DATs (fig. 10). And again this relation is not very clear-cut: 1992 and 1993 on one hand and 1994 and 1995 on the other switched positions, compared to what could be expected if a strictly chronological degradation had been the case.

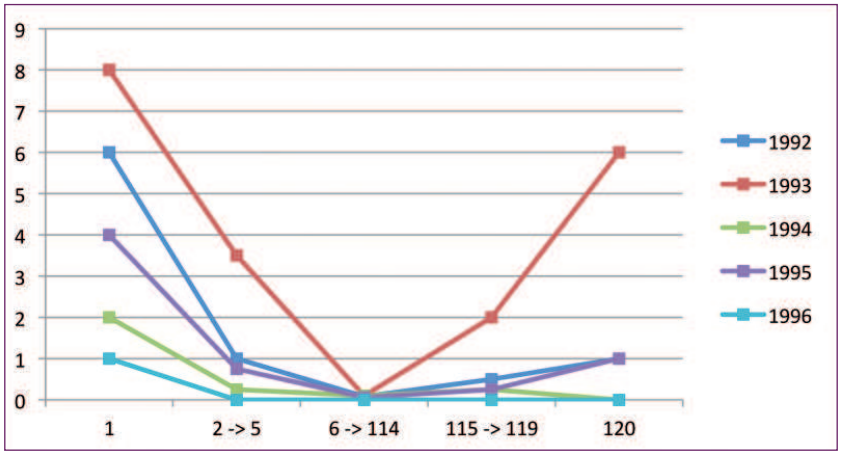

Fig. 10: Errors per minute in the audio timeline, outlined per year.

Considering the brands all three show the same effects of a considerably higher vulnerability for errors at the beginning and the end of the tape (fig. 11 and 12). BASF DATs are far less affected than Ampex and Sony. Ampex shows an additional vulnerability at the end, more than doubling the result of the Sony DATs.

MINUTE	1	2 -> 5	6 -> 114	115 -> 119	120
BRAND	errors / minute	errors / minute	errors / minute	errors / minute	errors / minute
SONY	9	1,75	0,14	1,5	2
AMPEX	7	2	0,08	1,25	5
BASF	5	1	0,22	0,25	1

Fig. 11: Errors per minute in the audio timeline, grouped by brand.

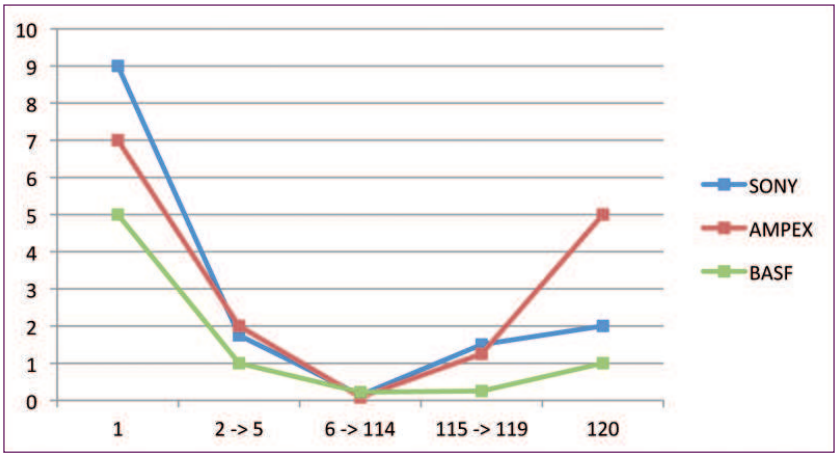

Fig. 12: Errors per minute in the audio timeline, outlined by brand.

5. Conclusions and nuances

In this article we have examined the results of the error logging by full human listening of 1,000 two-hour sound files, coming from an equal number of DATs. A recording period of almost 4.5 years was covered, from January 1992 until May 1996, with three major brands (Sony, Ampex and BASF) represented in the sample.

Answering the questions that have been lined up in the introduction, we have established that a total of 8.1% of all DATs were affected by at least one audible error. This number decreases every record year, leading to a first indication that there is a degradation of the sound signal through time. However, when we add up the full duration of all affected audio, we counted only 1,211 minutes (or slightly more than 1% of all audio), meaning that most errors are very short and only very few DATs are entirely corrupted. Considering length, only the numbers of *one-second errors* and *two-to-ten-second errors* tend to decrease through time. The longer kinds of errors show no clear tendency. DATs with a completely corrupted signal were very exceptional in our sample.

If we take a closer look on the brands Ampex seems to be the most vulnerable, followed by Sony and BASF. But as in our sample the different brands were not spread equally over the years (Ampex and Sony were in use from 1992 until early 1994, followed by BASF for the rest of the researched time span), it is still possible that age and brand interfere as factors of deterioration. Furthermore the errors coming from BASF cassettes were shorter and the entirely corrupted audio came most often from Ampex cassettes.

The results of our logging and research also reaffirm that the beginning and the end of the DATs are more vulnerable for signal loss. Here again there is a slight indication (but no explicit evidence) of gradual sound signal deterioration through time and a higher vulnerability of Sony and Ampex.

Should audio archives prioritize the DAT-to-file ingest with age or brand as a criterion? The answer can only be nuanced. There seems to be a slight relation between audio signal deterioration and the age of the DAT. Furthermore Ampex seems more vulnerable and faster in its degradation than Sony, and Sony in its turn seems more vulnerable and faster in its degradation than BASF. But the question remains to which extent the age relation and the brand relations influence each other.

To clear up these relations more diachronic (same brand, different periods) and synchronic (different brands, same period) studies are needed, also to exclude other possible factors such as differences in machine maintenance etc. But also the physical process of deterioration of the carrier and the signal stays an interesting subject for research. Regarding BLER we know that signal loss is gradual and that the possibility to calculate missing signals through the checksums stops at a certain threshold. In other words: an apparently perfect sound may conceal a very bad signal condition. 'Traumas' such as problematic recording conditions or poor conservation circumstances (e.g. exposure to extreme temperatures, humidity or magnetic sources) seem to play a role. In this respect the relatively low number of errors in our sample may be due to the professional recording and storage environments at VRT. If the history of the collection is known, it is therefore recommendable to give priority to 'traumatized' DATs.

If we consider the rather low quantity of lost audio in our sample, it may seem logic to shift the focus of DAT preservation strategies from the carriers to the (scarcity of) devices, which are often considered the bigger problem. According to Tim Bathgate however Digital Data Streaming (DDS) may provide the archival community with an escape route.[3] The signal loss problem though remains, up until today, irreparable and therefore continues to deserve our awareness.

3 BATHGATE, Tim. 2009. Took the one less traveled by. DAT migration at Radio New Zealand. IASA Journal 34: 50-64.

AUDIOVISUAL ARCHIVES AND INTERNATIONAL ORGANISATIONS: THE BENEFITS OF NETWORKING AND CO-OPERATION

(Paper presented at the annual conference of SEAPAVAA and the meeting of the Co-ordinating Council of Audiovisual Archives Associations in March 2011 in Kuala Lumpur and the IASA Conference 2011 in Frankfurt)

Kurt Deggeller, former convenor of CCAAA

Introduction

Globalisation is everywhere: in our daily lives and, in economics – certainly, – in culture – well maybe. What about information preservation? During my term as Convenor of the Co-ordinating Council of Audiovisual Archives Associations (CCAAA) I had many occasions to observe, how important networking was for the community of audiovisual archives. But I had also the strong feeling that the fragmentation of our already small group in 6 Associations limited its possibilities to act, weakened its position and made cooperation with the large sister NGOs of libraries, archives and museums difficult.

In fact, if you compare the figures of membership and financial turnover you can see that probably the whole group of audiovisual NGOs is smaller than each of the three NGOs in the heritage sector: IFLA (libraries), ICA (archives) and ICOM (museums).

It was probably for these reasons that at the end of the last century Crispin Jewitt, at the time president of IASA and director of the British Library Sound Archive, took the initiative to transform the former Round-Table of Audiovisual Archives into the more strongly structured Co-ordinating Council of Audiovisual Archives Associations. Later, when he had become convenor of the CCAAA, he succeeded in associating the organisation with different international bodies such as the World Intellectual Property Organisation WIPO, the International Committee of the Blue Shield ICBS and UNESCO. In the case of UNESCO, CCAAA cannot have official status due to the fact that some of its members already have a formal relationship with the organisation. Later in 2008, CCAAA was invited by IFLA to join the LAMMS coordinating council, a group of 5 NGOs whose aim is to narrow the gap between the different heritage sectors.

In my paper I will try to show the benefits audiovisual archives stand to gain by co-operating in a larger network of heritage institutions and to also show the disadvantages which could result should they remain apart.

I suppose that most of you have already heard about Europeana, the European digital library. In Europeana you can find content from museums and art galleries, archives, libraries and audiovisual collections. At the moment, audiovisual documents represent less than 5% of the documents accessible through Europeana.

I think that you will agree with me that this does not really reflect the importance of audiovisual documents in the 21st century. This situation has two main causes: one is, the backlog in the digitisation and documentation of audiovisual materials and the second is the desperately anachronistic situation regarding copyright. Digitisation of moving images and sounds needs a lot of specialist skills, costs a lot of money and is still hampered – at least with regard to moving images – by the absence of reliable standards. Concerning copyright it is the multitude of rights linked to audiovisual works and their relatively young age which means that only a small portion of the documents is in the public domain.

I'll give you another example from Europe. The EU-funded project TAPE – Training for Audiovisual Preservation in Europe – which lasted from 2004-2008, conducted a large survey on the situation of audiovisual archives in 34 European countries. 143 archives, 81 libraries and 42 museums participated in the survey. A large majority of the participants complained about the lack of expertise, of adequate storage and of playback-equipment, about backlogs in cataloguing and the uncertainty about digitisation. This result shows at least some reasons for the under-representation of audiovisual material in Europeana.

On a more global level, similar observations can be made when looking at UNESCO's Memory of the World programme. In June 2011, 45 new items were added to the World list. Only 4 of them represent audiovisual documents. There were other proposals for audiovisual holdings which were not successful due to the lack of adequate appraisal and suitable strategies for sustainable preservation and access.

In general, audiovisual materials have two major handicaps: they are – as shown by the TAPE survey – often poorly documented and therefore unknown; they are "hidden treasures", the title of another survey conducted in the UK. The other is that their life expectancy is shortened by carrier breakdown and technical obsolescence. It is therefore technically and financially challenging to guarantee the long-time survival of the documents.

What opportunities are there for co-operation with international bodies and what benefits can result for the community of audiovisual archives?

I would like to discuss this topic with reference to the following organisations: UNESCO, ICBS, WIPO and LAMMS.

UNESCO

In UNESCO audiovisual archiving belongs to the Information for all Programme (IFAP) in the Communication and Information Sector. It is the only programme exclusively dedicated to promoting universal access to information and knowledge. Amongst its five strategic priorities, information preservation is of particular interest to audiovisual archives. A working group has been set up to further the aim of this priority and it has put forward a list of 4 proposals for the Programme and Budget 2012-2013 of UNESCO: A World Report on Information Preservation, Safeguarding the Hidden Documents of Linguistic and Cultural Diversity, Open Source Software for Digital Preservation and Data Management and Promoting International Cooperation in Format Registries. All these proposals are of interest to he community of audiovisual archives which should play an active role in implementing these projects. [Meanwhile UNESCO could not implement theses projects in the programme due to financial constraints.]

I already mentioned the Memory of the World Programme which is linked to IFAP. For this programme more and better proposals for audiovisual documents are needed. MoW is generally not known enough and lingers in the shadow of its greater sister the World Heritage Programme. NGOs of the audiovisual field could promote MoW among their own members and encourage them to make proposals for the MoW-list. They should also invite their Members to participate in the National Memory of the World Committees.

Besides the programmes of the CI Sector, other activities of UNESCO require the presence of the audiovisual archives community. Two conventions are of particular importance: The Convention on the Protection and Promotion of the Diversity of Cultural Expressions of 2005 and the Convention for the Safeguarding of Intangible Heritage of 2003. In the Intergovernmental Committee of the latter we find only ICOM and ICOMOS as NGOs representing the heritage sector. I believe that the AV-NGOs should participate in the governing bodies of these conventions.

UNESCO also plays an important role in the implementation of the outcomes of the World Summit on the Information Society (WSIS) which took place in Geneva (2003) and Tunis (2005). It acts as facilitator in several action lines, some of which are of utmost importance to the av-community, namely "Access to information and Knowledge", "Cultural diversity and identity, linguistic diversity and local culture" "Media" and "Ethical dimension of the Information Society". By participating actively in the follow-up process, AV archives could raise their profile on an international level and make their important role in the information society more visible.

Of course, our NGOs should also play an active part in the General Conference of UNESCO which takes place every two years and it would be highly desirable for them to observe the debates of the Executive Board on items of particular interest for them.

The status of NGOs in UNESCO still needs to be improved. But we should not forget that UNESCO is an organisation of states and we must be aware that the representatives of the member states take the decisions. NGOs participate in the debate as observers representing professional expertise. It is therefore an important task for members of NGOs to keep in touch with their National UNESCO commissions and the diplomats representing their states in UNESCO and explain to them the importance and the needs of audiovisual archives.

The International Committee for the Blue Shield (ICBS)

The Blue Shield is the cultural equivalent of the Red Cross. It is the protective emblem specified in the 1954 Hague Convention (Convention for the Protection of Cultural Property in the Event of Armed Conflict) for marking cultural sites to protect them from attacks in the event of armed conflict.

The Blue Shield network consists of organizations dealing with museums, archives, audiovisual documents, libraries, as well as monuments and sites.

The International Committee of the Blue Shield, founded in 1996, comprises representatives of the five Non-Governmental Organisations (NGOs) working in this field:

the International Council on Archives (ICA), the International Federation of Library Associations and Institutions (IFLA) the International Council on Museums (ICOM), the International Council on Monuments and Sites (ICOMOS), and the Co-ordinating Council of Audiovisual Archives Associations (CCAAA).

National Blue Shield Committees have been founded in several countries. The Association of National Committees of the Blue Shield (ANCBS), founded in December 2008, is a body that coordinates and strengthens international efforts for specific action in the case of destruction in times of armed conflicts or natural disasters.

It is obvious that the audiovisual archives are endangered in the case of armed conflicts and natural disasters. Often broadcast archives are a specific target for bombing or looting in the case of international conflicts or civil war; and in the case of natural disasters such as floods and earthquakes expert knowledge on how to rescue damaged audiovisual material is necessary.

Over the last months there were numerous armed conflicts and natural disasters where no contact could be established with institutions or persons in charge of the audiovisual heritage of the nations concerned. The network for this is simply missing. Again the international profile of audiovisual archives could be considerably raised if disaster preparedness and recovery became a permanent topic in the activities of international AV-organisations and if the organisations maintained a network of experts on the recovery of av material within the national Blue Shield organisations.

World Intellectual Property Organisation (WIPO)

WIPO, the World Intellectual Property Organisation, is a specialised agency of the United Nations. It is dedicated "to developing a balanced and accessible international intellectual property system, which rewards creativity, stimulates innovation and contributes to economic development while safeguarding the public interest." WIPO was established by the WIPO Convention in 1967.

Thanks to the former Convenor of CCAAA, Crispin Jewitt, CCAAA has observer status in the Standing Committee for Copyright and Related Rights SSCR. This Intergovernmental Committee has been and still is discussing a topic which is of particular interest to the av-community: The exceptions and limitations of copyright for libraries and archives. Our colleagues from IFLA have drafted a treaty on this topic which will be discussed by SSCR during the next sessions. The situation of the AV-heritage in this discussion is complex mainly for two reasons: 1st because of the importance and complexity of the neighbouring rights of performers and producers and 2nd due to the fact that many producers of audiovisual documents –for instance broadcasters – also have archives. Public access to film and broadcast archives is a major problem for our profession. And, as it has been shown at the beginning of this paper, the uncertain situation in the copyright field is a major obstacle for the promotion of audiovisual archives through international access networks such as Europeana or the World Digital Library. But we must be aware that in WIPO only a network of organisations with strong relationships to national representatives can effectively influence the outcome of the debate. Experience shows that the right holders need a strong counterpart otherwise regulations will result which more and more hamper the necessary access to information and knowledge, particularly in the audiovisual field.

Another committee of WIPO also acts in a field of interest of the av-community: The International Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore a topic of particular interest for archives with audiovisual documents from linguistic and ethnographic research projects.

LAMMS co-ordinating council

In November 2008 the former IFLA-President Claudia Lux convened for the first time the international organisations of Libraries, Archives, Museums, Monuments & Sites,. Thanks to this initiative the LAMMS coordinating council came into existence.

The five international organisations for cultural heritage, IFLA (libraries), ICA (archives), ICOM (museums), ICOMOS (monuments & sites) and CCAAA (audiovisual archives) agreed to intensify cooperation between their organisations in those areas where libraries, archives, museums, monuments and sites have mutual interests and activities.

In the LAMMS group, the leadership of the international NGOs has formed a Coordinating Council to facilitate discussion on, to promote understanding of, and to foster cooperation on matters of common interest to the cultural heritage sector.

All parties recognize the importance of moving towards a mutual agenda to strengthen advocacy for the role and position of libraries, archives, museums, monuments and sites in the knowledge society of today and tomorrow, and to safeguard the world's cultural written, visual, and built heritage.

The focus of the LAMMS Coordinating Council currently lies in the following areas: Copyright and other legal matters, Political lobby, Preservation and protection of cultural heritage, Global digital libraries and Standardization.

The LAMMS initiative is strongly supported by several stakeholders, such as the Conference of Directors of National Libraries (CDNL) and the International Council for Scientific and Technical Information (ICSTI).

Through the LAMMS-platform the participation of the member associations in the International Museum Day 2011 (with the theme "Museum and Memory") was facilitated. This will hopefully be only the beginning of a series of future co-operations.

Conclusion

The networking and co-operation of Associations of audiovisual archives on an international level has to be improved. The role of the Co-ordinating Council of Audiovisual Archives Associations CCAAA in this process must be redefined. My personal feeling is that the future lies in networking with other organisations in the heritage field as is already the case in ICBS and in the LAMMMS co-ordinating council. The fragmentation of the audiovisual community weakens it and makes it vulnerable. The organisation of the international scene of audiovisual archiving reflects in many ways the situation after World War II. But as we all know all the parameters of our work have since then completely changed. Preserving and giving access to the audiovisual heritage to-day has nothing or very little in common with the concepts of 50 years ago. Obsolescence is not only threatening many types of audiovisual documents; its is also threatening the current way of organizing audiovisual archiving on a global level. Specialised institutions like film- and sound archives and the archives of radio and television should not continue to live in *splendid* isolation. They have major responsibilities in the preservation of a substantial part of the memory of the last 130 years. Libraries, archives and museums have to be aware that the audiovisual part of their collections must be recognized as having the same level of value as the other parts of their holdings. Together they have to act in favour of an increased protection of the audiovisual heritage in the case of armed conflicts and natural disasters, for universal access to the contents while respecting the rights of authors, performers and producers and an effective long-term preservation for those documents which are of importance for the collective memory. These are the key elements of an agenda which can lead to the improvement in the status of audiovisual documents, holdings and collections and of audiovisual archiving as a profession with a high level of technical and ethical responsibility.

Names of organisations and their acronyms

Organisations of the United Nations:

UNESCO
United Nations Educational, Scientific and Cultural Organization
Communication and Information Sector (**CI** Sector)
Information for All Programme (**IFAP**)
Memory of the World Programme (**MoW**)

Culture Sector (**CLT**)
Convention of the Protection and Promotion of the Diversity of Cultural Expressions (2005)
Convention for the Safeguarding of Intangible Heritage (2003)

WIPO
World Intellectual Property Organization
Standing Committee on Copyright and Related Rights (**SCCR**)
Intergovernmental Committee on Intellectual Property and Genetic Resources, traditional Knowledge and Folklore (**IGC**)

Non-Governmental Organisations (**NGO**)

Libraries, Archives, Museums, Monuments and Sites

International Council on Archives (**ICA**)
International Federation of Library Associations and Institutions (**IFLA**)
International Council of Museums (**ICOM**)
International Council on Monuments and Sites (**ICOMOS**)

Audiovisual Archives Associations

Association for Recorded Sound Collections (**ARSC**)
Association of Moving Image Archivists (**AMIA**)
International Association of Sound and Audiovisual Archives (**IASA**)
International Federation of Film Archives (FIAF)
International Federation of Television Archives (**FIAT-IFTA**)
Southeast Asia-Pacific Audiovisual Archive Association (**SEAPAVAA**)

Co-ordinating and umbrella organisations

Co-ordinating Council of Audiovisual Archives Associations (**CCAAA**)
ARSC, AMIA, FIAF, FIAT-IFTA, IASA, ICA, IFLA, SEAPAVAA

International Committee of the Blue Shield (**ICBS**)
CCAAA, ICA, ICOM, ICOMOS, IFLA

Association of National Blue Shield Committees (**ANCBS**)

Libraries, Archives, Museums, Monuments and Sites (**LAMMS**) Coordinating Council

IFLA, ICA, ICOM, ICOMOS. Observers: Conference of Directors of National Libraries **CDNL**, International Council for Scientific and Technical Information **ICSTI**

COOPERATIVE EXPERTISE AND COST EFFECTIVENESS: DEVELOPING AN AUDIOVISUAL PRESERVATION PROGRAM FOR UCLA LIBRARY

Siobhan Hagan and Jacob Nadal

1. Demand For An Audio Visual Preservation Program

The UCLA Library is a producer of, and caretaker for, substantial and significant audiovisual (AV) collections. Oral histories, films, videos, and sound recordings abound in library special collections. Notable examples include recordings of the novelist Aldous Huxley; videos created by the artist June Wayne; recordings of the Ojai Music Festival; literary critic and writer Roy Newquist's interviews with artists and intellectuals; and recordings of UCLA faculty that are deposited in the University Archives.[1]

The Library also often creates its own AV content. The Center for Oral History and Research records both video and audio oral histories that must be preserved and made available to researchers at the Library. With active speaker and workshop series and new facilities in the Charles E. Young Research Library, live performance capture is an important new area of emphasis. Beyond the Library, UCLA hosts, organizes, and presents frequent performances, conferences, and talks that connect the campus to a global scholarly and artistic community. The UCLA Library has a responsibility, sometimes implicit, other time explicit, to care for the creative work of the campus. Making that responsibility an operational reality requires audiovisual preservation to be an area of growth and emphasis within the Library's preservation program.

Plans for an expanded audiovisual preservation effort began with an assessment project led by Howard Besser (NYU), acting as a consultant to the UCLA Library. Dubbed "Performance Capture," this project identified activities within the Library and across the campus that had a need for preservation support. Responsibility for acting on the recommendations of the report was given to Sharon Farb, associate university librarian for collections and scholarly communication, and Jacob Nadal, preservation officer. The report outlined five areas for development – cooperation, selection, capture, preservation, and access – with key questions and issues for each. It also observed that the "Library will not be the only campus organization which will choose to collect, preserve, and make available recordings of campus performances. The Library needs to partner with other campus organizations who engage in this and offer cooperative expertise."[2]

"Cooperative expertise" has thus been the guiding principle in the Library's development of audiovisual preservation services. Generous support from the Arcadia Fund is helping the Library to build its services quickly, but creating a completely internal and self-sufficient AV preservation program is both unnecessary and cost-inefficient. With hundreds of audio and video production houses in Los Angeles County and several dedicated AV preservation vendors nationwide, there are many external options available.

UCLA is also home to the UCLA Film and TV Archive, second in scope only to the Library of Congress, and the UCLA Ethnomusicology Archive, one of the oldest and most significant collections of its kind in the United States. UCLA departments including music, communication studies, world arts and culture, theater, film, and television each boast top-flight faculty and students and are important centers for the creation and use of media.

Given this rich environment, the Library determined that the key strategic element a successful AV preservation program would require was an internal expert with three primary responsibilities: evaluating the Library's preservation efforts for AV media, connecting and collaborating across a variety of creators and service providers, and translating between curatorial concerns in the Library and technical concerns in AV preservation. To that end, Siobhan Hagan was recruited in the summer of 2011 to serve as the Library's first AV preservation specialist.

2. Technical Issues

In the fall of 2011, Ms. Hagan toured many different archives, museums, libraries, and laboratories to research current AV preservation practices. She met with specialists, viewed obsolete and state-of-the-art equipment, and learned of others' failures and successes in this area.

Of the places visited, preservation vendors were separated from collecting institutions and collecting institutions were sorted into those with in-house transfer capabilities and those without. To help UCLA frame its levels of need and potential areas of growth, institutions with in-house capabilities were classed as low, medium, and high, measuring the extent to which they followed preservation standards, had highly specialized and trained professional staff, and maintained high-quality audiovisual equipment in the proper set-up and environment. Finally, each site was labeled as focused or diverse, depending on the audiovisual formats they are capable of transferring, the amount of work they complete in relation to what they have in their collections, and the amount of AV content in their collections.

These categories have been used to help determine where the UCLA Library Preservation Department wants to be. Based on collections and current capacity, the goal for the next few years was set to fall somewhere within the medium range for all categories. In the more distant future, goals will be adjusted upward to the high level for adherence to standards and implementation of best practices. Future goals include the additional of specialized staff and accompanying space, equipment, and supplies, while maintaining a medium-level focus on formats, since almost every type of major audio, video and film format is likely to be reflected in Library collections. Format capabilities will increase, but the AV preservation program may never reach the point where the Library has its own film preservation lab, for example, or provides comprehensive services for all formats in-house.

Several important points stood out as a result of the site visits. First, preservation best practices must be followed without sacrificing quality or cutting important corners. In practice, this means reaching internal consensus among Library departments to define what the important corners are. All activities and decisions must be documented, and policies for everything made readily available. A major focus should be creating and documenting policies on the prioritization and selection of AV items and collections for preservation.

Adherence to standards and practices is a critical foundation, because as much as possible must be automated, while creating and following strict policies on selecting items for automation. For example, quality-assurance work will eventually be semi-automated, but a human eye and ear will always be involved (something Library curators and other stakeholders are likely to demand as well). As another example, a SAMMA robot would not be used for a collection of video art, but perhaps it would be for an access project of a large collection of professionally recorded videos.

Preservation program staff must develop strong relationships with Los Angeles-area video and audio engineers and film specialists, both production- and preservation-oriented. Any and all audiovisual equipment will be collected, either to repair for use or to harvest for parts. Therefore, relationships with knowledgeable repair people in the region will be essential, as all the equipment will require constant maintenance due to its age and the nature of this type of equipment.

The preservation department must provide training to UCLA Library staff on AV preservation issues and AV capture. Staff must also advocate the importance of AV preservation to the UCLA campus and media production, library, archive and museum professionals. Staff will be highly encouraged to highlight the UCLA Library AV collections through conferences, events, exhibits and social media.

Finally, the UCLA Library needs to conduct a survey of its audiovisual holdings. Completing such a survey may take years, but planning must begin now, which would initially include test-

ing and evaluating survey tools. However, even without a detailed survey, two major needs are clear: 1.) Lots of digital storage, ideally in three different sites that are geographically dispersed; and, 2.) Physical space that is secure, seismically sound, with good environmental controls and a reliable building envelope to guard against water, pests, or other infiltration.

3. Lessons Learned

The first year of concentrated work on audiovisual preservation has revealed some significant things beyond technical issues. One is that libraries are still developing their literacy for moving image and recorded sound media. Textual and graphic records have been at the heart of library and archival practice for centuries, but visual literacy has been increasingly important throughout the twentieth century as well. The existence of standardized vocabularies such as the Getty thesauri and the emphasis of digital library projects on bringing photographic collections to the web attest to the range of efforts devoted to these collections. Another is that the understanding of and accommodations for AV collections are still in their infancy. The work of certain specialist groups within the profession may be exceptions that prove the rule. The Music Library Association, for example, has years of work trying to adapt the library-standard MARC record to the needs of printed music, to say nothing of recorded audio and video.

Bringing an AV preservation specialist (and in this instance, one with a film and video production background) into the UCLA Library has started several positive discussions. It is important for the preservation community to understand that library and archive collections do not divide neatly along media lines and that a successful preservation staff member must have some understanding of film, video, audio and digital preservation. In the other direction, the Library's AV preservation efforts have prompted curatorial conversations of a kind not always held in research library preservation departments.

The classic model of the conservator-curator relationship asks the curator to set priorities and approve treatments with different levels of impact on the original item. The assumption is that the conservator has expertise in the materials and methods, while the curator is expert in the context and interpretation of the work.[3] This is not always the case for AV formats. In libraries and archives, these works are often parts of collections with a larger thematic association. A collection of political papers might contain recordings of speeches, broadcast interviews, and film elements used in creating a documentary. The curator may be expert in politics and history, but not in broadcast journalism. This leaves a potential gap in the traditional library preservation model, and it is worthwhile to consider the ways the library as a whole, and its preservation staff in particular, fills the need for understanding material culture and media literacy.

Alongside these intellectual concerns, moving into AV preservation has exacerbated several digital preservation issues, storage chief among them. Storing AV preservation masters in multiple copies causes the terabytes to add up fast. The UCLA Library has been able to purchase relatively low-priced, dual-site disk-based storage in partnership with UCLA Information Technology Services. Current pricing for a terabyte of network storage runs $500-$1,000, depending on whether it comes from University of California services or external vendors. An online, cloud-like service is desirable for many reasons, but even so, part of that cost is for a level of immediacy and online access that is not strictly required for preservation masters. Prices for online storage may fall as needs rise, but even so, using data tape technology, in automated near-line libraries or as stand-alone off-line media, and planning for regular forward migrations to make projects affordable is under consideration.

Finally, Library goals for providing access to these holdings have raised a variety of technical and legal problems. The technical issues are non-trivial but solvable, and the means of providing online access to AV collections have been thoroughly discussed in the digital library literature. Legal issues are familiar territory as well, in that everyone in AV preservation has confronted questions about rights, ownership and permissions. The UCLA Library seeks to provide the broadest possible access to all of its holdings, with the most important guiding work at present

the Association of Research Libraries' Code of Best Practices in Fair Use for Academic and Research Libraries.[4]

4. Next Steps

The Preservation Department intends to build three different stations for AV preservation work. Each will be designed to be scalable in order to steadily increase our capacity. A feasibility study conducted by the UCLA Library, UCLA Capital Planning, and consulting architects Pfeiffer Partners explored the development of new workspaces for the Library's collection management operations and additional climate-optimized storage for collections. Fundraising for these spaces will be no small task, but they represent an important continuation of the UCLA Library's strategic plan for integrating AV preservation into Library operations.

The first step in the workflow is *Station A: Processing and Treatment Room*, a secure room the access to which will be limited to a select number of staff. This is presently 120 square feet, with up to 400 square feet projected in the feasibility studies. In this room collections and materials will be tracked in a database with accompanying metadata so that the Library knows at all times what is happening to these items and where they are. The items, specifically their old and new containers, will be barcoded to link the physical items to the initial metadata created in the database. Next, the materials will undergo inspection, repair, rehousing, and cleaning. After this, items will be sorted into what will be reformatted in-house and what will be sent out to a vendor. The logistics of properly packing, shipping, and receiving items from vendors will also take place in this room. The items that will be reformatted for preservation in-house will move to *Station B: Visual Playback and Reformatting Room*. All location moves and preservation actions will be noted in the tracking database that will be located on a local server.

Station B will be for the preservation transfer of select formats. This set-up will be made scalable so that other formats can be added in the future. It will be housed in one secure room of approximately 120 square feet, with plans for expansion, the access to which will be limited to a select number of staff. The video formats to be reformatted in-house are Umatic and VHS. To start reformatting audio material, compact cassettes tapes and ¼" open reel will be transferred. These formats were chosen due to their prevalence in case study collections examined over the past six months, and their technological obsolescence, and their high possibility of degradation. Metadata will be embedded in the newly created digital files at this station. Playback of these formats and other select formats to be determined will also be offered. There will be a small reference library for information on AV preservation and paperwork and file folders that pertain to AV preservation and current and past projects worked on. This room will be locked. Shelving will house a graveyard of media equipment, although eventually a dedicated room for this will be necessary.

Station C does not need to be in a secure, locked area, although secure authentication using UCLA's Shibboleth system will be in place to control access to digital master files.[5] The Library's Cataloging and Metadata section already maintains a space for AV playback used in their cataloging workspace, so this may be an area that serves dual functions. This will be where mostly student workers will take the files created in-house and files received from the vendors, conduct quality assurance checks, and create reports on each file in the tracking database. Further metadata will also be embedded if appropriate.

Assistance in these preservation projects will be enlisted from interns and students worker, particularly those in UCLA's Moving Image Archive Studies master's program and UCLA's Department of Information Studies. Other collaborations are planned with various departments in the Library and across UCLA that are capturing events through AV materials. Lastly, an "Audiovisual Preservation Travelling Medicine Show" has been presented to students in the UCLA Library Special Collections' Center for Primary Research and Training, which will be expanded and presented to many different departments at UCLA.

(Endnotes)

1 UCLA, Online Archive of California: http://www.oac.cdlib.org/institutions/UCLA Consulted 14 March 2012.
2 A version of the report has been prepared for distribution. Contact Siobhan Hagan, AV Preservation Specialist, to obtain an electronic copy: mailto:shagan@library.ucla.edu.
3 For a detailed description of this, see the American Institute for Conservation's Code of Ethics and Guidelines for Practice: http://www.conservationus.org/index.cfm?fuseaction=page.viewPage&PageID=858 Consulted 14 March 2012.
4 Association of Research Libraries. ***Code of Best Practices in Fair Use for Academic and Research Libraries***. Washington, D.C. January, 2102: http://www.arl.org/pp/ppcopyright/codefairuse/index.shtml Consulted 14 March 2012.
5 Internet2 Middleware Initiative. ***Shibboleth***: http://shibboleth.internet2.edu/ Consulted 14 March 2012.

REPORT ON THE SURVEY OF MEMORY AND CULTURAL HERITAGE RESOURCES IN LUCAS DO RIO VERDE

Bertram Lyons

Introduction

In 1999 a survey was taken of Brazilian archives and libraries.[4] It was a success, but very little information was gathered to document the nature of such institutions in developing areas of Brazil such as the state of Mato Grosso. In her introduction to "Building Preservation Knowledge in Brazil," which discusses the extent and findings of the project, Ingrid Beck notes, "it has been said that Brazil is a country without a memory, firmly rooted in the present and with its eyes on the future."[5] Of course, that is what the Council on Library and Information Resources (CLIR) project was out to disprove. And, of course, it succeeded in its goals. Brazil has a memory. The people of Brazil have a memory. The network to document and preserve this memory is strong and growing.

That being said there are places in Brazil that did not appear in the survey. These places are not homogenous; there are many different reasons why they did not participate in or appear in the survey. Take for instance a town, a young town, in Mato Grosso called Lucas do Rio Verde, a town of less than thirty years, a town with nearly 40,000 inhabitants, a town built on demand, a town based in industrial agriculture. A town, the history of which, tells fascinating stories of pioneers, government mandates, national expansion, land grabbing, big business, frontier development, migration, labor issues, environmental policy, international agricultural exchange in the twenty-first century, culture clash, class structures, among many others.

Are places such as this devoid of history, devoid of support for the preservation of historical documentation? Does the Brazilian government support such development? Do private interests bolster preservation and documentation efforts? What is being done to build or to document local histories and who is carrying out such work?

As an archivist from the United States, this is not likely a set of questions I should be addressing. This is not my country, my culture, or my business. However, here I am, after living for nine months in Lucas do Rio Verde, asking these very questions and finding that, as always in life, the answers are complex and the details fascinating.

I entered the world of cultural heritage because I am interested in the documentation of society and culture for the sake of those who will come after us. I studied museology and history at the University of Kansas in the United States. I studied archival science and theory independently and at the University of Kansas. I am a certified archivist through the Academy of Certified Archivists. I have worked in museums, archives, and libraries for more than 10 years. I understand the distinct realms of each discipline, but I am interested more in the network of documentation that spans the boundaries and borders of these realms. I am interested in the realm of historical and social documentation in general.

Currently, I am employed as an archivist at the Library of Congress in Washington, DC. I was on leave with my wife in Brazil for nine months as she pursued research for her doctorate in Geography. While in Lucas, I explored questions about the nature of documentation, about how young towns develop cultural heritage infrastructure, and about what the answers to such questions contribute to assumptions about historical documentation and to the larger international discourse on preservation and access to records of the past.

4 Beck, Ingrid. Building ***Preservation Knowledge in Brazil.*** Council on Library and Information Resources, November, 1999. Accessed here, 2011/03/27: http://www.clir.org/pubs/reports/pub86/pub86.pdf.

5 Ibid., 1.

I asked and am asking these questions because I do not believe that archives, museums, and libraries are a given. Because I believe that people look to existing models, but people also improvise. Because I believe that people value their histories, people tell stories about their histories, and these stories matter.

When I learned that I would be living in Lucas for nine months, I decided it would be a great opportunity–a rare opportunity–to pursue a research project on a topic of interest to me. Therefore, I designed a project to conduct a survey of the cultural heritage and historical documentation landscape in Lucas. The Association for Cultural Equity[6] and the International Association of Sound and Audiovisual Archives[7] funded this work.

Project Description

We come to know the history of a place and its people from access to records and other artifacts that are left behind from the activities of everyday life. Similarly, information about the past is passed from person to person through memory and oral transmission. Oral histories, publications, government records, personal records, diaries, manuscripts, stories, photographs, sound and video recordings – these are some of the vehicles whereby information about the past is kept and retold. In contemporary western societies, a plethora of memory institutions such as libraries, archives, museums, historical societies, and cultural centers manage, in concert with social networks, the maintenance and dissemination of information about the past. Of course, these memory institutions are social constructs. The networks one social group constructs for memory preservation may differ entirely from the next. There is no perfect composition or alignment of such networks. They are ever-shifting and ever-changing. For this project, therefore, I proposed a survey of one nascent network of memory institutions with the intention of revealing new insights into the development of memory institutions in developing communities in an increasingly digital era.

Lucas do Rio Verde in the Brazilian state of Mato Grosso has a complex history. It is physically located in the heart of Brazil, and it is in a place that is and has been at the heart of national and international importance: pre-MST (Landless Movement) land conflicts, industrial agriculture, environmental conservation, economic development, frontier expansion, to name a few. As a settlement project of the federal government of Brazil, the area began being settled in the 1970s and early 1980s. Farmers from Parana squatted on the land beginning in 1976 when federal highway BR-163 was just being cut through the Cerrado. Four years later in 1981, INCRA (National Institute for Colonization and Agrarian Reform) opened a federal land settlement program in what would become known as Lucas, bringing up landless settlers (203 families) from Rio Grande do Sul who had become involved in land disputes. Eighty families from Sao Paulo state were also brought. In 1985, Lucas became a district of the town of Diamantino and began a three-year fight to be emancipated into an independent municipality, which it achieved formally in 1988, a little more than 23 years ago.[8] Since then industrial agriculture happened and now the area is part of Brazil's most productive soybean producing region. Lucas is also now home to South America's largest meat processing plant, built recently by Sadia. Lucas has grown quickly and with the boom of industrial agriculture, a soon-to-come railway linking the area to sea ports for export, and growing international and national investment in the area, it looks likely that the area will continue its speedy development. It already has a population of over 40,000 citizens, more than 10 schools, a professional futbol team, at least more than 40 churches, and boasts large cultural communities from southern, northeastern, and central Brazil.

My project looks at Lucas and asks, what institutions are responsible for documenting and preserving the activities – political, cultural, social, economic, industrial, educational – of the people

6 Official website: http://www.culturalequity.org.
7 Official website: http://www.iasa-web.org/.
8 Castro, Sueli Pereira, Joao Carlos Barrozo, Marinete Covezzi, and Oreste Preti. *A Colonizacao Oficial Em Mato Grosso: 'a nata e a bora da sociedade'*. EdUFMT: Cuiaba, MT, 1994, pp 95-100.

who live and interact there? What networks have been established to capture and disseminate the preserved information? For this project, I conducted a survey of memory institutions in Lucas do Rio Verde to develop baseline data on the types and extent of memory resources that exist in the town. The survey captures information about the history and ongoing management of each institution, including collecting practices, audience, mission, and long-term planning. It also documents the nature of the institutions' holdings and the ways in which these holdings are used and accessed by local and external communities.

Project Methodology

During the initial phase of the project in Lucas, I identified possible repositories, including the public library, the municipal archive, several private cultural heritage centers (Centro de Tradições Gauchas, Flôr do Cerrado, and Associação Cultural Gruner Wald), the local higher education university (Faculdade La Salle), and the municipal office of the Secretary of Education and Culture. These preliminary contact points helped me understand the mainstream cultural heritage climate in Lucas. Primarily, during this time, Professor José Dario Munhak, head of the municipal archive and history museum, sat with me and helped me to understand the history of Lucas and the history of the city's archival documentation as held by the city government. In these first months, I took time to learn Portuguese, I searched for other possible repositories in the area, and I began designing the survey that is the foundation of this project.

The eleven survey questions themselves are simple, but the survey was designed to minimize stress on the behalf of the repositories. The lower Amazon region in which Lucas is located is sensitive to foreign researchers because of years of NGO activity in the area's environmental issues. Also, as an outsider with minimal language skills, I wanted to be clear that I was trying to learn, not to prescribe. I wanted to be very clear to survey participants that I was not intending to critique the practices or opinions of the people in the area and that I was focused primarily on understanding such practices and opinions. To establish a baseline for data collection, I developed a questionnaire template that contains questions aimed at organizational/institutional repositories and personal/private collections.[9] This questionnaire was delivered to each repository who participated in this survey in order to insure consistent capture of quantitative data and to align all qualitative data gathered during the survey.

I intended to record interviews with central individuals from each institution about issues including funding sources, management structures, community outreach strategies and initiatives, operational procedures and practices, digital resources and capacities, facilities, collections development, access to and use of collections, audience and mission, as well as future plans and priorities. However, the survey questionnaire covers these issues, and my Portuguese language skills were not strong enough to maintain in-depth conversations. Therefore, I did not carry out recorded interviews. I did develop relationships with each participant, and if it is warranted in the future, I could request and complete recorded interviews. The survey includes a summary of the contents of each repository, including plans for access, management, and long-term preservation. The results of these questionnaires and my participant observation constitute the bulk of the project and the final report.[10]

Survey Findings

I identified and surveyed eight institutions in Lucas that are currently housing or creating caches of historical documentation. Three are government institutions, three are communication services, one is a private education institution, and another is a not-for-profit cultural

9 Survey questionnaire is accessible at the following URL (as of 2012/04/01): https://docs.google.com/document/d/1pP_qJPhlx-YjctcRvWsur2B2rBuV8DdoLCltTeo1Btg/edit

10 Survey data (translated from the original Portuguese to English) is accessible at the following URL (as of 2012/04/01): https://docs.google.com/spreadsheet/ccc?key=0Ai3bWoF9sI1ddGtkMVpEN293MVJxeWd3WHFoUkppaFE

heritage organization. Following are the types of collected materials identified as collection materials by respondents: newspapers, books, photographs, videos, news reports, advertisements, magazines, documents, reports, theses, interviews, and objects of material culture. All of the respondents held items in quantities of a thousand or more; three held objects in quantities of tens of thousands. Half of the respondents stated that they intended to save and preserve their collections for as long as possible; the other half stated that they would maintain their collections as long as it was of use to the business of the institution. All reported similar storage methods based on the nature of the collected material. Physical objects for the most part are stored in cabinets and on shelves, usually in folders. Digital items are stored on CDs, DVDs, external hard drives, internal hard drives, and, in one instance, networked servers. Regarding digital items, two participants reported having no digital content, one reported having all digital content, the remaining respondents reported the percentage of digital material to be somewhere between 15 and 80 percent.

Two of the three communication organizations reported that it is important to save historical documentation because it is a business incentive for the organization. The other reported that it is important to document the history of the city and the region. The remaining five respondents reported that it is essential to preserve their collections for documentation of the history of the city and the region. In all cases, the head of the institution has sole responsibility for deciding what will be kept and preserved. Regarding access to the collections, only one participant reported their collection to be off limits to the public. One institution charges a fee for use of its collections, and one institution requires a screening of the purpose of research before access is allowed. No respondents reported an active outreach program for informing the community about the collections. However, all participants stated that their future goals are to preserve their collections for either public or private use.

Discussion

I began this research by getting to know the town of Lucas and understanding its landscape and the work environment. I spent time with the employees of the office of the Secretary of Education and Culture, which led me to the public library, and then to the museum and archives (both of which currently reside in the space of the public library). The director of the museum introduced me to the library at Faculdade La Salle (the local university). I visited local schools to meet the teachers and understand what resources the schools have and use for research. I also attended cultural events at local traditional culture centers, including the CTG (the Center for Gaucho Traditions) and the Flôr do Cerrado (the center for Matogrossense culture and art).

Due to the lack of online resources to conduct this survey (most of these organizations lack any online presence short of news articles and press releases), the majority of my work in Lucas was face-to-face. I will note that the municipal government of Lucas posts legislation and notices online for public access.[11] They offer over two thousand public documents in PDF form for download or online viewing. Two of the TV stations, TV Rio Verde and TV Conquista, host websites that offer multi-media streaming of current news reports. One weekly print newspaper, Jornal O Luverdense, offers page-by-page online access to their most current editions. Other than that, there is very little online access to cultural and historical documents in Lucas. Except, and I think it is important to note, Lucas, for its size, has a strong online presence in terms of social media and external coverage. For instance (as of 2012-04-01):

Google: "Lucas do Rio Verde" 1,860,000 results
Google Images: "Lucas do Rio Verde" 148,000 results
Google Videos: "Lucas do Rio Verde" 71,000 results
YouTube: "Lucas do Rio Verde" 3,320 results
From april 10 2006 (http://www.youtube.com/watch?v=jYVJsmtOBCI) to today (http://www.youtube.com/watch?v=NpQybNshSJI)

11 Lucas do Rio Verde city government website: http://www.lucasdorioverde.mt.gov.br (accessed 2012-04-01).

Flickr: "Lucas do Rio Verde" 502 results
From July 8 2004 (http://www.flickr.com/photos/metalog/301063437/) to March 22, 2012 (http://www.flickr.com/photos/jaimemartins/6871448540/)

At the heart of citywide, active historical documentation are the municipally mandated museum and archive, neither of which have actual facilities. Activities and collections of both are located within the public library. The Secretary of Education and Culture oversees all three of these agencies, but all three have separate histories of development.

Lucas' Museu Histórico do Município is mandated by law[12] to house the local history museum and the municipal archive, but it has not yet been actualized into a physical structure: "Art. 4º - O MUSEU HISTÓRICO – Museu da cidade de Lucas do Rio Verde, órgão subordinado à Secretaria de Educação e Cultura, tem por finalidade recolher, abrigar, preservar e mostrar peças e documentos que testemunhem a história, a arte e da cultura dessa cidade. Ao mesmo tempo procura pesquisar e divulgar a cultura mato-grossense e outras advindas da formação desse povo nas suas diferentes abrangências, bem como promover o intercâmbio cultural e artístico com outras entidades congêneres do estado, do país e do exterior."[13]

Local historian and professor at Faculdade La Salle, José Dario Munhak has been working on research and development for the Museu Histórico since April 2010. Although the institution is slated to become a history museum, Munhak has focused extensively (and solely) on the acquisition of documentary materials, including photographs, legal documents, and research texts, both physical and digital in nature. Because there is no physical space to house collections of the Museu Histórico, Munhak borrows space from the municipal library, which is housed by the Secretary of Education and Culture, to organize and to store this growing archive. Currently the collections span approximately 12 linear feet, and are composed predominately of photographs (some original, others copies or prints). Munhak is developing an organizational schema for the collection, along with minimal indices of the archive's holdings. The library has little climate control and few resources to acquire archival storage materials. Currently, access to the collections is only available through contact with Munhak. He would like to continue growing the archival collections—Munhak requests donations from municipal residents—but he is reluctant to go too far until a secure building is built or designated to house the collections.

I worked closely with Munhak and his assistant, Fatima Terezinho Longo, to get a sense of the collection and the goals. Since there is no physical home for the museum, they are focusing on building the archival collection, which currently consists of photographs (probably around 1000), documents, newspapers, and magazines. Munhak also has created a small digital collection of images (mostly digital photographs of the entire backlog of the local newspaper, Folha Verde – since the newspaper itself will not release any of its archives to the public, Munhak found back editions in the library at Unilasalle and photographed them page by page in order to add them to the public archive). The archive has limited supplies and little contact with archival colleagues in Brazil. At this point they are working to establish an organizational ontology in order to begin to create catalogs and finding aids for their collections. The materials are not available to the public without close assistance by Munhak and Longo (because they are neither cataloged nor processed).

12 Originally the law provided for an Arquivo Historico Municipal Rio Verde, 2002/10/31 (http://www.lucasdorioverde.mt.gov.br/sisPref/legislacoes/arquivos/968/legislacao.pdf), but in 2005 this was subsumed into the Museu Historico, 2005/11/22: http://www.lucasdorioverde.mt.gov.br/sisPref/legislacoes/arquivos/648/legislacao.pdf; accessed 2011/03/27. According to municipal organizational charts, the Library (DBIBLIO) and the Museums/Archives (DMA) are two separate divisions under the Coordinator of Libraries and Museums (CBM) in the Secretariat of Education and Culture (SMEC): http://www.lucasdorioverde.mt.gov.br/sisPref/legislacoes/arquivos/662/legislacao.pdf, accessed 2011/03/27.

13 Text provided to author by José Dario Munhak via email correspondence, 2011/3/31.

The library, Biblioteca Publica Municipal "Monteiro Lobato", was first mandated through public law in 1989. I have neither found nor heard evidence of the existence of such a library until 2002 when a new public law created the library as it is today, giving it its current name and providing funding for the construction of a physical space. It contains approximately 10,000 holdings, 4 computers with Internet connections, a full-time librarian—Laice Correa Godinho Ribeiro—, and space for researchers.

In the back of the library is the current municipal archive (although I make a strong reminder here that the municipal government has ample facilities and technology for records management – which it handles within each secretariat). What you see here is the archive of history and culture, and its funding is minimal. The idea for a municipal archive of history is first seen in public law in 2002. It doesn't show up in any budget until 2005, at which point it combined with the newly created history museum.

Faculdade La Salle (Unilasalle), a local university since 2008, is host to its own library.[14] With a larger collection than the municipal library, and with more hospitable facilities, this library is open to students and employees of Unilasalle, with only limited access for the general public. This library is mostly composed of published resources and online database subscriptions, but it does have a small collection of local newspapers, magazines, and student papers, including master's theses. None of these unpublished materials are cataloged or available online, but they are of great value to the documentation of local history in Lucas. The facilities are quite modern and these unpublished resources are kept in an air-conditioned room.

The Association for Preservation of Matogrossense Culture (also known as Flôr do Cerrado[15]) is a not-for-profit cultural organization. It offers dance and music lessons for all ages, a community library specializing in local and regional history, festivals and events, and community support for low-income families. Aside from a unique collection of books about Mato Grosso, the Flôr do Cerrado collects photographs, newspapers, and news reports that document its efforts in the community.

14 For more information about Faculdade La Salle, visit their website: http://www.unilasalle.edu.br/lucas/ (accessed on 2012-04-02).

15 For more information about Flôr do Cerrado, visit their website: http://flordocerradomt.blogspot.com/ (accessed on 2012-04-02).

Two additional cultural organizations exist in Lucas: Centro de Tradições Gaucha and Associação Cultural Gruner Wald. Aside from public events that display cultural traditions, I am uncertain whether these organizations maintain physical or digital collections.

Many of the historical documents that exist in Lucas are still in the hands of private individuals and private businesses. The local newspaper, Jornal Folha Verde, maintains its own archive of the newspapers it has printed since its inception, which predates the proper city of Lucas by two years. In all estimations, this is the largest and most thorough collection of documentation about the city of Lucas and its inhabitants. The owners of Folha Verde do not offer public access to this material; instead, it is used only as a revenue generating resource for their publications. Another private business, Karis Comunicação, owner of TV Conquista and Jornal O Luverdense, operates in the same fashion, valuing its archives for its business needs, but not making the archives publicly available, except the most recent newscasts and newspaper editions.[16] Similarly, TV Rio Verde maintains a small archive of its news programs, but unlike the other large communications businesses, the owner of TV Rio Verde wants this material to be publicly available.[17] Because Lucas has a complex history of development, some documentary materials are in the hands of Brazilian Military, while others are with large landowners and farmers. Still other materials are held by the families and individuals who settled Lucas, working under the blazing Mato-Grosso sun to build farms, roads, utilities, and homes. The saying, "Knowledge is Power," holds true in Lucas, where historians and cultural proponents struggle against businesses to secure historical documentary resources.

Political factors influence the development of historical documentary repositories in Lucas. Because the town is new, because there were struggles during the creation of the town—between 1st wave and 2nd wave settlers—, because most of these people still live in the area, and because many of the 2nd wave settlers are in powerful positions in the municipality, the concept of history is contested and the question over which version should become the official version is a sensitive subject.

Environmental factors also affect the establishment of long-term collection repositories in Lucas, which is in the transition zone between Amazon and Cerrado ecosystems. There are two seasons: wet and dry. Both are hot and the wet season maintains a condition of high relative humidity for over five months. These factors, along with the lack of funding for environmentally controlled facilities—many of the buildings are made of concrete or patchwork wood, with no air conditioning and open windows—, and the inescapable presence of insects, lizards, and other pests, limit the capacity for long-term preservation of any documentary materials in Lucas.

In light of the above obstacles, there is a growing desire on behalf of the population of Lucas to document its past and its present. As I was leaving Lucas to return home, José Dario Munhak made a point to inform me that "the people [of Lucas] are willing to preserve local history; in the places I visit, the people always welcome me and ask to assist in the historical research."[18]

References

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Castro, Sueli Pereira, Joao Carlos Barrozo, Marinete Covezzi, and Oreste Preti. *A Colonizacao Oficial Em Mato Grosso: 'a nata e a bora da sociedade'*. EdUFMT: Cuiaba, MT, 1994, pp 95-100.

16 For more information about Karis Comunicação, visit their website: http://www.tvconquista.com.br/ (accessed 2012-04-02).
17 For more information about TV Rio Verde, visit their website: http://www.tvrioverde.com.br/ (accessed 2012-04-02).
18 Email correspondence between the author and José Dario Munhak, 2011/3/31.

Resources

Survey questionnaire is accessible at the following URL (as of 2012/04/01): https://docs.google.com/document/d/1pP_qJPhlx-YjctcRvWsur2B2rBuV8DdoLCItTeo1Btg/edit

Survey data (translated from the original Portuguese to English) is accessible at the following URL (as of 2012/04/01): https://docs.google.com/spreadsheet/ccc?key=0Ai3bWoF9s1ddGtkMVpEN293MVJxeWd3WHFoUkppaFE

Lucas do Rio Verde city government website: http://www.lucasdorioverde.mt.gov.br (accessed 2012-04-01).

RECONSIDERING THE CHECKSUM FOR AUDIOVISUAL PRESERVATION: Detecting digital change in audiovisual data with decoders and checksums

Dave Rice

Firstly, what are checksums for?

A checksum is small data value computed from a given amount of data, such as a file or bitstream, for the purpose of facilitating the future ability to detect changes in that given data. The generation and verification of checksums for digital archival holdings is a central principle of digital preservation and enable archivists to trust that data held within an archive is the same data that was received by the archive. Although checksum wrangling is typically a behind-the-scenes process within digital storage systems and repositories, these values are worth a closer look. The checksum value is generally expressed in hexadecimal representation (aka base 16) comprised of the numbers 0 through 9 and the letters A through F. Several checksums algorithms, such as CRC32, MD5, and SHA-1, have been introduced offering varying degrees of processing efficiency, security, and collision resistance[19]. As an example, the CRC32 checksum value for a text file that contains the ASCII characters "checksum" would be de6fdf9a and the MD5 value for the same file would be 226190d94b21d1b0c7b1a42d855e419d. If the text file changed, whether through manipulation, bit rot, or data corruption, then further evaluations of the file would produce a different checksum value. The mismatch of a newly calculated checksum and a stored checksum produced earlier is an alert that data under care has been changed.

Within digital preservation environments, the generation and verification of checksums against digital files can aid the confirmation or denial of digital authenticity. A checksum mismatch is an alert that a file under care has changed from a prior state; potentially triggering retrieval of backups, review of hardware, or migration of content. Generally, if a given checksum algorithm is applied to a file, then as long as the same checksum can be regenerated from the file then the data is verified, else a mismatched checksum reveals a digital change. Further details such as the whereabouts, extent, or significance of the change in data are not revealed by the checksum mismatch but only that the data examined now is not the same as the data examined before.

A checksums alone is not very self-descriptive or actionable. As checksums are evaluated from digital files, the PREMIS data dictionary requires that the checksum value be stored alongside the name of the algorithm that was utilized (such as MD5) and optionally with the name of the original producer of the checksum[20]. Metadata standards such as reVTMD[21] also recommend that the date and time that the checksum was evaluated is store with the checksum as well. This information provides further context to enable future use of the checksum.

For digital preservation activities, the application of checksums is an essential recommendation; however the checksum of a file offers only a yes or no response to the question "Has this file changed since it produced an earlier documented checksum?" Within a digital audiovisual collection if the files has changed, follow-up questions could include:

> "Does the change affect the presentation of audiovisual data?"
> "Where is the change?"
> "How extensive is the change?" or
> "Do these two different files present the same audiovisual data, i.e. is one file a lossless representation of the other?"

19 While this paper will not go into detail regarding collision resilience further information is available at http://en.wikipedia.org/wiki/MD5#Collision_vulnerabilities

20 See the PREMIS Data Dictionary for Preservation Metadata at http://www.loc.gov/standards/premis/v2/premis-2-1.pdf.

21 See the reVTMD metadata schema at http://www.archives.gov/preservation/products/reVTMD.xsd.

Additionally are the checksums of digital preservation best practices as effective when dealing with the large file sizes of audiovisual data? Should checksum strategies be extended for the preservation of video? Furthermore, what other roles have checksums played in audiovisual data? This paper will examine the relationship between audiovisual data and the objectives of checksums, will review tactics to allow the effectiveness and function of checksums to scale for audiovisual content, and will review the history of checksums in use within digital video to enable error detection and error concealment.

Little Checksums for Large Files

Often in digital preservation and repository design, the whole of each digital file is documented by a checksum. One file gets one checksum. A digital collection of office documents, emails, and images may contain hundreds of thousands of files in the space of a terabyte. With the large file sizes associated with archival audiovisual data a similar terabyte may contain only tens of files. The effectiveness and function of checksums do not scale for collections with larger file sizes. In a collection of documents a checksum mismatch may identify an issue within the space of a megabyte whereas in a collection of audiovisual material the checksum mismatch may potentially make suspect dozens of gigabytes occupied by a single file. As a real world analogy a checksum mismatch of an electronic document could compare to a fire alarm triggering in an office building. The fire department is alerted to the address and floor at risk. A checksum mismatch on an archival audiovisual file covers a vast area of data – like triggering a fire alarm that alerts firefighters only to the general neighborhood.

White papers and best practice documents for the digital preservation community recommend to regularly checksum our digital collections and identify mismatches in order to monitor digital integrity, but advice on how to respond to the mismatch is hard to find. There may be two copies of the digital material, one with a checksum mismatch and one without. A stable one could replace the changed one, but a backup may not always be available. An audiovisual file with digital corruption could still look and perform as well as the original or the change may affect the container or key codec attributes that cause the process of demultiplexing or decoding the file to fail completely.

A changed bit will affect audiovisual data very differently depending on the codecs involved. A tweaked bit within uncompressed audio and video would most likely be imperceptible to notice, changing at most one pixel or one audio sample. Audiovisual data with compression, whether lossless or lossy, could be affected dramatically; depending on the type of codec a changed bit could alter anywhere from a section of a frame to several frames of video[22].

Checksums Within Audiovisual Data

Outside of digital preservation environments, checksum functions and features have been integrated into many audiovisual codecs and containers to suit different purposes. There are checksum applications existing within some types of audiovisual data that do enable a more specific response than whole file checksums can allow. Some of these applications deal with error detection and error concealment and can identify which frames have changed in order to minimize the visual effect of the error during presentation. Other applications of checksums enable the confirmation of whether a losslessly transcoded file represents the original encoded data authentically or confirm whether the contained audiovisual data is maintained accurately even when other embedded metadata tags within the same file have been added or altered.

22 Resilience of various audiovisual codecs and containers to digital corruption can be tested with an input fuzzer. See, for example the zzuf application (use cautiously): http://caca.zoy.org/wiki/zzuf

DV Tape and DIF Block Parity Data

DV tapes, such as DVCam, miniDV, and DVCPRO, contain encoded digital streams of audiovisual data. Given the small size of the digital tape, damage to the data held on the tape is commonplace and the DV codec and DV hardware are designed to anticipate handling damaged data through video error concealment and controlled audio dropouts. When a DV tape is recorded, audiovisual data is divided into DIF blocks and written onto the tape digitally. The data of each block is analyzed through an algorithm to produce a very small checksum (aka parity data) that is also written with the DIF block. With this parity data, a DV deck can read the DV tape and verify if the data is read properly or identify audiovisual data that mismatches with its corresponding parity data. Rather than play damaged or unexpected data, the DV hardware will either copy from the corresponding DIF block of the last valid frame or drop out the audio. In these cases the digital damage to the tape is corrected but is concealed to minimize the visual or aural impact and make the damage less noticeable. Storing parity data during recording to tape and verifying parity data during reading from tape, allows DV hardware to incorporate restoration principles in playback so that inaccurate audiovisual data may be concealed with an approximate of the data lost. If the DV data is transferred from the tape to a file without undergoing any transcoding the resulting file-based DV stream will contain data that notes the location of frames and DIF blocks that contained checksum mismatches[23]. Since DV on a tape contains one checksum per video block of a frame, this data can enable the preservationist to know how extensive any digital damage is and where it is located. Although the checksum, in this case, can not correct the data the use and assessment of these mismatches can inform the archivist's response so that the tape may be transferred under adjusted circumstances in hope to produce a more digitally accurate data transfer. In this case the embedded parity data within a DV stream, evaluated at the time of the recording, enables a more precise response to the digital damage than with a whole file checksum.

MPEG and CRC Checks

MPEG streams are designed to decode gracefully even when interference or digital corruption hinders the transmission process. Formats such as MP3 or MPEG-2 transport streams may contain CRC (cyclic redundancy check) checksums that verify the data of the previously transmitted packet of audiovisual data. When an MPEG decoder, such as a software application or digital television, receives a section of data that does not validate to the attached CRC then the decoder can discard the invalid data and await the next valid section. The CRC checksums may occur frequently within an MPEG stream and mismatches between embedded CRC and a newly interpreted one make it feasible to note the extensiveness or location of digital change or corruption. MP3val[24] is one such validator for mpeg audio streams that make use of CRC checksums. The MP3val manual notes of the

"MPEG is a streamable format, that is, it is optimized for quick and easy recovery from errors. MP3 decoders are very tolerant to inconsistencies in the input file. Most players even don't report to user about stream errors. So, as a rule, the user doesn't know whether his files are valid or broken. But using broken files can eventually lead to problems during playback on certain software/hardware."[25]

Lossless FLAC and MD5 Signatures

FLAC, Free Lossless Audio Codec, uses another approach for embedded checksums. FLAC is a lossless format that compresses raw audio data to a smaller size while maintaining the ability to decode to the exact same audio samples that it encoded. Thus a 300 megabyte BWF

23 See the DV Analyzer project by AudioVisual Preservation Solutions which can evaluate this data: http://www.avpreserve.com/dvanalyzer/
24 http://mp3val.sourceforge.net/
25 http://mp3val.sourceforge.net/docs/manual.html accessed on April 1, 2012

(Broadcast Wave Format) audio file may be losslessly compressed to a FLAC audio file at about 100 megabytes. As the lossless nature of the codec implies, the FLAC file should then decode to the exact same audio samples as the original BWF. The header of a FLAC file contains an MD5 checksum or signature that represents the original audio data that is encoded. Since FLAC is a lossless format this MD5 also represents the audio data that should be decoded from the FLAC file.

As an example, suppose a Broadcast Wave Format file called "original.wav" is processed with FFmpeg[26], an open source set of tools to process audiovisual data. The raw audio data of the file can be decoded and sent to a checksum utility. With ffmpeg installed on a computer a command could be entered within a terminal window to decode the audio samples of the BWF file and evaluate the samples with the MD5 checksum algorithm, like this[27]:

ffmpeg -i original.wav -f md5 decoded_wav.md5

The resulting file "decoded_wav.md5" would contain the following text:
MD5=6d0b18032fd23dfbf400b092eb9642f7

Using the compress utility called flac, also available as a command line application, the Broadcast Wave Format file "original.wav" may be converted to a lossless FLAC file like this[28]:

flac original.wav --keep-foreign-metadata -V -o lossless.flac

Within the header of the resulting FLAC file, "lossless.flac", is contained the MD5 signature of the original audio data: 6d0b18032fd23dfbf400b092eb9642f7 (the same checksum as produced when applying a checksum to the decoded audio data of the original file).

Although both files, "original.wav" and "lossless.flac", decode to identical audio data the two files are very distinct structurally. The whole-file checksums of the two files would be different and the FLAC file, "lossless.flac", would be a third of the size of "original.wav"; however both files should both decode to identical audio presentations. FLAC's embedded checksum offers a functional advantage of the FLAC file over the BWF file in that the specification's incorporation of the embedded MD5 checksums mean that the audio data may be verified without additional external checksum workflows. The encoding of audio data and generation of a checksum occurred in the same action and are packaged together in a single file.

The wiki at etree.org offers further explanation on the utility of using embedded checksums to document what the lossless encoded data should decode to rather than to document what the data actually is.

A FLAC Fingerprint is generated only for the audio data portion of the file. (Therefore, changing the filename or the tags or FlacMetadata does not change the fingerprint calculation.) In contrast, an .md5 is generated against the whole file, including header portions. ... Under FLAC, you are allowed to change the compression ratio and add/remove meta data to .flac files without changing the actual audio. The audio may be identical, but the extra data will completely change the .md5 checksum. Checking these

26 http://ffmpeg.org

27 Documentation and downloads for FFmpeg are available at http://www.ffmpeg.org. This command means the "original.wav" file is used as the input (-i) and to be processed into the "md5" format (-f) then the output is directed to the file called " decoded_wav.md5". With FFmpeg's default use of the md5 format the first audio and video streams of the input (in this case just a single PCM audio stream) are uncompressed to raw video and signed 16 bit audio to be processed by the md5 muxer.

28 The flac utility and documentation are available at http://flac.sourceforge.net/. This command converts the input file, "original.wav", into the output file (-o) "lossless.flac". The '-V' or --verify command is used to decode the encoded stream parallel to the encoding process to double-check the losslessness of the transcoding. If FLAC is encoded and decoded with the --keep-foreign-metadata then the FLAC may also maintain non-audio data from the source file, such as a bext chunk or other types of embedded metadata.

.md5s against the new .flac files will report failure, even though there is nothing actually wrong with the new fileset. That can cause major confusion.[29]

Codec Independent Implementations of Frame Based Checksums

FFmpeg incorporates formats called framecrc[30] and framemd5[31]. These formats were integrated in order to facilitate testing functions such as verifying that an adjusted decoder maintains intended results or that an FFmpeg decoder decodes a proprietary stream to the same data as a decoder by another vendor. Although originally intended as a testing format, the framemd5 format helps enable some of the same goals performed by checksums in the cases of DV, MPEG, and FLAC by provided a checksum of each decoded frame.

By producing checksums on a more granular level, such as per frame, it is more feasible to assess the extent or location of digital change in the event of a checksum mismatch. In recalling the analogy of a whole-file checksum for audiovisual data as a neighborhood file alarm, the additional generation of more granular checksums enables tracking of digital change or alarms with greater precision.

By decoding a file and processing the decoded data to generate a framemd5 document, each decoded audio and video frame is documented according to its timestamp, digital size, and MD5 checksum. For the first three frames of video, the framemd5 output could be[32]:

```
#tb 0: 1001/24000
0,      0,      0,      1,   518400, 5bc19af1a75adb8bda9d7939098 1a0ea
0,      1,      1,      1,   518400, bb485b0d6fd001358aa7dbe7603 1ff4d
0,      2,      2,      1,   518400, 30dc414cd4487dd58b0d16a5ddafba35
```

In this output the columns refer to the stream number, counting from zero, (column 1), the decoding and presentation timestamps (column 2 and 3), the samples duration (column 4), the size of the data checksummed in bytes[33] (column 5), and the MD5 checksum for that data.

Storing a framemd5 file along with each audiovisual file can not replace the function of a traditional whole-file checksum. That is, it is useful to have both the fire alarm for all the buildings and floors within a neighborhood, as well as the fire alarm for the whole neighborhood. It is still possible for a file to be changed in a way that would result in a mismatch for a future whole-file checksum analysis, but not create any difference between a stored framemd5 output and a newly created framemd5 output. This could occur when embedded metadata is edited but the stored audiovisual data remains the same.

For audiovisual data, storing both a whole-file checksum and a framemd5 output enables greater awareness of digital change in managed files, a more strategic and aware response to change, and the ability to verify lossless transcoding. If an audiovisual file is found to have a mismatch between a newly generated whole-file checksum and one generated previously, indicative of digital change, then comparison between a stored framemd5 document and a newly generated one could facilitate in pinpointing the digital change as it affects audiovisual presentation if at all.

29 http://wiki.etree.org/index.php?page=FlacFingerprint accessed on April 1, 2012
30 http://ffmpeg.org/ffmpeg.html#framecrc
31 http://ffmpeg.org/ffmpeg.html#framemd5
32 The output framemd5 is produced by using this FFmpeg command: "ffmpeg -i a_movie_file.mov -f framemd5 a_movie_file.framemd5". The (-i) refers to the input file, (-f) refers to the output frame which in this case is 'framemd5' and then 'a_movie_file.framemd5' is the name of the output file.
33 518400 is the number of bytes used for a frame of uncompressed YUV 4:2:0 video at 720x480.

Whole-File Checksum plus framemd5

Determining Extent and Relevance of Digital Change

Suppose a QuickTime file is documented by both a whole-file checksum and a framemd5 output and then a user inadvertently opens the QuickTime file, clicks File>Save, and then closes the file. In this process the QuickTime file will remain largely the same except that an embedded timestamp will update to the last saved date changing a couple bytes of the file. Upon the generation of a new whole-file checksum on the QuickTime file there will be a mismatch between the new checksum and the stored one, confirming the change. This checksum mismatch notes that an issue exists but offers little clue to what it is. If the QuickTime file is again used to generate a new framemd5 output, it will show that the decoded frames of the QuickTime file are identical to what was decoded before the change. With this information the nature of the change can be clarified; in this case digital change did occur but did not affect the audiovisual presentation produced by the file.

Within another scenario, a QuickTime file is migrated from one server over a wireless connection to another server and within the data transmission process a few bits are inaccurately copied. In this scenario too, the resulting whole-file's checksum would mismatch the checksum of the original file. Upon comparison of framemd5 documents between the original file and the copy, individual lines of the framemd5 documents would mismatch, revealing exactly which frames where affected by the changes and informing how extensive the change is.

The use of lossless codecs alone does not guarantee that the resulting encoded lossless audiovisual file could be used to reconstruct the original audiovisual data. A preservation-suitable lossless audiovisual encoding should decode to the same data that the original source would decode to, meaning that each pixel, frame, and timing decoded from the lossless version should be the same as the decoded original.

An original uncompressed digital audiovisual file called "uncompressed.mov" could produce this framemd5 output (the first four video frames are listed):

```
0,      0,      0,      1,   518400, 6a6b8be7dbac428b86669992cc740d10
0,      1,      1,      1,   518400, 6a6b8be7dbac428b86669992cc740d10
0,      2,      2,      1,   518400, 2eb3a9a53f42d5c6b21e3b6b7e267414
0,      3,      3,      1,   518400, e67d03e253f3997ae2db46aa28d8c749
```

Let's imagine that an archive decides to transcode the uncompressed file to a lossless codec in order to reduce storage requirements. This ffmpeg command generates a lossless ffv1 encoding from the original file and copies the audio data as-is.

```
ffmpeg -i uncompressed.mov -map 0 -c:v ffv1 -c:a copy lossless.mov
```

Generating a framemd5 report on the "lossless.mov" should produce the same output because both files, although utilizing different codecs, both decode to identical audiovisual presentations. If the two files do not decode to produce identical framemd5 documents then it is likely that the transcoding from the uncompressed codec to the lossless codec was not truly mathematically lossless[34].

34 Within some transcoding environments it can be easy to inadvertently cause a change in colorspace, pixel format, chroma subsampling or other technical audiovisual specifications between the input and the output that would compromise the losslessness of the process although the resulting codec itself may be lossless.

Under Development

At the time of this writing, the technical documentation[35] and a new version of FFV1, FFmpeg's lossless video codec, are under development. Version 1.3 of FFV1, currently marked as an experimental encoder, adds a mandatory CRC checksum to each frame header. This feature facilitates lossless encoding of video data in a manner that binds checksum protections into the encoding process. This feature allows digital lossless video collections to effectively assess holdings to identify stored data that mismatches the data originally encoded, enabling a lossless format to be self-checking.

In Summary...

The preservation of audiovisual collections requires optimization of preservation systems and practices that can scale to and endure the large file sizes required. Once within the territory of audiovisual data, the traditional whole-file checksums can appear to be slow and vague. In looking as well to checksum applications found within compression technology we can identify tactics that enable precise responses to data corruption in more granular ways. While the traditional users of the embedded checksums of DV, MPEG, and FLAC have been decoding hardware and software, the functions and opportunities of these more granular checksum approaches serve needs within digital preservation environments as well. By utilized FFmpeg's framemd5 format those advantages do not need to be restricted to a particular set of codecs. Utilizing frame-based or more granular checksumming in addition to whole-file checksums allows for more targeted discovery and could provide the archivist with an additional tool to analyze (and potentially repair) digital corruption within archival collections.

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Michael Niedermayer, FFmpeg
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Jimi Jones, Library of Congress

35 Technical documentation is being drafted here: https://github.com/FFmpeg/FFV1, accessed April 1, 2012

A WORKFLOW STUDY OF MIGRATING ANALOGUE MULTI-TRACK AUDIO RECORDINGS TO DIGITAL PRESERVATION FILE SETS

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Abstract

Migrating obsolete carriers to digital file sets is a common and accepted practice for preservation and access within the audiovisual archival community. In the creation of these digital preservation and access files, archivists are presented a wealth of opportunities, obstacles and considerations with regards to workflow and file management. Specifically, this paper examines migration workflow for analogue multi-track audiotapes and discusses media assessment, playback preparation, digitization, file management, ephemeral document capture, and metadata entry in the context of both technical and time resources. While this paper does not speak specifically to born-digital multi-track audio, many of the file management issues are the same.

Workflow methods and observations for this paper were made in the course of ongoing digitization projects within the Drexel University Audio Archives. By studying cases from this collection of diverse formats and content, this paper describes workflow processes from playback to descriptions while identifying management priorities and inefficiencies when migrating multi-track audio objects. Statistical time-cost analysis of the collection will display many of the issues involved in managing such file sets, such as file count, file association and file searching.

1. Introduction

The principles for using digitization as a preservation method are clearly established within the audiovisual preservation discipline. With regard to audio objects, digitization is usually used as a preservation method because of the condition of deteriorating media or the diminishing supply of functioning obsolete playback equipment. In either case, there is a potential threat that an audio object might become unplayable. Therefore, an active approach to migration is necessary to assure that recorded sound survives in perpetuity. The IASA technical council document *The Safeguarding of the Audio Heritage: Ethics, Principles and Preservation Strategy* (IASA TC03 2005) states that no matter how robust the carrier is, "preservation of the document in the long term can only be achieved by copying the contents to new carriers/systems". However, copying recorded sound from one carrier to another will result in generational loss such as signal degradation and added noise if the migration is performed to a new analogue carrier. Therefore, a one-time high-resolution migration to the digital domain is preferred. Not because a digital transfer is exempt from its own anomalies, but because additional noise from the migration process is minimized and, as stated in IASA TC03, "only the digital domain offers the possibility of lossless copying". As long as great care is taken to maximize the quality of the playback system and that the digitization parameters provide for a high-quality conversion, any future migrations will be performed in the digital domain, allowing for exact copies with no signal degradation or data loss. It is with these principles in mind that IASA TC03 proposed that "for the long-term preservation of the primary information contained on an analogue carrier it is necessary, therefore, to first transfer it to the digital domain"

By using digital migration as part of a preservation plan, archives must develop workflows to process audio materials in both its analogue and digital form. These include cataloging materials, preparing the analogue object for playback, digitization, and capturing all necessary descriptive metadata. These workflows are fairly well established in most audiovisual archives and file formats and metadata standards align well with mono and stereo audio objects. For instance, an audiotape becomes a .wav file while the tape boxes and paper documentation become associated .tif files.

For the digital file, all metadata needed to describe it can be neatly embedded in the file header as well as a central database for easy searching. However, when processing a multi-track object, the complexity is greatly magnified. While a .wav file can contain both streams of a stereo recording, it is unable to contain sixteen or twenty-four streams of audio that make up a multi-track tape. Therefore, each stream is contained within its own mono .wav file and additional metadata must be created to keep these files associated with each other. While embedding metadata is still possible, the description of each file within a multi-track set will be different from one another. For instance, the first file in the set may contain a recording of the bass guitar while the second file may contain a recording of the bass drum. Each file contains a recording that, by itself, does not represent the complete recorded performance. Therefore, great care must be taken for individual elements of a recording to be described in a meaningful way while maintaining its place within a complete set of elements.

This paper examines these process workflows as they relate to multi-track audio objects and the complexities that arise from a complete digital object existing as numerous discrete elements. Specifically, this paper describes each workflow process while measuring the processing time for a small set of multi-track objects that were studied during the summer of 2011 at the Drexel University Audio Archives and included selected recordings from the Sigma Sound Studios Collection. From this collection, twelve multi-track tapes were chosen. Though this is not a large sample, tapes were only processed when staffing was available to complete each step of the workflow. For data consistency, all of these objects were twenty-four-track two-inch tapes. In order to demonstrate added complexities, six of these tapes were forty-eight-track tape sets. In other words, the first tape in the set contains tracks one through twenty-four and is called the "master", while the second tape contains tracks twenty-five through forty-eight and is called the "slave". This master/slave scenario creates added complexities to processing, as two analogue objects become two sets of twenty-four .wav files that must remain associated in order to maintain record completeness.

In demonstrating workflow, one set of master/slave tapes was examined for this paper. Specifically, this tape set is a forty-eight track Gloria Gaynor recording from December 1980. Produced by Gene McFadden and John Whitehead, these recordings were released in 1981 by Polydor on the album "I Kinda Like Me". In measuring the processing time, average times from all twelve tapes were used. The workflow is broken into these processes: Object Description, Object Digitization Preparation, Digitization and Processing, Preservation and Track Metadata, and File Management.

2. Object Description

Basic object description is necessary regardless of the preservation plan. In order to have a meaningful search, each object needs to be described by a minimum set of fields. This basic set of descriptors can constitute the entire catalog entry for an analogue object. As shown in Figure 1, these fields include necessary information such as Object ID, Object Title, and Artist as well as fields to describe the objects physical characteristics and location within the repository. Furthermore, the basic description provides information regarding the contents of the recording. In the case of a music studio multi-track recording, such as this Gloria Gaynor recording, song titles and notes regarding those songs help complete the description. The information in this basic description can mostly be gleaned from written documentation on the container and included paper records.

Field Title	Field Value	Field Title	Field Value	Field Title	Field Value
Object ID	558781345	**Record Creation Date**	5/6/10	**Song 01 Name**	Chasin' Me Into Someone Else's Arms
Object Creation	12/23/80	**Legacy ID**	C316-24-1	**Song 02 Name**	The Story of the Joneses
Object Title	Gloria Gaynor Multitrack Master	**Location**	Drexel University Audio Archives	**Song 03 Name**	Yesterday We Were Like Buddies
Artist	Gloria Gaynor	**Shelf Location**	F	**Song 04 Name**	Yesterday We Were Like Buddies
Studio of Origin	Sigma Sound Studios	**Shelf Number**	23	**Song 05 Name**	I Kinda Like Me
City of Origin	Philadelphia, PA	**Project Title**	Sigma Sound Studio Collection	**Song 01 Notes**	HL + TL
Object Number of Set	1	**Object Status**	OK	**Song 02 Notes**	HL + TL
Objects in Set	2	**Status Date**	5/6/10	**Song 03 Notes**	HL + TL (Outtake)
Object Format	Analog Audio	**Object Condition**	Excellent	**Song 04 Notes**	HL + TL
Object Type	2" Tape	**Condition Date**	5/6/10	**Song 05 Notes**	HL
Manufacturer	Scotch	**Accession Source**	Sigma Sound Studios		
Make and Model	250	**General Notes**	Multitrack Master used for June 15, 1981 Polydor Album Release of Gloria Gaynor - I Kinda Like Me.		

Figure 1. Basic Object Description

This basic description provides the necessary information to clearly understand the recorded contents of an analogue object. Since this description is derived from already existing documents, the time it takes to enter the data is not great. However, this description is inadequate to describe the object once it has been digitally migrated. Therefore, once digitization has been identified as a preservation method for an analogue object, a richer set of metadata must be captured. This richer set, however, cannot be entered until the digitization process has been completed, as the necessary information will not be entirely known.

3. Object Digitization Preparation

Before an audio object can be digitized for preservation, preparations must be made to assure a successful migration. The first step in this process is to assess the objects condition and playability. This step is usually accomplished by a simple visual inspection. With most modern multi-track tapes, the main concern is sticky-shed syndrome, whereby hydrolysis can greatly hinder playback quality (IASA 2009, p.51). Examining the tape pack and observing if the tape falls easily away from the pack can usually determine this condition. Once the overall condition is determined, it is possible to create a playback strategy that may or may not include restoration processes to maximize playability. For instance, if mold growth has been detected, cleaning the tape may be necessary before playback. If sticky-shed syndrome has been detected, baking the tape may be necessary. However, while baking a two-inch tape can take many hours to perform, it does not require active monitoring. Therefore, without the need for person-hours, calculations in this paper do not include baking time.

Once the object is ready for playback, all necessary equipment must be calibrated to maximize playback quality. This process starts with demagnetizing the playback machine and cleaning all tape path surfaces. The playback machine must then be calibrated so that the playback will match any included project tones. Or, if there are no available project tones, it must be calibrated to an appropriate playback level using a test tape. Calibration will also include aligning any noise reduction system that was used in the original recording. In the case of studio created musical recordings, Dolby™ type A or SR noise reduction is commonly used. While calibration is a fairly straightforward technical process, the shear number of presented audio paths can complicate multi-track calibration. For instance, processing time to calibrate twenty-four channels of playback simply takes considerably more time to complete than a two-track playback calibration.

Lastly, the Digital Audio Workstation (DAW) must be prepared for digitization. This may include calibrating the converters to a specific operating reference level and setting all appropriate input paths. However, the primary preparation is to assure that the appropriate file types are chosen and that all the conversion parameters are set to preservation quality standards.

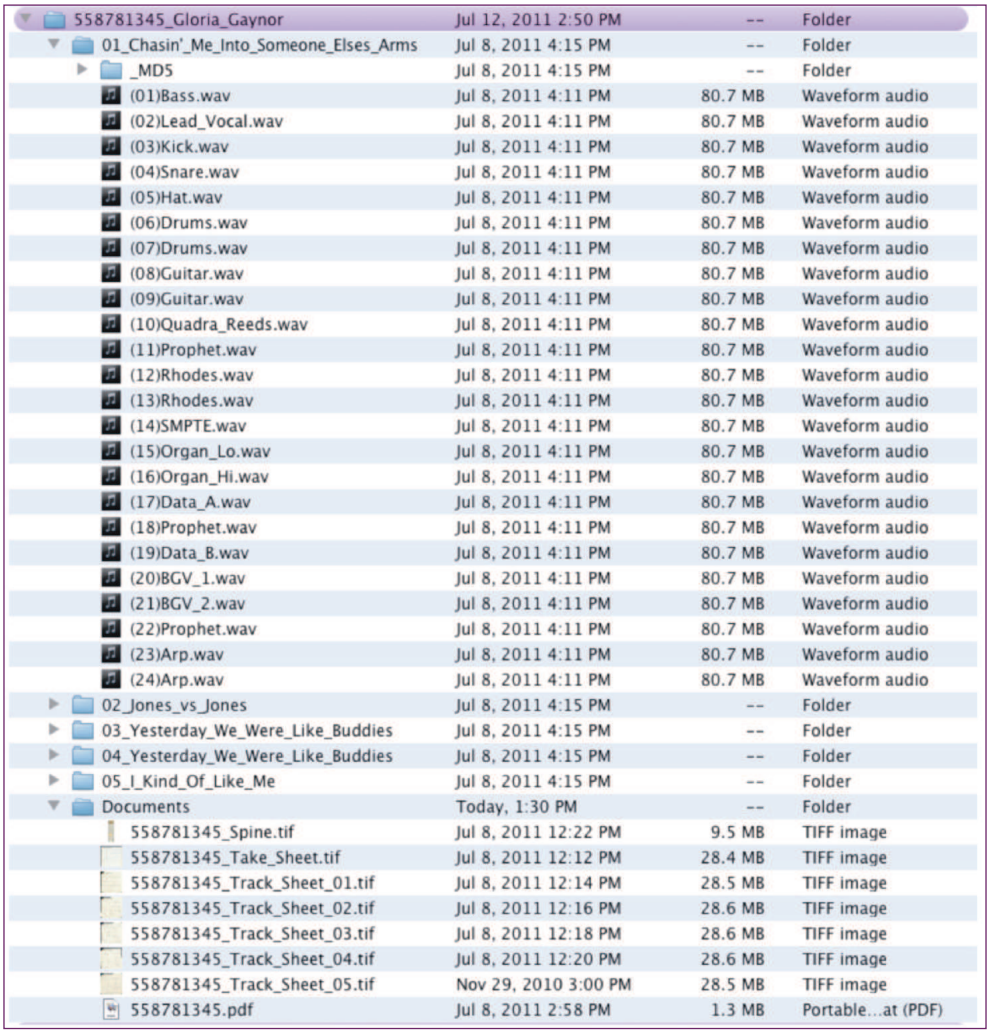
Object digitization preparation time can vary depending on the object condition and the complexity of the calibration. However, proper preparation is vital for successful digitization and cannot be minimized to save time. While this description of preparation is not a step-by-step procedure, it serves to show the scope of the process and its importance.

4. Digitization and Processing

Digitization of the analogue object is simply a real-time playback while re-recording the audio streams into a DAW. Therefore, after object preparation, the time spent digitizing is roughly equal to the playing time of the object. However, it is vital to monitor the process to assure that the quality of all audio streams are not compromised and that there are no unforeseen circumstances that interrupt the process.

After digitization, it is also wise to examine the files for quality assurance. Digitization, however, is not only an audio event. All documentation that is written on the analogue container as well as all paper documents that accompany the object requires scanning to preservation quality .tif files. The number of scans will vary. However, most studio created tapes will require scanning of the tape box, a take sheet, and a track sheet for each song. Other documents may include musical charts, lyric sheets, and equipment recall sheets.

After digitization, it is important to export each song, or recorded event, to an individual file set. For instance, each song on a twenty-four-track object should constitute an individual file set of twenty-four discrete mono high-resolution .wav files. The reasoning is simple. When it comes to file naming, each song's set will require different names per track that match that song. For instance, track nine of song one may be a guitar recording while track nine of song two may be a piano recording. While this may add to any potential disassociations, having discrete files sets for each song will allow for more meaningful metadata regarding each track to be collected. Figure 2 shows the completed file sets for object one of the Gloria Gaynor tapes. Displayed are the song file sets along with the associated scanned documents.



558781345_Gloria_Gaynor	Jul 12, 2011 2:50 PM	--	Folder
01_Chasin'_Me_Into_Someone_Elses_Arms	Jul 8, 2011 4:15 PM	--	Folder
_MD5	Jul 8, 2011 4:15 PM	--	Folder
(01)Bass.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(02)Lead_Vocal.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(03)Kick.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(04)Snare.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(05)Hat.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(06)Drums.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(07)Drums.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(08)Guitar.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(09)Guitar.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(10)Quadra_Reeds.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(11)Prophet.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(12)Rhodes.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(13)Rhodes.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(14)SMPTE.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(15)Organ_Lo.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(16)Organ_Hi.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(17)Data_A.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(18)Prophet.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(19)Data_B.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(20)BGV_1.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(21)BGV_2.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(22)Prophet.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(23)Arp.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
(24)Arp.wav	Jul 8, 2011 4:11 PM	80.7 MB	Waveform audio
02_Jones_vs_Jones	Jul 8, 2011 4:15 PM	--	Folder
03_Yesterday_We_Were_Like_Buddies	Jul 8, 2011 4:15 PM	--	Folder
04_Yesterday_We_Were_Like_Buddies	Jul 8, 2011 4:15 PM	--	Folder
05_I_Kind_Of_Like_Me	Jul 8, 2011 4:15 PM	--	Folder
Documents	Today, 1:30 PM	--	Folder
558781345_Spine.tif	Jul 8, 2011 12:22 PM	9.5 MB	TIFF image
558781345_Take_Sheet.tif	Jul 8, 2011 12:12 PM	28.4 MB	TIFF image
558781345_Track_Sheet_01.tif	Jul 8, 2011 12:14 PM	28.5 MB	TIFF image
558781345_Track_Sheet_02.tif	Jul 8, 2011 12:16 PM	28.6 MB	TIFF image
558781345_Track_Sheet_03.tif	Jul 8, 2011 12:18 PM	28.6 MB	TIFF image
558781345_Track_Sheet_04.tif	Jul 8, 2011 12:20 PM	28.6 MB	TIFF image
558781345_Track_Sheet_05.tif	Nov 29, 2010 3:00 PM	28.5 MB	TIFF image
558781345.pdf	Jul 8, 2011 2:58 PM	1.3 MB	Portable...at (PDF)

Figure 2. Individual File Sets

5. Preservation and Track Metadata

Preservation metadata describes the process and technical parameters of the migration process. This data set contains information about tape preservation, playback equipment, calibration specifications and digital conversion parameters. Figure 3 shows the preservation metadata that was captured for the Gloria Gaynor tape set and the metadata that is traditionally captured for each audio object. Many of these fields are auto-filled, as most of the technical specifications rarely change. For instance, the same digital converters are used for all digitization within the Drexel University Audio Archives. Therefore, once calibration specifications are determined, the calibration and conversion parameters will generally remain the same.

Field Title	Field Value	Field Title	Field Value
Tape Baked	No	Track Count	24
Date Baked	n/a	Noise Reduction	Dolby A
Baking Temperature	n/a	A/D Converter	Apogee AD-16X
Hours Baked	n/a	File Format	BWF
Hours Cooled	n/a	Sample Rate	96 KHz
Transfer Date	11/29/10	Bit Depth	24 Bits
Object Sides	1	Alignment Tones	558781345
Source Machine	Studer 827	Conversion Reference	-16 dBFS = 0 VU
Object Speed	15 ips	Transfer Software	Pro Tools 9
Track Configuration	Multitrack	Transfer Drive	DUAA_INT_01

Figure 3. Preservation Metadata

While preservation metadata is comprised of a small and consistent set of information, track metadata is much more complicated. For instance, track metadata must include information for each song as well as metadata to describe each file in the set for each song. In Figure 4, the information for one song from the Gloria Gaynor objects is shown. Each individual song will not only have its own title, but often a different set of songwriters, producers and engineers. It is in this data scheme where the complexity of describing multi-track audio objects becomes apparent.

Field Title	Field Value
Song 05	I Kinda Like Me
Songwriter	Gloria Gaynor
Songwriter	Edward Alfred Sierra
Producer	Gene McFadden
Producer	John Whitehead
Engineer	Dirk Devlin

Figure 4. Song Information (Song 05 from object one of the Gloria Gaynor set)

However, these complexities become more apparent once metadata for each file is created. For instance, with a twenty-four-track object, descriptions are required for all twenty-four files created for each song. The track number (to maintain original order), track name and comments can generally be gleaned directly from the original track sheets of the analogue object. However, there are a few issues with using this information verbatim. For instance, the Drexel University Audio Archives collects the track name verbatim under the heading of "original name". This allows for any original misspellings, abbreviations or colloquialisms to be included in the record. However, a standard vocabulary within the database is maintained under the heading "track name". This requires the cataloger to translate the original name to the track name using an established vocabulary. Furthermore, it is also important to make sure that what is listed on the original track sheet is indeed what that file contains. The differentiation between original name and track name allows for the correction of potential inconsistencies. Figure 5 shows the entered data for a single twenty-four-track song and the relationship between fields.

Track Number	Track Name	Performer(s)	Comments	Original Name
1	Bass	Jimmy Williams	Dir	Bass
2	Lead Vocal	Gloria Gaynor	3/23/81 O/D Bounced 87 Hi Pass -2@1.2pre, +2@10kpost	New Lead
3	Kick	Keith Benson		BD
4	Snare	Keith Benson		Snare
5	Hat	Keith Benson		Sock
6	Drums	Keith Benson	Sc	Drums
7	Drums	Keith Benson	Flt	Drums
8	Guitar	Roland Chambers		GTR
9	Guitar	Dennis Harris	Denis	GTR
10	Prophet	Jerry Cohen	#2	Prophet
11	Sax	Sam Peake	O/D #3 Key from 18	Sax
12	Clavinet	Jerry Cohen	3-19-81	Clav
13	Clavinet	Jerry Cohen	3-19-81	Clav
14	Congas	Daryl Burgee	3-18-81 O/D #2 Prime Choice	Congas
15	Data B			Data B
16	Crumar	Jerry Cohen	3-19-81 O/D #1 Hi	Crumar
17	Prophet	Jerry Cohen	3-19-81 O/D #1	Prophet
18	Sax	Sam Peake	1-18-81 O/D 1	Sax
19	Sax	Sam Peake	3-18-81 O/D #2 Kepex from Trk 18	Sax
20	BGV 1	Carla Benson, Evette Benton, Barbara Ingram	3-18-18 Girls O/D	BKGD
21	BGV 2	Carla Benson, Evette Benton, Barbara Ingram	3-18-18 Girls O/D	BKGD
22	Crumar	Jerry Cohen	1-12-81 O/D #2 Lo	Crumar
23	SMPTE		off sync head	SMPTE
24	Claps		1-12-81 O/D #2	Claps

Figure 5. Track Metadata for a single song (Song 05 from object one of the Gloria Gaynor set)

When entering track metadata, the cataloger has the opportunity to enrich this data with information not readily available. For instance, the original track sheets may include performer information. However, it may not, and, as seen with track naming, spellings may be inconsistent. Therefore, in an effort to maximize the database search potential, researching performer information and entering performer names using an authority file can greatly enhance the track metadata. However, this research time and data entry increases processing time that may or may not be deemed cost effective. For this paper, this additional processing time was measured to quantify its impact on data entry.

6. File Management

To complete processing, file management procedures are needed. These procedures include file naming, Global Unique Identifier (GUID) creation and MD5 Checksum creation. In the case of the Drexel University Audio Archives, these final processes are automated. For instance, information from the database is collected and, with custom software, all files are renamed to match the database names, GUIDs are created and inserted into the file header and MD5 Checksums are created for future data integrity checks. Once this process is completed, all GUID and MD5 data is imported into the database to complete the record. At this point, all files, objects and descriptions are formally tied together. The processing time for these file management procedures is quite consistent due to the automated process. Therefore, while this step is vital in maintaining proper file association, its impact on processing time is minimal.

7. Conclusions

7.1. Processing Results – Gloria Gaynor tape set

The Gloria Gaynor tape set that has been used to illustrate each workflow process consisted of two tapes, a master and a slave. The master tape contained five songs, while the slave tape contained only four. This song imbalance is due to an outtake of one song remaining on the master tape for which a slave object was never created. Therefore, from these two tapes are nine audio file sets. Within these file sets are 216 .wav files with their corresponding 216 .md5 checksum files. Scans of the container and paper documents yielded 13 .tif files. Managing these file sets was complex, because four of the songs on the master require association to the four songs on the slave to maintain completeness. However, these file sets represent separate

analogue objects. Their digital migration results in files that need to remain together while also maintaining a representation of separate original objects. Figure 6 illustrates this file association.

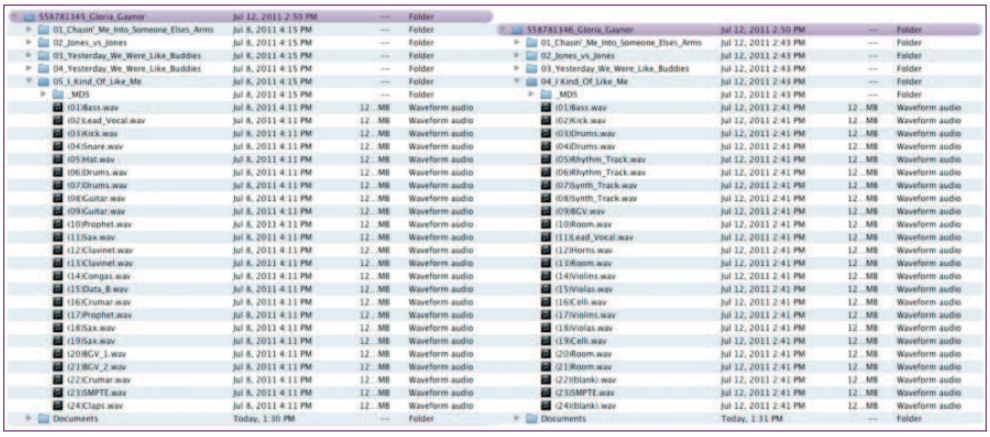


Figure 6. File association for Master and Slave multi-track tapes.

Processing this tape set took a total of 5.1 hours to complete. In that time a total of 1832 description fields were added to the database. Of those 1832 fields, 1100 were automated, which saved significant processing time. Of the manually entered fields, only 66 were entered for the basic description, 40 were entered as preservation metadata, and 732 were entered as track metadata. From these numbers, it is clear that multi-track processing can be a labor-intensive endeavor. Specifically, the greatest number of entered fields is in track metadata. However, this data is vital to keeping files properly named and described. While these fields also include enhanced metadata that requires research time, there is no shortcut to track names and comments. Furthermore, the 5.1 hours of processing time assumes 100% productivity. Therefore, processing these two tapes would roughly constitute an entire workday's worth of processing time.

7.2. Processing Results – Complete Study

With regard to the entire bulk of studied tapes, processes were measured and averaged to get a sense of what full multi-track processing entails. Each process in the workflow was timed, recorded and averaged to not only determine how long each process takes, but to also help identify processes for which the time-cost involved might be deemed too high and where efficiencies might be made. For instance, the average time to complete a twenty-four-track object with a full description is 2.2 hours. However, if the enriched information and its research time are excluded, processing is reduced to an average of 1.9 hours. While this reduction in processing time is not insignificant, it is also not a huge burden. Therefore, it must be determined if the additional descriptive information is worth the time-cost involved. A case could be made either way. For instance, the added information aids in searching and provides more meaning to search results. However, with limited resources, an institution may determine that any savings in processing time is necessary.

With regards to object description, the basic description for each analogue object takes an average of 7.6 minutes. For data entry consistency, authority files were consulted. This process took an average of 5.7 minutes per object. However, it was observed that commercial recordings garnered more results from authority files than non-commercial recordings. Therefore, the recorded content may have some effect on authority file searches. Furthermore, authority file searches for the basic description only need to be performed on one object of a set, because the information will be the same for all objects. In the case of a master/slave set, only one search for two objects needs to be performed.

In the case of digitization preparation, an average of 18.5 minutes per object was measured. This average time is greatly effected by the availability of project test tones and the quality of those tones. For instance, in some cases, the printed project tones change level unexpectedly or certain channels were printed improperly. In these cases, the operator may need to check with a standardized test tape for level assurance. To gain consistent results, the study performed for this paper used only twenty-four-track objects. However, the number of audio channels that require calibration will have an impact on calibration time. For instance, a sixteen-track object will require less time to calibrate than a twenty-four-track object. As stated earlier about restorative practices, because tape baking does not require staff activity, any necessary restorative baking time was not included in this calculation.

Digitization is roughly a real-time endeavor. Therefore, a recording's content length has great affect on digitization time. However, as mentioned before, each song or recorded element needs to be exported as a separate set of files. Therefore, after digitization, some post processing time is needed. With that in mind, the average time needed for digitization and post processing was 29.1 minutes per object. Unlike authority file searching, there is no reduction in processing time with digitization. Each object requires real-time playback regardless of its associations. With each object studied, containers and paper documents were scanned, averaging 5.2 scans per object. The time it took to scan these documents was an average of 7.5 minutes. Obviously, scanner speed and document quantity have a significant effect on this measurement.

Preservation metadata entry incurred the smallest amount of processing time. As many of these parameters do not change, the database can easily be designed with pull-down fields, which allows for quick data entry. Therefore, the average time to enter preservation metadata was only 2.8 minutes. Regardless of the content, this entry time is extremely consistent.

Unlike preservation metadata, track metadata requires significantly more entry time. For instance, the average time to enter track metadata is 31.3 minutes per object. This measurement translates into an average of 9.7 minutes per song. Therefore, given an identical track count, there is a direct correlation between entry time and the number of songs per object. For instance, if a tape was recorded at a tape speed of 15 inches per second, it is possible for that tape to contain more songs than one recorded at a speed of 30 inches per second. Additionally, there exists the opportunity to enrich the track metadata by researching and entering performers, songwriters and any other pertinent information that is deemed valuable for searching or research. In this study, the time it took to research and enter enriched metadata averaged 15.2 minutes per object. This process represents a significant amount of time-cost. However, it can be argued that this enriched metadata provides valuable information to potential researchers. Similar in nature to the authority file search, more information can be found regarding commercially released recordings, which can increase the time to complete this process.

File management is another process that, because of automation, does not incur a great time-cost in processing. For instance, the average time to names files, create GUIDs and MD5 Checksums and import that data back into the database only takes 11.1 minutes. Considering that this process requires multiple data exports and imports, file management is a rather efficient endeavor.

With these measurements, it is possible to paint a complete picture of processing workflow and time-cost for multi-track audio object processing. For instance, it takes a total average of 13.3 minutes to describe a twenty-four-track audio object. That time includes authority file searching. To digitize the same object and describe it to its fullest extent, it takes an average of 2.2 hours.

If one excludes the enriched metadata when entering track metadata, total processing time can be reduced to an average of 1.9 hours. To put these numbers into perspective, they will be applied to the holdings of the Drexel University Audio Archives, which houses 1201

twenty-four-track objects. Table 1 shows how many 40-hour workweeks are required to complete each scenario. It is important to keep in mind that these numbers assume 100% productivity.

Processing	Time per object	Total 40-hour workweeks required
Analogue Objects with Basic Description	13.3 minutes	6.7
Digital Objects with Full Description	2.2 hours	66
Digital Objects with basic Description (no enriched metadata)	1.9 hours	57

Table 1. Required processing time for 1201 objects

With the complexity and time costs associated with multi-track audio processing, any repository interested in maintaining a multi-track collection must determine feasibility. For instance, can the processing time-costs for the digital preservation of multi-track audio objects be absorbed? While archival value is not always defined in monetary terms, the additional time-cost may seem reasonable if it provides a high level of research value. For instance, the additional time can garner a rich database, which can help open access to researchers. But then we must ask: does better access justify the processing costs? Or, would it be more appropriate to take a targeted digitization approach, where objects are only processed when requested or in need of preservation? In any case, the processing of multi-track audio objects is a significant undertaking. Defining appropriate workflows and efficiencies is vital to the success of maintaining a multi-track audio collection with digitization as the primary preservation plan.

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Discography

Gloria Gaynor, *I Kinda Like Me*. Polydor, 1981.

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NOTES