46TH ANNUAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION OF SOUND AND AUDIOVISUAL ARCHIVES (IASA)

All for One — One for All: Common Concerns — Shared Solutions

Paris, France
27 September – 1 October 2015

The International Association of Sound and Audiovisual Archives (IASA) announces its 2015 annual conference to be hosted 27 September through 1 October at the Bibliothèque nationale de France, in "La Ville-Lumière", Paris, France. IASA welcomes all who manage and care for the world's sound and audiovisual heritage to come together in Paris, the enchanting city of light, where we will explore innovative and tested solutions to contemporary issues that face us all.

In reference to Dumas's *Three Musketeers*, and in honour of hosting a conference in this centre for knowledge and national heritage, the 2015 Annual IASA Conference will boast the theme:

All for One — One for All: Common Concerns — Shared Solutions.

We invite one and all to the Bibliothèque nationale de France on 27 September through 1 October 2015 to discuss these sub-themes:

- Archives without walls — semantic networks and born digital information
- Organizing knowledge
- Legal deposit
- Archive workflows
- Selection — acquisition, preservation, and access
- Collaborative description
- Obsolescence

The programme will include Papers, Tutorials, and Practical Workshops.

...and then, we urge you to stay one more day in Paris for the first ever, Europeana Sounds International Conference on 2 October 2015 in the Grand Auditorium of the Bibliothèque nationale de France. This one-day conference celebrates Europeana Sounds, a ground-breaking project of the European Commission and the Europeana Sounds Consortium to provide access to Europe's sound heritage. IASA is excited to collaborate with this important event.

Please find all conference information on the conference website at http://2015.iasa-web.org.

For any further information or questions please contact the Organizing 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

iasa

THE WORK OF THE ARCHIVE IS UNENDING

I began my career as an archivist working in the archive of the late American folklorist and collector, Alan Lomax. My connection to the Alan Lomax archive was connected to my experiences as an independent sound engineer for various music groups in Memphis, Tennessee and other locales in the U.S. For over four years, I worked with colleagues to help bring order to the immensity of Lomax's collections and to complete efforts to digitize the extent of the recordings that Lomax himself had collected over the course of his 60+ active years of documentary work.

Heavily steeped in the issues of sound archiving, I was led from this experience to acquire further education in a graduate program for Museum Studies at the University of Kansas in the United States. I had begun to see the richness that can be found in archives, but I wanted to see the bigger picture more clearly. I wanted to know more about the construction of archives, about the history, and about the theories that underlie the archival process. I began to read far and wide about archives — all types of archives — and I began to learn about the inherent politics of archives: the fact that memory can be created and erased within an archive, the fact that archivists themselves play central roles in the course of human social memory. One archivist-author in particular spoke to me in his writings. This author had experienced the political complexity of archives firsthand, in a country that underwent a process of rapid and profound political change in the early 1990s. I learned from this archivist that archives can be agents for healing (individual and social) and for justice. Wrongs can be righted and hidden voices can be discovered within the archives. I also learned the value of looking at what archives do on the ground — the innerworkings, the people, the collections, the users — while also analysing what it is that archives symbolize in their locations — be it the community, the state, the country, or the world. That there is a multi-dimensional continuum from which archives can be measured.

At the IASA conference last year in Cape Town, South Africa, we all had the chance to hear from this author firsthand. His keynote spoke of ghosts in the archive, but for me I was hearing the words of a living South African archivist whose writings had been one of the foundational building blocks of my archival philosophies. Verne Harris, Director: Research and Archive, at the Nelson Mandela Foundation, opens this issue of the IASA Journal with a text adapted from his keynote at this year's annual conference. I am honored to include Harris' work in the IASA Journal. His text encourages archivists to reach out continually to those who are absent from the archive and to be aware that what is absent is always present, reminding us that there is much to be done to ensure that our archives are serving their intended publics. For Harris, and many others, justice is a central archival purpose. Harris' text concludes reminding us that the fight for justice is ongoing.

This issue of the IASA Journal addresses another central challenge for archives today: the rush to preserve sound and audiovisual recordings before they are lost to obsolescence and degradation. This is not only a threat to physical objects. If we agree that archives serve as a source for social memory and heritage, then this is a definite threat to our global memory and heritage — and this fight is also ongoing.

Michael Casey, from the University of Indiana in the United States, is not only a proponent for organized and intentional action on behalf of archives to salvage recorded heritage but he has led the fight in the U.S. to secure institutional funding for such activity. And at IU, Casey and colleagues succeeded in mounting one of the largest institutionally-funded audiovisual preservation efforts to date. Casey's call to action in this issue delineates the obstacles, articulates the solutions, and provides evidence of archives in the U.S. who are actively engaged in the process of programmatic reformatting.

New Zealand suffered from severe earthquakes in 2010. Marie O'Connell and her colleagues at the New Zealand Archive of Film, Television, and Sound were faced with the task of putting the archive back together after the tremors dislocated and shuffled the contents of the archive

into a complete disarray. O'Connell shares her experiences and offers a reminder that even as obsolescence and degradation threaten audiovisual collections, we must make sure our disaster preparedness plans are up to date and that they take into account the most likely disasters that could occur in the archive's vicinity.

This issue of the journal includes two articles from the NOA team in Austria. I think they are important articles to include because they propose arguments for two issues that are currently looming in the audiovisual archive world. In the context of broadcast archives, the first article (Kummer, Kuhnle, and Gabler) proposes a balance between production and preservation in terms of digital file management, specifically that of digital video files. With IASA-TC 06 in process, this article provides useful arguments for scenarios when an archive might select an ffv1 codec over uncompressed or jpeg2000. The authors also argue for the use of AVI as an interim storage wrapper for broadcast archives. The second NOA contribution comes from Sebastian Gabler, who presents a method for managing digital time-based audiovisual assets using metadata at an abstracted level. In Gabler's view, for access purposes, an archive needs only to work from one set of digital files. Access to content at full duration, in segments, or any other combination or slicing of files can be provided through a combination of well-designed metadata and automated file processing.

Building on the theme of degradation to audiovisual materials, specifically magnetic media, this issue offers two scientific studies of methods to combat Soft-Binder-Syndrome (SBS) in magnetic tape. Enric Giné Giux from the Sonology Department at the Escola Superior de Música de Catalunya in Barcelona, Spain, provides a study on a batch of 500 compact cassette tapes from the collection of late pianist Alicia de Larrocha. Giné Giux's article illustrates a re-lubrication method that provided successful outcomes for digitization of the audio contained on the cassettes. Federica Bressan, Sergio Canazza, and Roberta Bertani, all from the University of Padova, Italy, provide a careful evaluation of the effects that thermal treatment (i.e., baking) has on magnetic tape stocks. Although the authors do not condemn the process, they provide evidence that there are risks to the process and that there is not a "one-size-fits-all" recipe for thermal treatment.

Reporting on migration efforts in southern Africa, Thandie Puthologo and Ruth M. Abankwah, at the University of Namibia, have written a comparative analysis of the migration process from analogue to digital formats for broadcasting at Botswana Television and at the Namibian Broadcasting Corporation. This article largely evaluates the readiness of viewers to receive digital vs. analog broadcast signals. Although slightly tangential from the archives trajectory, the paper is important because it reminds us that technological changes in the generation and delivery of audiovisual content have ramifications at all stages of the access cycle, even within the homes of everyday citizens. Analog obsolescence, in this case, is unavoidable for TV viewers.

Back in the archive, Austin Schultz, from the Oregon State Archives in the U.S., reports from first-hand experience with technological obsolescence — The Sawyers Rols dictation machine, to be precise. Schultz and his colleagues were faced with zero access to over 1,400 Rols audio recordings. Read Schultz's article to see how they overcame obsolescence to provide access to the first 20 Rols tapes, and what their plans are for the remainder.

Not all audiovisual archives are broadcast oriented, nor are they completely audiovisual oriented. Actually, most archives are of the sort that contain and provide access to a mixed array of content, including manuscripts, photographs, monographs, sound recordings, films, videos, 3-D materials, and any other type of documentary medium one can imagine. In these types of archives, historically, audiovisual content has been pushed to the side, overlooked, or hidden, as Megan McShea suggests in her contribution in this issue. McShea, of the Smithsonian Archives of American Art in the U.S., shares the results of a three-year project carried out at the Smithsonian to investigate methodologies for processing mixed-media collections with more efficiency and with assurance that audiovisual content receives equal attention and coverage in the process. Additionally, as appendices, McShea provides thorough documentation for processing audiovisual material in mixed-media collections that can be useful to archives looking to improve processing times, minimize backlog, and improve access.

Wrapping up this issue of the IASA Journal is an article from a recent winner of IASA's Research Grant Award, Gustavo Navarro. Navarro provides a report of his IASA-sponsored work to document and preserve recorded histories of the inhabitants of Southern Patagonia in Argentina in collaboration with the Municipal Archives of the province of Santa Cruz. Navarro's report includes documentation of his work to collaborate with the Municipal Archives as well as an overview of how the project partners decided to provide access to the recordings that were created and preserved during his project.

As Editor, I want to express my thanks to all the contributors to this issue. The journal received enough expressions of interest for this issue that I was forced to request that twelve articles be placed on hold until the next issue (Issue 45). This is a great problem to have and I hope that the IASA community continues to desire to publish work in the journal. As I have said in past editorials, the IASA Journal is a mouthpiece for the audiovisual archives community and all are welcome to contribute. It is here that we can continue to engage in discourse about important contemporary issues, share information about ongoing activities, and philosophize about what the future holds.

We look forward to hearing from you.

Bertram Lyons
Editor, IASA

Dear IASA friends and colleagues,

IASA-1000. This is the motto I propose for my term as president. While I recognise that such a membership target is probably unrealistic, I believe in setting the bar high when jumping into the future. To get anywhere close, we will need to understand what draws members to our sister associations, we will need to draw on our competitive edge, and we will need to effectively market the value IASA adds for a reasonable membership fee.

IASA has undergone significant changes in recent years to remain relevant and to raise the profile of the association. The most significant were changing the constitution and incorporating IASA as an entity under UK law. It is my task to take IASA forward in the direction set by past presidents Richard Green and Kevin Bradley and consolidated by Jacqueline von Arb. To venture beyond the steps of these three past presidents and to match the achievements of the past presidents before them in shaping the IASA we know, is daunting and intimidating — to say the least. At the same time it is comforting to draw from the legacies of the presidents before me and to be guided by their actions, their work, and their examples.

Only two new members were elected onto the Executive Board: myself and Judith Gray (as our new Vice President for Membership). Jacqueline von Arb moved into the supportive role of Past President, while the other board members retained their positions: Pio Pellizzari as Vice President: Training & Education; Bruce Gordon as Vice President: Conferences; Lynn Johnson as Secretary-General; and Bertram Lyons as Editor. Tommy Sjoberg remains as Treasurer and Richard Ranft as our very capable web manager. Indeed a very experienced and accomplished Executive Board to take IASA into the next three years. I would like to extend my thanks and gratitude to Alvaro Hegewisch, our previous Vice President for Membership, for the work he did and the role he played (and is still playing) in promoting IASA in the Ibero-American region, as well as to Kevin Bradley for outstanding leadership as IASA president and past president. Under Kevin's leadership IASA adopted a new constitution, became an incorporated entity, introduced sponsorships for additional IASA revenue and changed the organising model for our annual conferences.

My vision for IASA was embodied in my election declaration and is based on five strategic objectives to ensure the financial health and future sustainability of IASA:

- Maintain IASA's financial health by building professional partnerships, as well as looking at opportunities to operate more effectively in the EU.
- Promote an active membership and encourage participation in IASA's activities. In this regard it will be vital to keep IASA affordable for members.
- Finalise the administrative arrangements arising from IASA's incorporation under the laws of Wales and England, including a professional secretariat.
- Continue the work done by IASA with regard to government organisations and NGO's in ensuring that sound and audiovisual heritage remain part of international discussions.
- Maintain and promote the training initiatives undertaken by IASA and continue to seek partnerships in this regard.

As such, I intend to focus on growth opportunities for IASA and to involve you in our plans to be discussed at our next Executive Board meeting in March 2015. One of the issues we will be looking into is our membership fees structure. With a new constitution and our positioning as an incorporated entity, it may mean we need to overhaul our membership fee structure to attract new members.

Training initiatives remain a core focus for opportunity. With the excellent work Pio Pellizzari and his colleagues are doing we are looking forward to more and exciting initiatives. In this regard, the TC, as always, plays a vital role with the publication of the TC guidelines. The latest and long overdue *Handling and Storage of Audio and Video Carriers* IASA-TC 05 skilfully edited by Dietrich Schüller and Albrecht Häfner is another fine example and contribution. The IASA TC-05 was formally launched during the recent Cape Town Conference during

which both Dietrich and Albrecht were acknowledged for their work on the publication. Their longstanding commitment to IASA and the TC is commendable.

IASA's new status from now on requires the formal submission of our first financial statements under UK law. Both Tommy and Jacqueline worked hard to ensure that all required documentation was submitted to the UK Companies House in good order. The next few months will see more submissions from us (as per requirements) and as we grow into this new role and venture.

IASA's relationship with UNESCO has always been strategic and constructive. UNESCO has also gone through changes over the past few years. IASA has to rekindle the relationship and strengthen ties with UNESCO to maintain a meaningful partnership that benefits both organisations. In addition, we will maintain our relationship with the CCAAA and look for opportunities to build strategic partnerships with NGOs, sister organisations, and the private sector.

This brings me to our 2015 conference, which will be hosted by the Bibliothèque nationale de France in Paris. The animated conference theme *All for One — One for All: Common Concerns — Shared Solutions* is of course a reference to Alexander Dumas' book *Three Musketeers*. Dumas' book continues to capture the imaginations of readers today with the musketeers as colourful figures who find themselves in many precarious situations and fall in and out of love. When D'Artagnan, the young and 'temporary' fourth musketeer, falls in love, the older and experienced Atos advises that… *"Time, dear friend, time brings round opportunity; opportunity is the martingale of man. The more we have ventured the more we gain, when we know how to wait."*

The IASA Conference in Paris will bring humour, friendship, opportunities and debate — all qualities of Dumas' book, and dare I say of IASA. I have no doubt that the 2015 conference will be a great success. I am looking forward to seeing you there.

And so, with opportunity quite the *martingale* for IASA, I thank you for your confidence and trust. With a supportive Executive Board and membership I look forward to growth, opportunity, and collaboration being the hallmarks of the next three years.

Ilse Assmann
President, IASA
January 2015

SPECTRES OF ARCHIVE AND LIBERATION[1]

Verne Harris, Nelson Mandela Foundation, South Africa

I want to talk about spectrality in the work of archive — in the content of our work, in the contexts of our work, and in our collaborations. I want to talk about ghosts. Does anyone here believe in ghosts? What about living ancestors — the ones who are gone, but who still speak to us? I will come back to these questions later, but let me say immediately that the experience of feeling haunted is a daily one for me. The archive is full of ghosts. South Africa is full of ghosts.

So here we are at an archives conference in South Africa in 2014. It is almost a year since Nelson Mandela died — his ghost speaks loudly to me. It is fifty years since the apartheid regime sent Mandela and his Rivonia comrades to prison for life. They all speak to me. It is one hundred years since the start of World War One, the war to end all wars. That war was not a distant European war. Battles were fought here in Namibia and East Africa. Thousands of Africans died. And the world changed, for 1914 was also the beginning of a century of unspeakable warfare. I hear the voices of the countless dead, maimed, and lost. They haunt me. They demand that I embrace a responsibility before them. They call me to action. Avery Gordon defines this experience as follows: "Haunting … always registers the harm inflicted or the loss sustained by a social violence … But haunting, unlike trauma, is distinctive for producing a something-to-be-done."[2] Something to be done; action; the work of liberation. So, my address this morning is about the ghosts of archive and the call to the work of liberation.

Of course, all of us in this room are children of the Enlightenment — that great project of the 18th and 19th centuries that extolled reason and sought to vanquish ghosts, angels, gods, and other supernatural aliens. However, even the most dedicated modernists among us, even those of us most influenced by science and technology, I would argue, experience the spectral every day — in the materials that we work with, and in the contexts that we find ourselves in. I want now to share with you a short clip from a movie, Ken McMullen's 1983 classic *Ghost Dance*.[3] The great thinker Jacques Derrida is an actor in the movie, and in the scene that follows he plays himself meeting with a potential graduate student, played by the actress Pascale Ogier. There was no script for this scene, with Derrida improvising in response to a question from Ogier:

> *Ogier: I'd like to ask you something. Do you believe in ghosts?*
>
> *Derrida: That's a difficult question. Firstly, you're asking a ghost whether he believes in ghosts. Here, the ghost is me. Since I've been asked to play myself in a film which is more or less improvised, I feel as if I'm letting a ghost speak for me. Curiously, instead of playing myself, without knowing it I let a ghost ventriloquise my words, or play my role. Which is even more amusing. The cinema is the art of ghosts, a battle of phantoms. That's what I think the cinema is about, when it's not boring. It's the art of allowing ghosts to come back. That's what we're doing now. Therefore, if I'm a ghost, but believe that I'm speaking with my own voice, it's precisely because I believe it's my own voice that I allow it to be taken over by another's voice. Not just any other voice,*

1 This text is based on the notes used by me for the keynote address at the Annual IASA Conference "Connecting Cultures: Content, Context and Collaboration" in Cape Town on 6 October 2014. I have attempted to reproduce as closely as possible what I said on that occasion, taking into account comments offered from the floor on the day and by readers of the draft text, including Michelle Caswell and Jo-Anne Duggan.

2 Gordon 2008, p.xvi.

3 At this point in the address I screened a clip from the movie. The transcript which follows was generated by me from the YouTube resource - http://www.youtube.com/watch?v=0nmu3uwqzbI. Accessed October 21, 2014. Most of the scene unfolds in the French language — here I reproduce the English subtitles from the resource. The only changes I have made are to punctuation.

but that of my own ghosts. So, ghosts do exist. And it's the ghosts who will answer you. Perhaps they already have. All this, it seems to me, has to do with an exchange between the art of the cinema, in its most original, unedited form and an aspect of psychoanalysis. Cinema plus psychoanalysis equals the Science of Ghosts. You know that Freud had to deal all his life with ghosts. [Telephone rings on Derrida's desk.] Now the telephone is the ghost!

[Derrida proceeds to take the call, speaking in English to an unidentified interlocutor. The call ends.]

Derrida: Well, that was the phantom voice of someone I don't know. He could have told me any old story. Someone who arrived from the USA and says he knows a friend of mine. Well, what Kafka says about correspondence — about letters, about epistolary communication — also applies to telephonic communication. And I believe that modern developments in technology and telecommunication instead of diminishing the realm of ghosts, as does any scientific or technical thought, leaving behind the age of ghosts as part of the feudal age with its somewhat primitive technology, as a certain perinatal age, whereas I believe that ghosts are part of the future and that the modern technology of images like cinematography and telecommunication enhances the power of ghosts and their ability to haunt us. In fact, it's because I wished to tempt the ghosts out that I agreed to appear in a film. It could perhaps offer both us and them the chance to evoke the ghosts: the ghost of Marx, the ghost of Freud, the ghost of Kafka, that American's ghost, even yours! I only met you this morning, but to me you're already permeated by all sorts of phantom figures. Whether I believe in ghosts or not, I say "Long live the ghosts!" And you, do you believe in ghosts?

Ogier: Yes, certainly. Yes, absolutely. Now I do, absolutely.

In watching this scene from *Ghost Dance* you have, literally, been watching two ghosts. Pascale Ogier died of a drug overdose in 1984 at the age of 25. Derrida died of cancer in 2004 at the age of 74. And yet — I am sure you would agree with me — they speak to each other *as if* the encounter happened today. They speak to us *as if* we were observers of their conversation *now*. Their presence and their immediacy, I would argue, are created by the medium. The archive is all about the livingdead. It is infused by the presence of what is absent, and the absence of what is present. So, a ghostly presence on the screen. And yet, in the logic of Derrida's thesis, at the same time the clip is a record of two ghosts conversing at a particular moment three decades ago. Ghosts before they died. And viewed now, in 2014, by an audience of ghosts. For we are, at once, material and spectral. And our engagement with the archival trace — which is daily experience not only for archivists — offers us a mirror. What is present speaks loudly of absences, and what is absent presents itself insistently. The experience of being haunted.

The movements of haunting in archive are multiple, the voices always myriad. Elsewhere (Harris 2011) I have explored this in relation to a specific archive, the Nelson Mandela prison files. There I attempted to demonstrate that listening to the ghosts of archive is not only an interesting intellectual exercise but rather, at once, an ethical imperative and a robust basis for practical archival work. Here I want merely to name what seem to me to be the primary spectral movements in archive. Four of them. Firstly, the movement generated by spectral authors. Whether the writer of a letter (a Kafka or a Mandela) or the director of a movie (a McMullen), the authors in archive are always, in principle, absent. They have left an exterior trace which can speak for them when they are unable to speak for themselves; which will speak for them when they are dead. (Of course, archive never speaks for itself, but you get my point.) And I am sure many of you have had that uncanny experience of

reading something you wrote many years ago — a diary entry from your teenage years, or an email to a long lost friend — and thinking "oh my god, who was I when I wrote this!?" Who is this stranger, this ghost?

A second primary movement is generated by spectral content. Notwithstanding the fantasy of a comprehensive, complete archive, always archive is an assemblage of fragments. For in the structure of archiving, no matter how dense the process in a particular case might be, no matter how great the commitment to completeness, there are dynamics of both inclusion and exclusion. There are always exclusions. And what has been excluded, together with what has been lost, will whisper around the fragments. Ghostly voices. Thirdly, spectral context. Archivists use their medley of descriptive instruments and underlying professional competencies to provide the users of archives with access to a rich array of context. Expertise in contextualisation, arguably, is the core archival competency. But, of course, there is no end to context. The layers are innumerable at any moment, and they shift over time. Always will be heard the whispers of contexts undocumented, unknown, or yet to be generated. Ghostly voices. And fourthly, spectral place of consignation. Where is the place, and it could be a virtual place, where the record, the fragment, the archive was born and lived outside of archival purview? We fantasize about 'original order', rightly, but need to fantasize also about original location. For the fragments under our purview comprise matter out of place. And the whispers of dislocation can be heard. Ghostly voices of other places, of lineages, of origins.

Are not our information technologies all about 'matter out of place'? On the one hand they create a semblance — or a simulation — of presence, of immediacy, of touch, which is so powerful, so compelling, that their delineation of absence ironically defines what they are. On the other hand, arguably, they are defined most fundamentally by the concept of matter without place.[4] The virtual. For those of us who grew up in the 1970s, this is a spectral space. Are you not haunted by the days of letters, post offices, faxes, bank queues, deposit slips, even WordPerfect 5.1? Haunted not only by the world you lived in, but also by the 'you' that you were in that world?

So, here you are in South Africa twenty years after apartheid ended formally. So much of what we South Africans do in our public discourse is about referencing that apartheid past. Arguably we identify ourselves against that past. Certainly both the state and our elites evoke a present in terms of an absence of that apartheid past. But is it absent? Is not the imprint of apartheid now, in the present, not very apparent? For those of you who have had a chance to explore Cape Town, is it not evident that the city is still structured by apartheid-era separations and hierarchies? Are we not haunted by that past and other longer oppressive pasts? How is it possible that today South Africa is more unequal than it was in 1994? In fact, by some measures it is the most unequal society on earth. How is it possible that in 2014 we have seen thousands of community protests, many of them becoming violent? How is it possible that in 2012 police shot and killed 35 striking miners in Marikana? That day I heard the ghosts of those shot by the police at Sharpeville over fifty years ago.

What about archives here in South Africa? I do not have time to talk about archive in the broadest sense, so I will focus on the new post-apartheid national archival system. Our public archives system. By the end of Nelson Mandela's presidency, most of the system's building blocks had been put in place and it was beginning to take shape around five key objectives:

4 Although place is unavoidable, even in the realm of the virtual. For, as Michelle Caswell pointed out in her reading of this text, 'the virtual' is always, in the end, a series of ones and zeros that must be programmed using hardware that exists in space and travels through cables that exist in space, using infrastructure that exists in space, and are decoded (and experienced) using more hardware in space by a human in space. We could take it further, and explore harsh realities like where the coltan is mined that is needed for the computing, where the computers are assembled, and where the landfills are located in which hardware is dumped when we have moved on to new versions of 'things'. Haunted spaces. Arguably Caswell is naming 'material' ghosts of 'the virtual'.

- Turning archives into an accessible public resource in support of the exercise of rights.
- Using archives in support of post-apartheid programmes of redress and reparation, such as the Truth and Reconciliation Commission, land restitution, and special pensions.
- Taking archives to the people through imaginative and participative public programming.
- Active documenting of the voices and the experiences of those either excluded from or marginalised in the colonial and apartheid archives.
- Transforming public archives into auditors of government record-keeping in support of efficient, accountable, and transparent administration.

Much good work was done systematically through the 1990s, but the hopes of that period have not been realised. Today the national archival system is in trouble. This despite the work of many courageous and dedicated professionals. The vision of the 1990s has evaporated. Chronic underfunding and lack of resources is ubiquitous. The political will required to change things is largely absent. The system, simply put, is not delivering. These conclusions have been reached by the Archival Platform (a joint University of Cape Town-Nelson Mandela Foundation project) on the basis of a detailed analysis undertaken over two years (2012-2014).[5] (Archival Platform 2014) As I speak the Platform's report is being finalized for submission to the Minister of Arts and Culture during November 2014. According to the Report (pp.3-4) the system in 2014 fares poorly when measured against the key objectives of the 1990s:

- As has been noted repeatedly by the Auditor-General in recent years, the state of government record-keeping is embarrassing. And public archives are not equipped, resourced, nor positioned to do the records auditing and records management support they are required to by their mandates. Poor record-keeping undermines service-delivery, cripples accountability, and creates environments in which corruption thrives.
- Generally public archives have been unable to transform themselves into active documenters of society, nor to fulfil their mandated role of co-ordinating and setting standards across sectors. Oral history projects are common, but are both random and undertaken in modes that are profoundly problematic in relation to voice and to power. The huge potential of digitisation in support of preservation and public access has not been harnessed.
- Apartheid-era patterns of archival use and accessibility have proved resilient. Archives remain the domain of elites. Public archives do very little outreach, and only a fraction of their holdings are accessible online.
- Swathes of documentary memory are being lost, especially in electronic environments. While 21st century recordkeeping is primarily electronic, public archives remain geared to paper-based realities. Numerous cases have been reported of records 'disappearing'. And public archives continue to authorise the destruction of the vast majority (estimated at over 90%) of public records through appraisal processes without independent monitoring in the public interest.
- Ironically public access to archives has become more restricted in the era of a constitutionally protected freedom of information. The 1990s vision of 'open democracy', which saw archives opened in ways that had been impossible under apartheid, has been lost. The Promotion of Access to Information Act is routinely used by archives for gatekeeping. And the impending Protection of State Information Act has already fostered new cultures of secrecy within public archives and revivified that old apartheid oppressive tool — the classified record.

The Archival Platform's analysis reveals a national archival system that looks like something from the past. After twenty years of democratisation and transformation the system reminds me of nothing so much as the 1980s State Archives Service and its bantustan subsidiaries. We are haunted by this presence of what we want to be absent. We are haunted by our 1990s

5 In what follows I draw from an early draft of the Archival Platform's analysis. (Archival Platform 2014) More specifically, I reproduce a draft of a section of the analysis' executive summary, a section which I generated the first draft of. A ghost of the published version, now given a form of materiality.

dream of a truly post-apartheid system. We are haunted by the ghosts of those who sacrificed so much for our liberation.

But let me draw to a close, with Nelson Mandela. In naming him I practice what he taught us — the naming of ghosts, the ancestors, the ones who are present though absent and who demand action from us. In so many of his speeches, but also during informal conversations, he would name the ghosts — Walter and Albertina Sisulu, OR Tambo, Chris Hani, Ruth First, Robert Sobukwe, Steve Biko, Chief Luthuli, Anton Lembede, John Dube … So what is the ghost of Madiba saying to us? Here, in South Africa, archivists, in 2014? What is he saying to the world? A world riven by multiple conflicts, by poverty on frightening scales, by deep structural inequality. For such inequality is not just a South African reality. As French economist Thomas Piketty has demonstrated (Piketty 2014), the shocks to our global systems of 1914–1945 led to a great turnaround in inequality in the period 1950–1980. But since 1980 we have gone backwards, to levels of inequality last seen in the eighteenth century. What is the ghost of Mandela saying to us in these contexts?

Well, this is what he said to us exactly twenty years ago:

> "The truth is that we are not yet free; we have merely achieved the freedom to be free, the right not to be oppressed. We have not taken the final step of our journey, but the first step on a longer and even more difficult road … The true test of our devotion to freedom is just beginning."[6]

And this is what he said to us ten years ago:

> "Most importantly, we want [the Centre of Memory] to dedicate itself to the recovery of memories and stories suppressed by power. That is the call of justice. The call which must be the project's most important shaping influence."[7]

The call of justice. A call which is, precisely, a call of 'the other'. The call, the demand, by the strangers, the ghosts, to be invited in. To be heard. To be reckoned with. To be enabled to reckon with us. I end with a quote from Jacques Derrida:

> "No justice … seems possible or thinkable without the principle of some *responsibility* … before the ghosts of those who are not yet born or who are already dead, be they victims of war, political or other kinds of violence, nationalist, racist, colonialist, sexist, … victims of the oppressions of capitalist imperialism or any of the forms of totalitarianism."[8]

As Derrida said in the movie *Ghost Dance*: long live the ghosts! A luta continua. I thank you.

6 Mandela 1994, p.617.
7 Nelson Mandela Foundation 2005, p.98.
8 Derrida 1994, p.xix.

References

Archival Platform (2014) *State of the archives: An analysis of South Africa's national archival system, 2014* Cape Town, University of Cape Town.

Derrida, Jacques (1994) *Specters of Marx: the state of the debt, the work of mourning, and the new international*. London, Routledge.

Gordon, Avery (2008) *Ghostly matters: haunting and the sociological imagination*. Minneapolis, University of Minnesota Press.

Harris, Verne (2011) "Ethics and the archive: 'an incessant movement of recontextualization'", in Cook, Terry (ed.) *Controlling the past: documenting society and institutions* Chicago, Society of American Archivists, pp.345-362.

Mandela, Nelson (1994) *Long walk to freedom* Randburg, Macdonald Purnell.

Nelson Mandela Foundation (2005) *A prisoner in the garden: opening Nelson Mandela's prison archive*. Johannesburg, Penguin.

Piketty, Thomas (2014) *Capital in the twenty-first century*. Cambridge, Harvard University Press.

WHY MEDIA PRESERVATION CAN'T WAIT: THE GATHERING STORM

Mike Casey, Media Digitization and Preservation Initiative, Indiana University, USA

1. Introduction

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

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

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

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

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

2. What is the problem?

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

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

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

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

2.1 Numbers

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

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

2.2 Degradation

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

2.3 Obsolescence

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

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

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

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

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

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

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

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

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

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

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

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

3. How much time do we have?

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

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

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

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

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

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

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

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

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

3.1 Value

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

3.2 Film

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

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

21 Thanks to George Blood for suggesting this analogy.

4. What can be done?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Special thanks to George Blood, Chris Lacinak, and Richard Wright for their contributions to this article.

THE DAY THE EARTH MOVED UNDER OUR FEET

Marie O'Connell, The New Zealand Archive of Film, Television and Sound

1. Abstract

This paper presents a personal account of a series of natural disasters — namely earthquakes — that my colleagues and I lived and worked through, and how those events affected our archive — *The New Zealand Archive of Film, Television and Sound* (then Sound Archives/Ngā Taonga Kōrero). In particular, I intend to describe the recovery and relocation process, and our experience of restoring order to the physical archive.

2. The sequence of events

I began working at Sound Archives/Ngā Taonga Kōrero — an archive predominantly focused on collecting and preserving New Zealand's recorded radio heritage — in 1994. In 2002, I moved to the United States where I would spend five years preserving Civil Rights Era oral histories in Mississippi. When Hurricane Katrina struck the southern United States in August, 2005, I experienced my first encounter with a major disaster.

Image 1. Clock stopped at the time of the September earthquake after falling off the wall.

Hurricanes are destructive and traumatic, but they do not usually arrive unannounced; earthquakes come without a warning. There is no opportunity to prepare, nor can their magnitude or duration be predicated — this fact was made evident to me three years after I had returned to Sound Archives/Ngā Taonga Kōrero, when a 7.1 magnitude earthquake struck Christchurch on September 4th, 2010, at 4.35am.

Like most people, I was woken when I was thrown out of my bed onto the floor, and — over the top of the earthquake's rumble — I could hear the sound of things smashing in my house. Owing to the depth and distance of the earthquake's epicentre, there were no fatalities, and our archive was more disheveled than damaged. When we returned to work after the events of that weekend, we discovered that many of our collections — consisting of open reel tapes, DATs, CD-Rs, cassettes, nitrocellulose discs, and documentation — had been ejected from their shelving. Our disaster plan did not prescribe a particular course of action, but common sense suggested that we should return our collections to their shelves and do what we could to secure them from ongoing aftershocks. On a very limited budget, John Kelcher — a fellow conservator — and I purchased cord and packing tape, which we secured over the front

of each shelf as a temporary measure until proper earthquake bracing could be installed. Amazingly, this stopgap solution protected some items throughout the sizeable aftershocks that would continue to rock us over the next four months. On February 22, at 12.51pm, however, a magnitude 6.3 earthquake hit Christchurch. It was shallow, relatively close to the centre of the city, and profoundly destructive. Due to building collapse and falling masonry, 185 people would lose their lives.

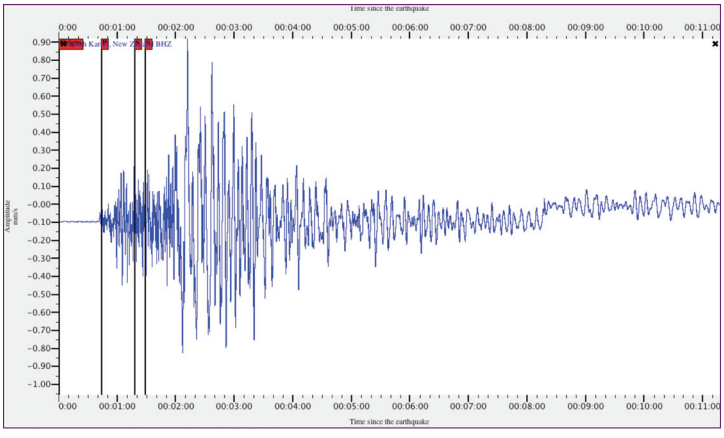


Image 2. Graph of the February 22, 2011 earthquake.

I was just leaving the restroom when the earthquake hit. The force knocked me to the floor, and I could only watch as a solid wall cracked open in front of my eyes. The multi-story building that housed the archive was compromised, but still standing; however, the Methodist Church opposite our building collapsed immediately. The city centre was evacuated, and our building was immediately cordoned within a perimeter known as the 'Red Zone' — an area in which civilian access was forbidden. Uniformed army personnel secured every point of thoroughfare through this zone.

3. Back to work

Ten days after the earthquake, we were granted access to our building. We were given a fifteen-minute window in which seven people — four Urban Search and Rescue personnel, an engineer, and two staff members — were allowed to enter the building. Their goal was to take photographs of the damage that would inform our recovery planning. During a subsequent effort, a member of our IT department would retrieve the servers that contained our digital repository.

Image 3. First entry into our building.

For a time, an emergency generator provided power to our floor, though it was shut down due to the concern that a power surge from ongoing aftershocks could cause a fire; naturally, we became concerned that the collection's climate could no longer be regulated. For three months, we would work out of a hotel room while our collections continued to reside in our inaccessible building. In May 2011, despite a dearth of rental space, our manager successfully secured a new building — previously an air conditioning sales office — with a warehouse space attached that seemed suitable as a temporary home.[28]

4. The recovery operation

In late-May 2011 after all of the final engineering inspections had been carried out and it was deemed safe to re-enter our damaged building, our recovery operation began.

Everybody was required to be processed at the Civil Defence headquarters, and we were each provided with photo identification that gave us the necessary credentials to enter the building and the Red Zone for a specified period. Everyone was required to wear a fluorescent jacket and a hard hat.

We worked in two teams of three, and in as logical a manner as possible we filled sturdy poly-propylene crates with collection items that belonged together. Those crates were numbered and photographed, and log sheets for each crate listed their contents, image number, room number, aisle number, row number, and shelf number.

We had made a point of having a number of archivists on the team; this was important because together we were able to ensure that the handling and record keeping was methodical, and could support the re-ordering process that would follow.

Image 4. Loading bay.

28 This was to be our temporary home for six months, though, as of this publication, we still occupy this space. A permanent archive is still being sought.

We took advantage of our damaged building's old loading bay to load pallets with these crates. A moving company would then transfer these to a removal truck, and drive to our new site approximately two kilometres away.

It took us about 3 weeks to get everything out.

Image 5. Audio pickup sticks.

Aside from the threat of ongoing aftershocks, we stayed cognizant of the threat to emotional well-being. Everyone was encouraged to be honest about how they were coping — all of my colleagues were dealing with complex issues at home, some with condemned houses, and the ongoing stress of the continual aftershocks.

5. The sorting process

With all of our collections relocated, it was important to re-impose order on the material that we had rescued. Although the content of our archive had been moved in its entirety to our new site, the crates in which our recordings had been transported could not be shelved on arrival due to the fact that shelving had not yet been installed; moreover, the contents of the crates were only partially ordered. While the shelves were installed, and subsequently populated with crates, I took the opportunity to make use of the documentation that had been created during the recovery process. I transcribed our handwritten logs and paired that information with approximately 800 images to generate a spreadsheet that could be used to keep track of the location and provenance of a given crate as it moved around during this period of disarray. Although all of our crates had been shelved, it was clear that we were dealing with a 'sliding puzzle' — the crates were shelved in no particular order, and both the crates and their contents would need to be sorted in-place in order to re-impose a logical structure on our archive.

Image 6. Wall with images.

To do this, I first sorted our images in such a way that images pertaining to large, homogeneous collections were grouped together. Given the link between images and crates, we could now pull several crates out of the shelves; order their contents according to each item's numerical identifier (using the images to track down any items that were missing); and then return that group of crates to the shelves so that a collection — although it may be partitioned over many crates — was now stored contiguously. Of course, this methodology was not practical for our smaller, heterogeneous collections, especially those arising from external sources (perhaps with awkward numbering or poor representation in our finding aids). To sort these collections, we laid out seven crates — one for each media type — and progressively filled these crates. We used whatever finding aids we could to compile a list of identifiers for recordings that we expected to find, and attempted to fill these crates in numerical order. Accordingly, a 'missing' recording could result in several hours' worth of searching through finding aids, crates, and images in order to determine whether a recording was truly 'missing' (or if it ever existed in the first place!).

Image 7. Sorting workbench.

The sorting process began in July 2011, and concluded in July 2012. Over the course of these twelve months, John and I sorted 105,000 sound recordings into order, as well as documents, photographs, and other ephemera. As a result of our methodical process, we were able to produce spreadsheets listing every item in the collection, and that data could subsequently be imported into our catalogue. Importantly, we were able to establish the existence of over 2,000 recordings that were not previously represented in any of our finding aids. For the first time since the Archive's inception, perhaps, we had a complete, centralised record of our entire collection.

6. The silver lining

Since September 4th, 2010, Christchurch has endured over 14,000 aftershocks. Prior to these horrific events, many aspects of our collection suffered from poor documentation, or awkward identification and physical storage. Moreover, thousands of items in our collection were not known to exist.

Had we not suffered these earthquakes, I expect that our archive might have remained in that state, with little impetus to improve. It is because of this disaster that we now know everything we have and where it is located, and this profound level of organisation is proving immensely beneficial to our ongoing conservation and preservation efforts — this is our silver lining!

The author would like to thank Tim Bathgate for his editing assistance.

BROADCAST ARCHIVES: BETWEEN PRODUCTIVITY AND PRESERVATION

Jean-Christophe Kummer, NOA Audio Solutions, Austria
Peter Kuhnle, NOA Audio Solutions, Austria
Sebastian Gabler, NOA Audio Solutions, Austria

1. Abstract

File-based digital archiving has been in use in the AV sector for the past 20 years. Recommendations such as IASA-TC 04 for audio have helped give archivists a high awareness of quality when digitising archive material. The Open Archival Information System reference model provides assistance with the organisation and layout of long-term archiving. Specific requirements regarding the usability of an archive, however, present broadcast archives with more sophisticated requirements. In this article, the authors consider different aspects of the appetite for AV broadcast archives and the suitability of data formats in the AV sector from historical, current, and forwarding-looking perspectives.

2. What is the purpose of a broadcast archive?

Asking this question quickly sheds light on the different requirements of archivists and producers within a broadcasting company. The range of responses here spans from "conserving cultural heritage" to "a backend for transferring out of the production system."

The purpose of a conventional archive is typically the collection, description, and preservation of physical carriers. The user has no direct access to the media content, and can only view its metadata. In these archives, content is only available once the corresponding carrier is played back.

One of the main reasons for digitising audiovisual inventories is most often related to the laboriousness of this setup.

2.1 The archivist's perspective

For traditional archivists, the prevention of amnesia — or the preservation of archival material — is key.

Archivists also highlight the need for a media library, to enable the cataloguing, searchability of, and access to the material. Whereas the main requirement in preservation is maintaining as exact a copy of the original as possible (formal cataloguing), when it comes to the process of actually cataloguing the material, it is the indexing which is key — that is to say, description of the content's features and its availability. To this end, public archives generally use standardised archiving rules[29] with their associated data schemas. Due to their level of detail, only significantly slimmed-down versions of these schemas can be used in broadcasting archives. Because of the file format, the availability of the media now becomes merely a technical and logistical problem, since the laborious process of creating or lending copies no longer applies.

2.2 Producers' needs

On the other side of the catalogue we have the producer who, given the task at hand, wants to use the archive material as efficiently as possible in new productions. Catalogue searches are content-oriented and so, from an archiving perspective, both the logical, original context, as well as the original format of the archived object, are more of a hindrance than a help. Since production generally only requires small segments in a specific file format, it makes more sense

29 Typical set of rules: MARC21 in the Anglo-Saxon world, www.loc.gov/marc/; MAB2 used to be prevalent in German-speaking countries, but was finally superseded in 2013.

if they can be retrieved from the catalogue directly as required. Direct delivery from production systems with the associated metadata in a standardised format helps to minimise cost. Heritage archive material should also be made available in its restored version in order to keep the production process as lean and fast as possible. Long processing times should also be ruled out as much as quality-reducing format conversions.

2.3 Potential solutions

One approach is a logical division into an archiving area and a cataloguing area (mediatec or media library).

While digital originals or their equivalents are managed in the archiving area after careful digitisation — observing the recommendations of the IASA-TC 04[30] wherever possible — the cataloguing area contains reorganised entities, derived from factual descriptions, so-called objects of the 'segment' type, e.g., a documentary. Corresponding media can be linked several times and in sections with the metadata, meaning that physical copies or copied sections can be avoided (Figure 1).

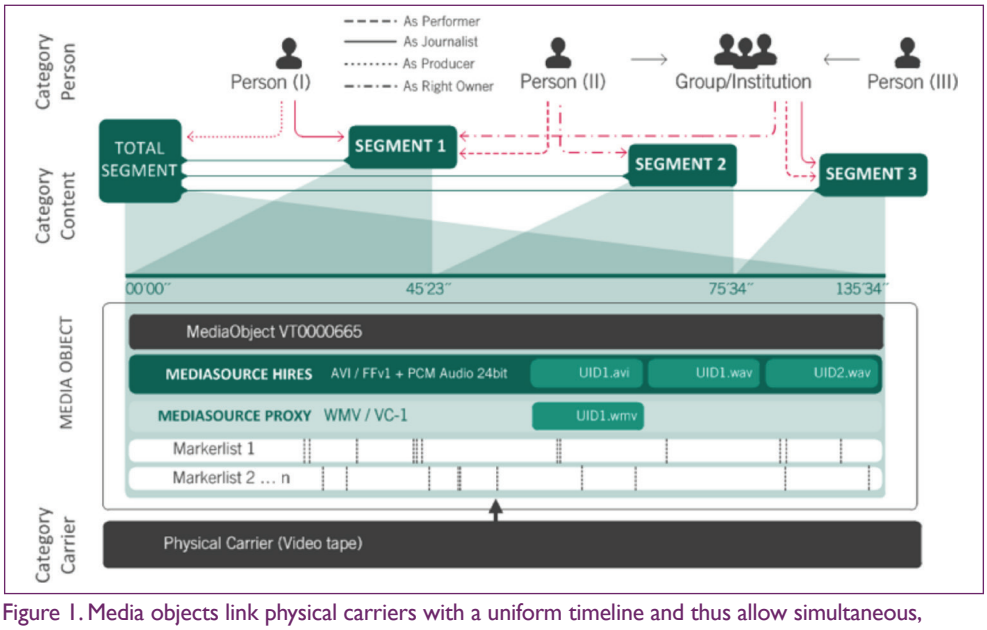


Figure 1. Media objects link physical carriers with a uniform timeline and thus allow simultaneous, consistent access to different codings and segments of the same content. People are then linked by semantic role (author, producer) to the segments (system: NOA mediARC).

Media management should also hold content in several parallel formats so that restored copies, digital originals, and working copies can be stored together. This means that the parallel, restored copy of archive material can then be made available in the catalogue if the quality of the original version renders it unsuitable for publication. Likewise, it is also necessary to create a filing structure for fragments of recordings, which cannot be digitised in a coherent manner. Should the need for a restored copy arise during cataloguing — or the quality control checks carried out when adding new content — the system should be able to control the relevant processes to achieve this. It is often possible to restore source material automatically with few qualitative faults; to this end, 'official' external modules should be pluggable so that it is always

30 http://www.iasa-web.org/tc04/audio-preservation

possible to work with state-of-the-art technology. By contrast, initiation and control of semi-automatic processes, which also incorporate external editing software, help ease the handling of more seriously damaged material.

In order to provide timely access to sections of a catalogue object in the desired target format, the cataloguing system should always include an additional working copy in a format that can be processed quickly and universally, if the original format does not allow this. The Open Archival Information System, known as OAIS[31], makes the distinction here between the Dissemination Information Package (DIP), the output for the consumer, and the Archive Information Package (AIP), which constitutes a consistent, easily readable description of the archived object (Figure 2).

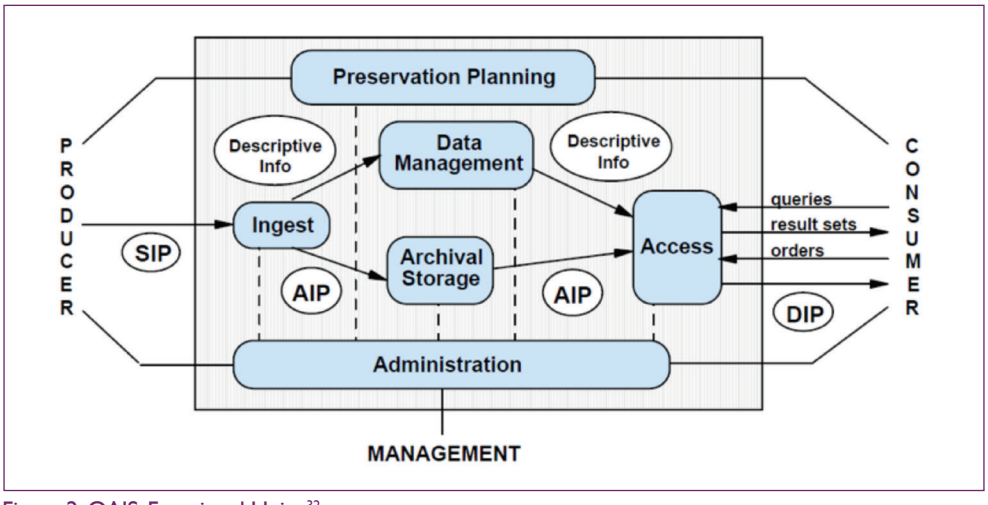


Figure 2. OAIS: Functional Units.[32]

When requesting media, the user has the choice of requesting an original copy or a clip in one of the supported target formats. It should also be possible to deliver metadata in parallel. Freely configurable modules should be available, given the variety of formats necessary (Figure 3).

31 OAIS is a reference model for a dynamic, extensive archiving information system and is rooted in ISO Standard 14721:2012.

32 Picture source: http://en.wikipedia.org/wiki/Open_Archival_Information_System.

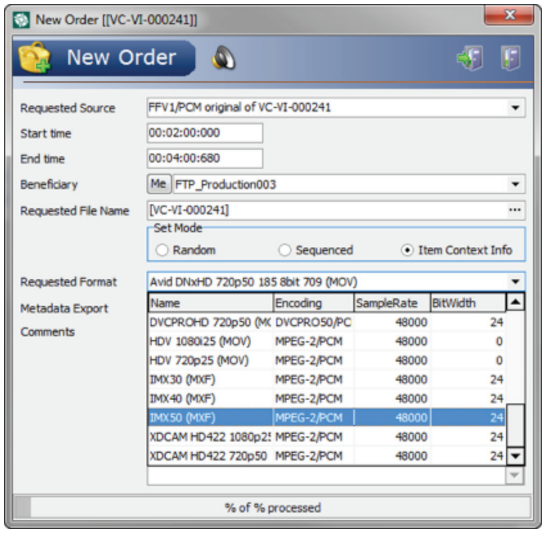


Figure 3. Placing a cart order for a 2-minute segment in a specific target format, querying items stored in various original archives (here FFv1[33]). The beneficiary in this instance is a production system's FTP server gateway (system: NOA mediARC).

Linear archival formats, from which segments can be exported, have long been in existence in the audio sector. Nevertheless, an attempt shall be made to look critically at a variety of different archiving formats in the audio as well as video sector.

3. Fifteen years of BWF in audio archiving — a success story?

As an audio archival format, the Broadcast Wave File[34] certainly has its advantages. Years of use in archiving raise the question: would we go down the same route again?

Looking back on those formats that could be read fifteen years ago and those that are readable even today, it is clear that some are still in use. Whether *.txt, *.jpg, *.pdf, or *.wav are viewed as suitable, these formats do have one thing in common: they are easy to open.

It is probably safe to assume that an archive based on formats for which there are hundreds of programs today will still find some form of code that can read them in 30 years' time.

From where does the idea of a specific archive format stem?

The archiving world tends to connect all metadata of a technical as well as content-related nature to the archive object, presumably in order to also preserve, in the digital world, the physical idea of the carrier on which the metadata is located. In the OAIS specification, the AIP provides for the creation of clearly readable archive objects, something that enables archived media to be read and interpreted, even when the necessary devices and applications are no longer available. Yet it does not outline a single, descriptive file that can be used for archiving purposes. Looking back to the early file-based audio world, it is clear that acceptable solutions for workflows and archives were established in the production and archiving environment — primarily as a result of the 'tapeless' file sizes — a good ten years before the video world.

33 FFv1: mathematically lossless Open Source Video codec, reference: www1.mplayerhq.hu/~michael/ffv1.html; also www.digitalpreservation.gov/formats/fdd/fdd000349.shtml.

34 http://www.digitalpreservation.gov/formats/fdd/fdd000356.shtml.

In the 1990s, it emerged that *.wav, as a basic RIFF format, would be suitable as an audio archive format, both because it uses linear encoding and also because it can be played back using the integrated player on any Microsoft operating system, without the need for a license or any significant additional hardware costs.

Consider the background to this realization. Very few professionals worked with *.wav on a regular basis, since the majority of professional interfaces in the 1990s were still using Apple-centric solutions (SoundDesigner, Sonic Solutions, etc.), which worked with SDII or AIFF formats.

The willingness to consider a format known during this period as 8-bit system sound (for which *.wav was being used primarily) as a suitable archive format, albeit in a slightly modified version (24 bit/48 kHz), was therefore the product of altruistic thinking and an example of significant foresight by the archiving world and industry. *At the time, the main rationale for this was the widespread use of playback systems.*

Most conscientious producers took to redundantly storing all technical metadata in an index in the archive system, so that the archive data could still be filed at a later date in whatever header metadata structure would become available. Despite this, it took a long time for a clear specification to emerge.

In hindsight, does the BWF specification still make sense today?

Today, a few things would probably be done differently:

- A file format that accepts only ASCII characters[35] in the descriptive chunks would, today, be considered unsuitable: character sets such as those based on the Latin alphabet, including even German special characters (ö, ä and ü, for example) would otherwise be completely stripped out. Most people would now choose to follow at least an ANSI or Unicode implementation instead.
- The fact that coding history has been implemented in a variety of ways means that semantic, automated processing is often unachievable.[36]
- The interpretation of the peak file as a component of the header may, on occasion, be understood by a system. At other times it may be ignored by others, or even overwritten with a proprietary version.[37]
- The proliferation of RIFF chunks has led, at best, to a correct selection characteristic in the production system,[38] but is still a classic case of a specification's 'vendor lock-in.'

In 2005, it was already clear that MAM systems could not make much use of the information embedded in the header. A workaround was created by requiring systems to produce a 'tandem of files.' This consisted of textual information of whatever kind (XML, TXT – potentially following a standard such as METS[39]), most often paired with the audio file of the same name.

Some manufacturers certainly made an effort to export the chunk information (David, Blue Order[40], and NOA, among others), but ultimately only time will tell whether the information lying dormant in the headers will be of relevance in 30 years' time, and whether code to interpret it will still be available.

35 http://tech.ebu.ch/docs/tech/tech3285.pdf, ASCII coding of chunk information.
36 https://tech.ebu.ch/docs/tech/tech3285s2.pdf, broad definition of "CodingHistory".
37 https://tech.ebu.ch/docs/tech/tech3285s3.pdf.
38 https://tech.ebu.ch/docs/tech/tech3285s2.pdf, FileSecurityReport and FileSecurityWave are only available from a manufacturer (VendorLock).
39 http://www.loc.gov/standards/mets/.
40 BlueOrder, Kaiserslauten was taken over by Avid in January 2010.

If nothing else, the work involved in parsing headers (in comparison to text-based files) requires special tools today, which are often not justified given the effort involved.

The technical utility of embedding descriptive metadata is demonstrated from a purely practical point of view: currently, there are many large-scale digitisation projects being carried out in both Europe and other areas of the world, some already completed, in which material is being digitised retrospectively.

Digitisation itself usually only accounts for 10% of the overall time needed for these projects, with the remainder spent managing metadata, clarifying rights, and handling carriers.

Commercial broadcasting companies' projects are set up in such a way (see the Swedish broadcaster SRF, Slovenian RTV and Croatian HRT) as to achieve a certain result in a limited time.

In the case of SRF, the task was to digitise 220,000 hours of ¼-inch material, DAT, and CDs within three years (Figure 4). This was successfully carried out within the target period, with the appropriate quality control, at eight special recording stations using a shift system.

Figure 4a to 4f. Clockwise from top left to bottom left: SRF recording studios (audio and video), 1-inch MAZ machines, videotape archive, tape/Senkel, and CD archive collections.

Adding the 10-fold larger job of correct metadata research to the impressive effort of digitisation would have meant that even filling the BWF 'description' field with a correct, comprehensive working title (before writing the BWF) would probably not have been affordable.

Since the system used relies on the premise of an extremely robust relationship between database record and media object, subsequent socialisation of content becomes possible.

As a result, this information is unlikely to end up in the header of the already digitised BWF file, which may even be exported to LTO tape. Instead, it is more likely to be kept in an easily searchable, non-redundant index of a low-maintenance, migratable, and readily available standard database that offers multiple ways to access the data, other than through the manufacturers' interfaces alone.

Without wanting to sound critical, it seems logical to conclude that for audio archiving at least, it is not absolutely necessary to store descriptive metadata in the header of an archived object, but rather to keep only a rudimentary archiving number and technical metadata within the file, provided it is possible to interpret and process this data automatically in a sufficient number of different systems.

In doing so, it might be easier to migrate separately stored metadata from an easily readable format into the next archive format. However, it seems essential that the RIFF file as a widespread codec in a WAV container as a linear essence best suits the requirement of essence storage.

As elegantly as archiving in the audio sector can be solved using WAV/BWF and the optional TandemFile, the range of choices for the world of video is just as diverse.

4. Making video archive copies for long-term archiving — lossless or lossy?

Broadcast archives are based on the premise that current production formats, even those that use data-reducing codecs, need only to be exported to tape-based long-term storage to fulfill the criteria of 'archiving' content. But are there any other approaches?

4.1 Codecs

Before diving into the accompanying metadata and how it can be stored, the crucial question of which codec to use still remains. In the world of video, a codec's suitability for use in production often dictates the chosen archive format, especially for public broadcasting companies who, by their very nature, focus primarily on the level of productivity of the archive.

Twenty years of experience in audio digitisation have shown that retrospective digitisation archive projects, which were implemented on the basis of psycho-acoustic data-reducing formats (cf. MP1L2 archive in the mid 1990s), are of practically no real significance today. Digitisation projects were even repeated in linear formats provided the funds could be found. Looking at the effect of multiple codings of data-reduced formats within a video segment, it can be seen that by cascading several encoding steps, there is a successive loss of source information (Figure 5).

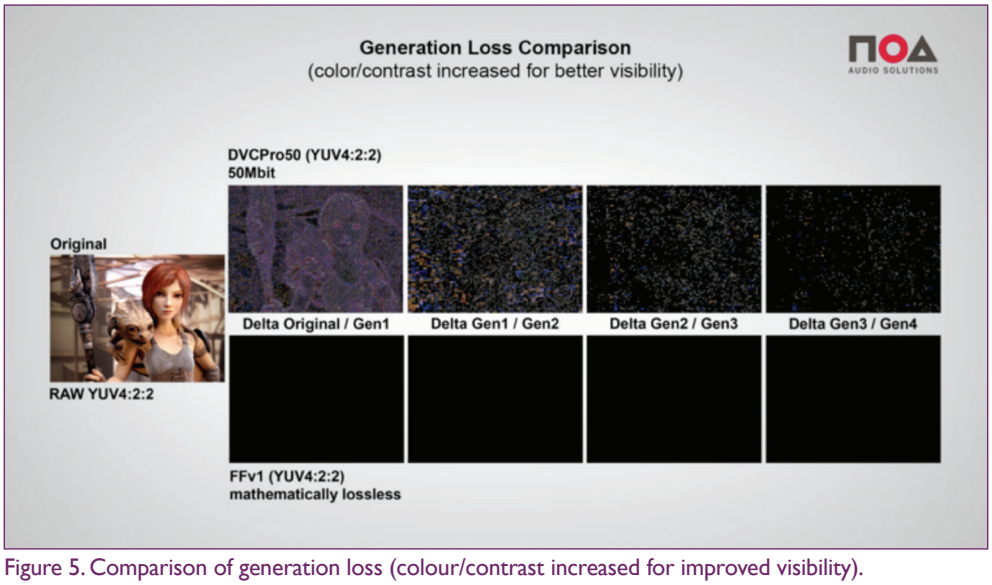


Figure 5. Comparison of generation loss (colour/contrast increased for improved visibility). The sequences of dark images display the respective differential signal to the precursor signal. The multiple coding has absolutely no effect in the case of mathematically lossless coding (lower row).

4.2 Linear video? In the production archive? For SD material?

The cost of the memory required, the burden on networks, and the unsuitability of lossless encoding in the production system are obvious reasons for avoiding such a course of action.

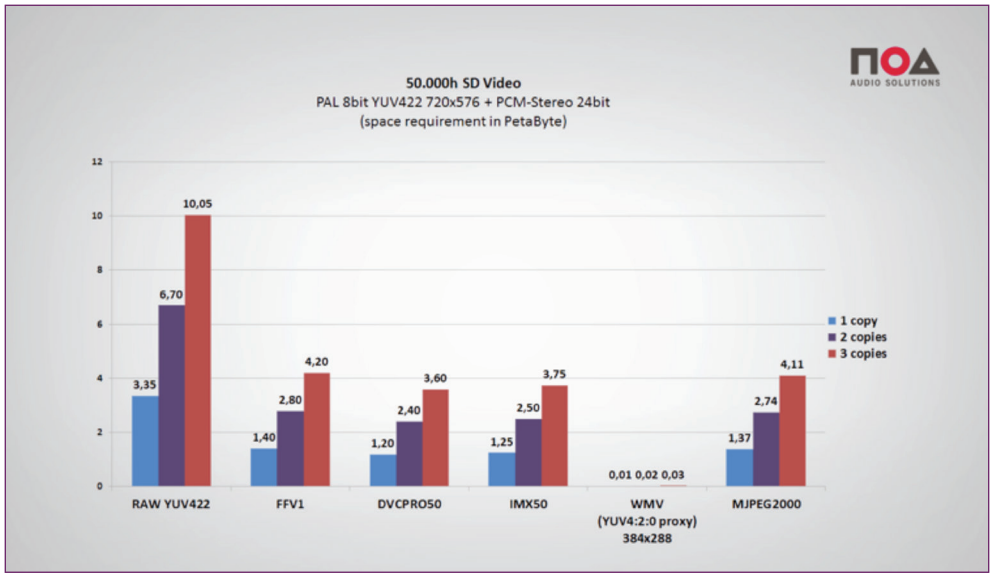


Figure 6. Comparison of memory requirements for 50,000 hours of SD video in petabytes (PB) (PAL format: 8 bit, YUV 422, 720×576 and PCM 24 bit stereo).

Considering the memory requirements of linear versus typical compressed material, the following applies (Figure 6). As can be seen, mathematically lossless formats such as FFv1.3 or MJ2K[41] (also called MJPEG-2000) result in only marginally larger files than data-reducing production formats such as DVCpro50 or IMX50.

Although MJ2K in particular was promoted within the Library of Congress, FFv1.3 has since emerged as a codec alternative. Filed in an AVI container,[42] it meets archive requirements for simplicity and ease of readability with some minor known limitations.

Regardless, three copies of 50,000 hours of SD material would take up the rather impressive total size of around four petabytes: a cost factor which, in any case, still needs to be considered. Nevertheless, in times of tight budgets it seems a little excessive to follow the purist idea of storing archives in a completely linear way. It also seems avoidable, given that doing so increases the overall cost by 100%.

If, therefore, there is little difference between lossless and lossy memory requirements, the question of the amount of time required for conversion of the archive format to a production-ready version remains (Figure 7). The ability to convert FFv1.3 to DVCpro50 at almost eight times the rate of MJ2K could be one of the reasons — alongside ease of use — why FFv1 has gained importance.[43]

41 MJ2K – Samma Profile: Beschreibung: http://www.digitalpreservation.gov/formats/fdd/fdd000271.shtml.
42 http://www.digitalpreservation.gov/formats/fdd/fdd000349.shtml.
43 FFv1 implementations: www.Archivematica.org; www.digitalpreservation.gov/formats/fdd/fdd000343.shtml; Open Source Digitisation of Österreichische Mediathek; City of Vancouver Archives; NOA MediaButler.

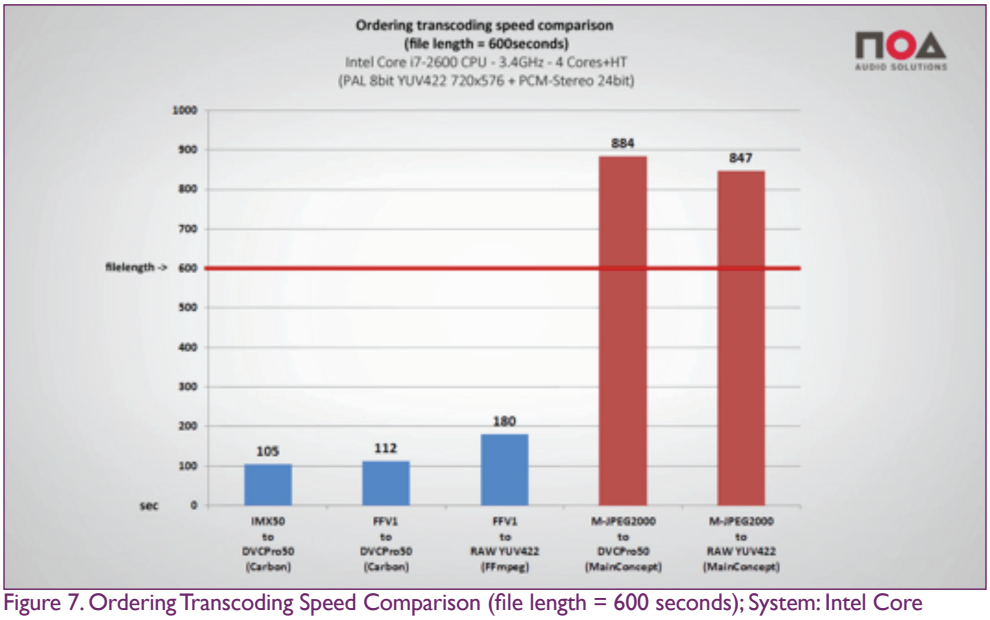


Figure 7. Ordering Transcoding Speed Comparison (file length = 600 seconds); System: Intel Core i/-2600 CPU, 3.4 GHz, 4 Cores+HT; PAL-Format: 8 bit, YUV 720 576 + PCM-Stereo 24 bit.

In addition to this, it has become apparent that converting between two lossy formats takes almost the same amount of time, without resulting in any additional benefits. Strictly speaking, it should be added that the data is already contained in MXF wrappers[44] before the whole file is written.

4.3 What do others do with their inventories?

Broadly speaking, there are two main trends. Large national archives (e.g., the U.S. Library of Congress[45]) with generous budgets can afford to use three memory formats at the same time, with the corresponding cost structure:

- linear or mathematically lossless formats, e.g., linear.mov, ffv1.avi, j2k.mxf
- production formats, e.g., MXF D10, DVCpro50
- proxy formats, e.g., WMV, H264

By contrast, broadcasting companies only use:

- production formats, e.g., MXF D10, DVCpro50
- proxy formats, e.g., WMV, H264

4.4 Are there any alternatives?

As a result of an EBU study[46] conducted in 2010, it was established that delivery from long-term archiving systems to production can take, on average, up to ten minutes.

44 MXF Smpte Spezifikation: Op1a: SMPTE 378M.
45 Report Carl Fleischhauer IASA 2013 Vilnius.
46 https://tech.ebu.ch/docs/techreports/tr006.pdf.

A closer inspection of the content requested from the archive shows that requests are made primarily for segments which need to be converted, where possible, into a different target format.

So why not consider the following:

- mathematically lossless formats, e.g., linear.mov, ffv1.avi, j2k.mxf, which actually fulfill archiving requirements and have tried and tested re-transcoding paths
- proxy formats, e.g., H.264

The effective advantage of MXF-based archiving files lies in the more reliable partial availability, which allows processing to begin before the transfer is complete. This, in principle, sways the balance in favour of MXF-wrapped MJ2K files or, if the lossy nature of the coding can be disregarded, generally only for lossy MXF files.

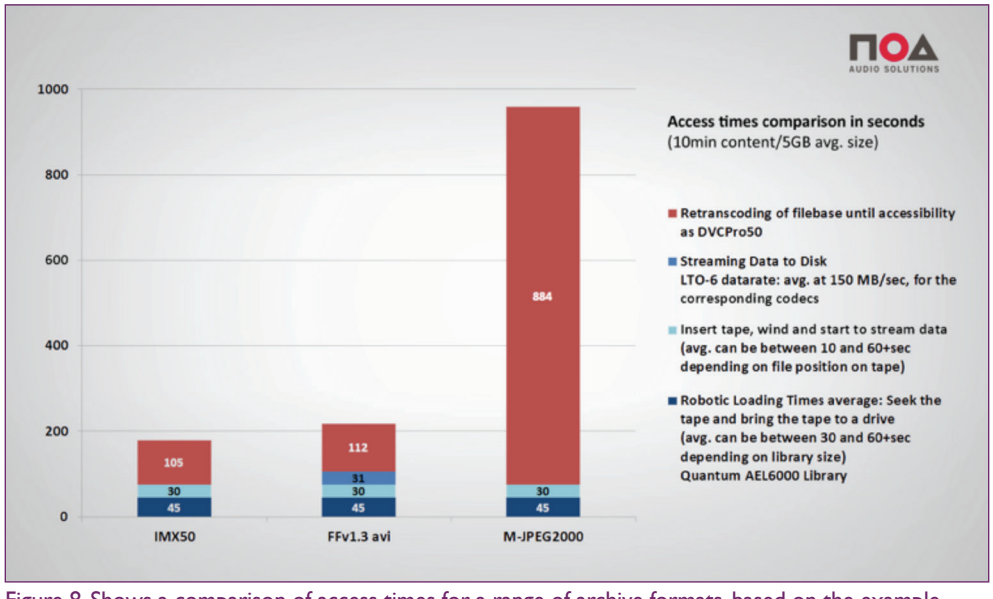


Figure 8. Shows a comparison of access times for a range of archive formats, based on the example of SD archiving; in this case, the transfer of a 10-minute video source SD file from an LTO 6 tape to a target production format (here DVCpro50).

If only allowing for lossless codecs from an archiving perspective, then the complexity of the MJ2K codec takes its toll when recording into or writing out from the archiving system. Also, a direct comparison of FFv1 and IMX50 as archiving formats is not entirely at the expense of the lossless compressed format when delivering to production (primarily with respect to the statistical means of robotics and tape-loading times). The economic savings in storage space are, however, considerable when taking linear versus lossless compressed video into account.

This means that today, production systems can be harvested from the lossless archive with DVCpro25 files — and other parallel systems with MXF OP1a-, H.264 or streaming files — which are then able to be exported, on demand, in the future.

Above all, what remains is the realisation that a sustainable archiving decision will have to be made again in ten years' time, since the life cycle of a production system tends to be between 3 and 5 years, and the production formats prevalent at that time may well be different to those in use now.

4.5 Wrappers

Video codecs become readable only when used in conjunction with a wrapper. In the same 2010 EBU study, broadcasters emphasised the serious nature of the problem of interoperability, giving it a score of 93 out of a maximum of 100. However, an IRT study[47] into the compatibility of manufacturers' MXFOP1a implementations in the production sector showed that improvements had been made, at least within the field of data reduction.

On the whole, the archiving sector seems to have the choice between several complex MXF versions for SD, provided that they are mathematically lossless, be it the MXF Samma profile MJ2K, AXF files,[48] or if one were to wait for the adoption of the MXF AS 07 specification.[49]

It seems inevitable that there will be some interoperability problems with formats that are not yet well-established (see previous commentary regarding experiences with audio). For this reason, some (in particular public video archives in the US) continue to opt for pure linear formats[50] and their corresponding tandem files, packaged using BagIt,[51] and are therefore forced to accept the 2.5-fold memory requirements.

The same cannot be said for RIFF-based AVI files, which can also be played back on any Windows computer. With ffdshow[52] or LAV filters,[53] the open source community also provides suitable packages for system-level decoding. They support codecs, aspect ratio, and multi-channel audio — all license-free and without the need for special hardware.

"Core" technical metadata is embedded in this wrapper. The storage of additional necessary technical metadata is carried out through a tandem XML file.

The conversion of archive material into a target format is a task that can be scripted easily with ffmpeg[54] or achieved using industrial encoders such as NOA MediaButler[55] or Harmonic Promedia Carbon[56] (previously Rhozet), which are able to read system codecs.

Since, according to the OAIS guidelines, production systems should never have access to originals and only intermediary instances should be used to produce the (broadcast-compatible) export formats, the Material Exchange Format (MXF) demonstrates its value once again: as a Dissemination Information Package (DIP), it is created from the archive format (FFv1 in avi in this instance) in line with demand, and the MXF then satisfies all transmission chain stability requirements with characteristics of a production format that can be processed in a swift and robust way.
If, in the next ten years, the archiving world manages to agree on a lossless video standard which also satisfies broadcast archive requirements, nothing stands in the way of lossless conversion from FFv1.avi into this target format using simple open source tools. FFv1 can be considered the perfect interim format that helps archivists and broadcasters in their decision.

Regardless, the operating archive will be able to migrate its archive data via simple scripting without the worry of vendor lock-in or help from the initial vendor.

47 http://mxf.irt.de/activities/2013-11-MXF-Plug Fest-ExecutiveManagementReport.pdf.
48 AXF has become a SMPTE standard, mostly driven by FrontPorch – now Oracle.
49 MXF AS-07 is developed within www.amwa.tv.
50 "*What Should We Do Today: Toward an Interim-Master for the Preservation of Digital Audiovisual Materials*" George Blood, Annual Conference 2011, Austin, TX, Association of Moving Image Archivists.
51 http://en.wikipedia.org/wiki/BagIt.
52 http://ffdshow-tryout.sourceforge.net/.
53 https://code.google.com/p/lavfilters/.
54 http://www.ffmpeg.org/.
55 http://www.noa-audio.com/products/actline/mediabutler/.
56 http://www.harmonicinc.com/product/promedia-carbon.

5. Conclusion

Decisions about the logical organisation of information and format issues in broadcast archives should, under no circumstances, be made from a production point of view alone. Requirements for archiving over a 50-year period differ greatly from the interests of production departments, which have to deliver results in much shorter periods of time. Appropriate technologies, which can generate linear or mathematically lossless archive formats, are provided both by the open source community as well as the industry. This development must be taken seriously because it is a pragmatic one.

A system that provides the archiving structure and that demonstrates organisational abstraction with respect to production in accordance with OAIS, while at the same time focusing on open standards and easily migratable media content, has a promising future and seems set to fulfill archiving requirements.

RE-LUBRICATION OF COMPACT CASSETTE TAPES WITH SBS (SOFT BINDER SYNDROME)

Enric Giné Guix, Sonology Department, ESMUC (Escola Superior de Música de Catalunya), Tasso Laboratori de so. Barcelona, Spain

1. Introduction

The Alicia de Larrocha Foundation[57], devoted to pianist Alicia de Larrocha (Barcelona, 1923–2009) holds a valuable collection of private audio recordings, mostly non-commercial live concerts and interviews that covers over 60 years.

Following IASA guidelines, more than 500 compact cassettes of all brands and types have been recently catalogued and digitized (04/2013 – 07/2014). Although most carriers were in good optical and mechanical condition and allowed for proper transfer, around 2% of them presented severe degrees of tape-to-head sticking and squealing ("stick-slip[58]"), which resulted in a well-known array of problems:

- The frequency modulation (FM[59]) of the original audio carrier which causes, depending on its extent, from a wobbly flutter effect to complex non-linear frequency sidebands (high frequency artefacts) that cannot be removed once in the digital domain.[60]
- A progressive decrease in the original signal level, especially at high frequencies (low-pass filtering).
- Increased tape-to-head tension and friction that slows down and eventually stops the deck playback transport.

Such problems are as a whole the result of the so-called *Soft Binder Syndrome* (SBS)[61] to substitute what was formerly known as *Loss of Lubricant* (LoL).

The goal of this article is twofold:

- To review key theoretical aspects of SBS as a result of FM distortion and analyse its effects on the digitized frequency response of some affected cassette tapes.
- To present a practical implementation for individual tape re-lubrication which, based on past reported experiences,[62] sometimes combined with cassette shell re-housing, has given good results for renewed playback and digitization in the short and midterm.

This re-lubrication proposal is based on a standard tape transport speed-controlled with an Arduino[63] motor shield processor that is able to provide continuous and even lubrication to tape as it travels in an external path around a rotating foam drum flooded with cyclomethicone, a volatile siloxane that completely evaporates with time. Playback equipment for the re-lubricated tapes (Nakamichi CR-7 and ZX-7) remained undamaged in the mid/long term.

57 www.aliciadelarrocha.com.
58 In a similar way a bowed string would trace a saw-tooth-like vibration, the stick-slip tape movement causes a saw-tooth-like kinetic friction variation that shifts up and down the originally constant transport speed, frequency-modulating the resulting voltage induced in the playback head.
59 "In contrast to linear modulation, exponential modulation [such as FM] is a nonlinear process; therefore, it should come as no surprise that the modulated spectrum is not related in a simple fashion to the message spectrum" (Carlson 2002:18).
60 Due to the sidebands produced by FM modulation, this disturbance can mistakenly remind of a sampling clock error in the digital domain where aliasing distortion was present.
61 A term defined by Richard Hess -see Hess, R.(2007:251)- and recalled by FACET (2007:46).
62 See Hess (2007:260) and experiences by Marie O'Connell quoted at http://richardhess.com/notes/2006/03/09/wet-playing-of-reel-tapes-with-loss-of-lubricant-a-guest-article-by-marie-oconnell/.
63 See http://www.arduino.cc/.

2. SBS, SSS, LoL: the problem and the terminology in context

"Soft Binder Syndrome" is broadly accepted as a catchall phrase to describe several problems related to hydrolyzed polyester urethane binders (including lubricants) and consequently to different and faulty tape behaviours:

- SSS ("Sticky Shed Syndrome"), mostly referred to polyester back-coated tapes that may show any combination of stickiness, shedding, and/or squealing that *can* be temporally reduced by backing (aka tape incubation).
- LoL ("Loss of Lubricant"), a term being historically applied to polyester-based tapes that will squeal due to the stick-slip traction provoked by stickiness, but mostly without oxide significant shedding, and which *do not* respond positively to backing.

It has been shown that, in normal conditions of use and storage, magnetic tape is not prone to lose its original amount of lubricant, even though exhibiting SSS or SBS. Following Hess terminology, the FACET document proposes SBS-UP (Soft Binder Syndrome — Unidentified Problems) as a way to particularly refer to this formerly misunderstood "Loss of Lubricant."

Analogue cassette tape (from 1963 on) may exhibit this SBS-UP (and not SSS) due to the following facts:

- Polyester urethane binders were used.
- Although it is always polyester based, tape was not back coated (coating being closely related to SSS).
- Tape may show stick-slip and squealing problems, but not oxide shedding.
- Reportedly[64], cassette tape has never responded positively to incubation.

If incubation is discarded as a temporal solution, and if actual lubricant loss is dismissed as the main reason for SBS-UP, then which approaches remain?

2.1 Cold playback

Instead of acting on the tape, Hess and others propose to adapt the environment for a controlled cold playback, were low temperature — below the so-called glass transition temperature Tg — would reduce stick-slip noise modulation. In favour of this approach there is the experienced fact that SBS increases with working temperature, that is, after the reproducing machine has achieved its normal working temperature (which may be especially high in cassette decks). The author has not yet tried or found any case studies of this approach specifically applied to cassette tapes and players, but Hess has tested it on open-reel tapes.[65]

3. Lubrication, again

Discounting actual loss of the original lubricant, its degradation or failure to work as intended might be one of the reasons for a failure playback. Based on re-lubrication, temporal solutions have been devised to reduce friction by temporally smoothing tape-to–head wear while minimizing spacing losses (HF response decay).

Re-lubrication should then be considered not as a way to compensate for a material loss, but to recover the ability of transporting the tape smoothly through its path.

Several lubricants have been reported as possible candidates,[66] among which the author considered two:

64 See Hess, R. (2008:256).
65 See Hess, R (2008: 253-253).
66 See Hess, R.(2008:258).

- Jojoba oil, a 100% vegetable oil obtained through cold pressing of the seeds of the *Simmondsia chinensis*.
- Cyclomethicone pentamer, a volatile, non-greasy, low viscosity silicone oil (also known as decamethyl, cyclopentasiloxane cyclopentasiloxane).

Cyclomethicone has been preferred for the following reasons:

- The existence of previous successful experiences, specifically on cassette tapes.[67]
- No need of dilution with isopropyl alcohol, which reportedly swells the binder and makes it softer.[68]
- The assurance of volatility after a certain amount of time, which means that the silicone will fully evaporate in the mid-term, long after digitisation has been made possible.

Image 1. Cyclomethicone and Jojoba oil.

This final point must be overstated, as any additional lubricant will not be absorbed by the binder and thus should be removed, spontaneous vaporization being the ideal solution.

67 See Hess, R. (2007:260) specific approach for cassette tapes.
68 See Hess, R. (2007:259).

4. Practical implementation

As the total amount of cassettes affected by SBS in the Alicia de Larrocha Archive was not critical, a simple, one-at-a-time method for cassette tape re-lubrication was devised to allow for a motorized, smooth, uniform application of the lubricant over the whole tape width and length *outside* the cassette deck, avoiding the need of electromechanical modifications.

A prototype was built based on the following elements:

- One *Arduino Due*[69] microcontroller board, plus *Arduino motor shield processor*
- One standard cassette tape transport (motor included) un-mounted from a portable cassette player
- One rotating foam drum flooded with cyclomethicone, able to lubricate tape continuously and evenly as it travels in an external path

The actual implementation could not be simpler. The Arduino microcontroller is programmed through a computer laptop to control the rotating time, speed, and, eventually, direction of the standard transport motor (real-time forward playback speed used). The foam drum is heavily flooded with the synthetic lubricant and remains fully wet throughout the length of any tape; being lightly-weighted, it sticks to tape and rotates along by static friction on its axis, avoiding the need for a synchronic motor.

The prototype, mounted on a soft plywood board, allows for adjustable pins or hooks to specifically house any cassette and provide the easiest and smoothest path around the foam drum. When needed, a specific pin is oriented towards the pinch roller to add a slight pressure in order to maintain tape-to-roller contact for steady tape transport.

Such a solution avoids the need to extract the tape from its cassette shell to apply re-lubrication, so welded shell tapes (with no screws) are not damaged.

69 Arduino is an open-source electronics platform based on easy-to-use hardware and software, intended for the implementation of all kinds of interactive projects. See http://www.arduino.cc.

5. Affected tapes

Table 1 shows actual tapes (brands and types) found with severe degrees of SBS-UP. Their production years significantly coincide around 1970-1980.

	Cassette brand & model	Production years*	Type	Problem	Diagnosis
1	BASF SM cassette LH super 120	1974-75	Type I	squealing tape (stick-slip)	SBS
2	Philips SuperFerro High Output LN C-90	1978-81	Type I	squealing tape	SBS
3	Philips SuperFerro High Output LN C-90	1978-81	Type I	squealing tape; progressive HF signal loss	SBS
4	TDK Low Noise C120	1975-78	Type I	squealing tape	SBS
5	BASF SM cassette LH super 90	1974-75	Type I	squealing tape; wow and flutter	SBS
6	AGFA-GEVAERT C90+6 HIGH DYNAMIC	1975-77	Type I	cassette stops; too high tape tension and friction at the tape head	SBS?
7	Scotch C-90 Extended Range Low Noise High Density	1971-73	Type I	squealing tape; wow and flutter; could not be rewound/played back	SBS
8	unknown - unbranded		Type II	severe wow	SBS
9	Philips Super Ferro floating foil SECURITY High Output LN	1987-81	Type I	increasingly squealing tape	SBS

Table 1. List of tapes from the Alicia de Larrocha Archive affected by SBS.
* Referred by http://vintagecassettes.com/.

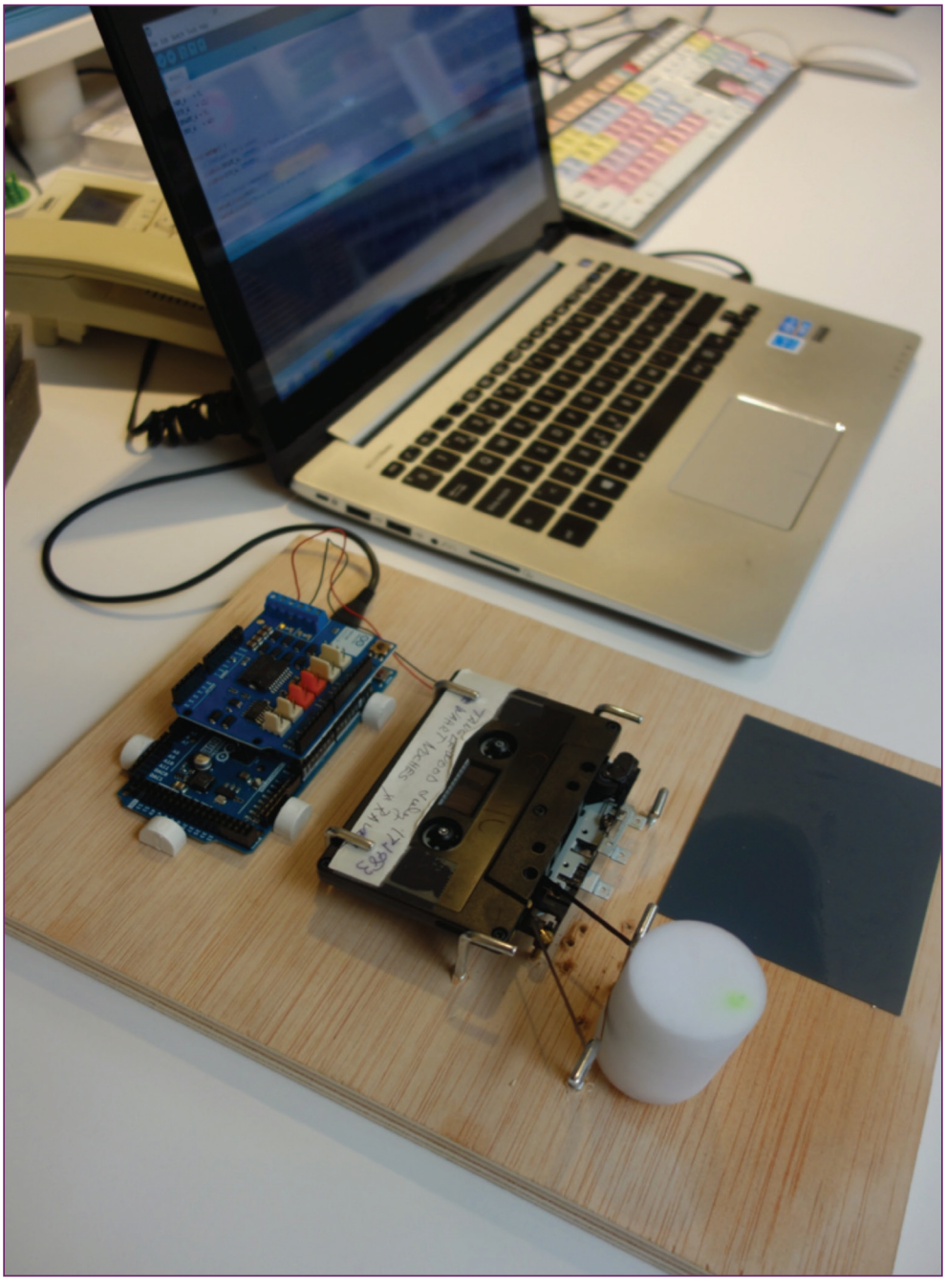


Image 2. Re-lubrication device prototype. Tasso Laboratori de so.

6. Case reports: frequency analysis and re-lubrication results

Re-lubricated tapes were played back and digitized within the next 24 hours to ensure action before lubricant evaporation. Results were satisfactory in all cases, even though a second pass was needed for the cassette tape corresponding to Case 1.

Two study-case examples, Case 1 and Case 2, can be heard at http://www.tasso.cat/en/re-lubrication-of-compact-cassette-tapes-with-sbs/. No post-production processes were applied whatsoever. A videographic example of the working prototype is also provided.

6.1 Case 1: a fragment from Tape nº7 (Table 1)

As sonic and graphical evidence, we will analyze a 75-second sample of the Chopin Piano Concerto nº2, played by Alicia de Larrocha with Orquestra Ciutat de Barcelona (former OBC) conducted by Antoni Ros-Marbà on April 17, 1971 (live recording). The sample was recorded in tape nº7 (see Table 1).

Figures 1 and 2 show the sonogram and the superimposed waveform of this musical passage, pre and post re-lubricated. Vertical axis shows frequency in a logarithmic scale. Beyond the extended high frequency noise along the timeline, highlighted high frequency modulated side-bands are especially revealing. Such inter-modulated ascendant and descendant artefacts are the side effect of a musical phrase where the solo piano plays ascendant and descendant scales. Such artefacts largely disappeared from Figure 2.

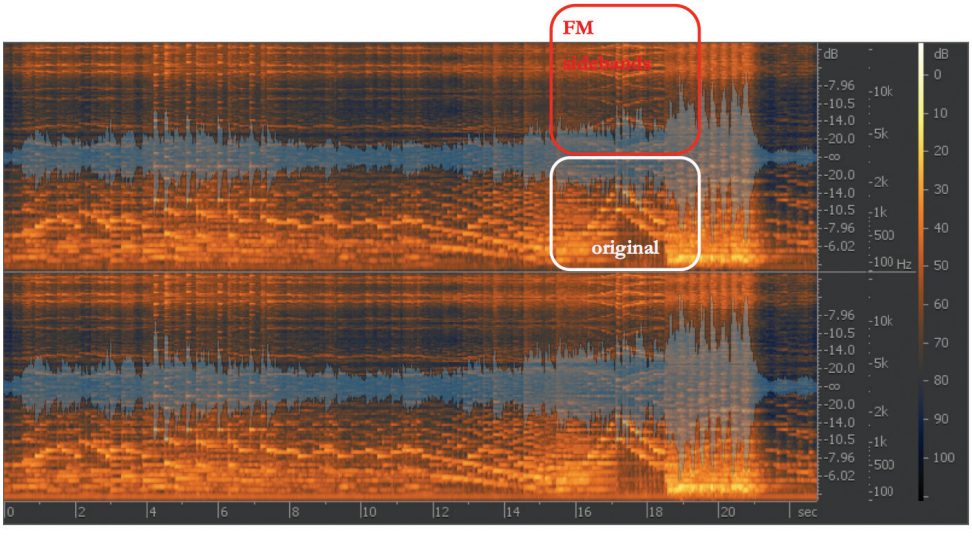


Figure 1. Case 1 pre-lubrication spectral analysis.

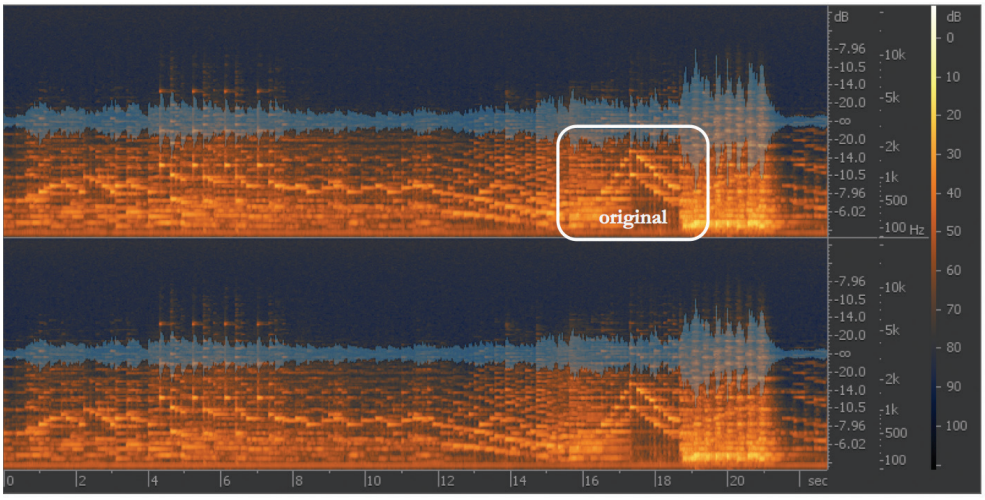


Figure 2. Case1 post-lubrication spectral analysis.

Figures 3 and 4 allow for a closer look at a linear-scale sonogram70 of the same musical fragment. Figure 3 reveals several side band replicas of the original content (centred at f_c) at frequencies $f_{sb} = f_c \pm nf_m$ (where n=1,2,3...) and spaced at multiples of f_m.

Based on analysis of the sonogram data, the original baseband — the spectrum of the original audio carrier — is frequency modulated by the stick-slip distortion at an approximate modulation frequency of f_m = 4920Hz (a period T_m = 0,203ms).

A mild stick-slip distortion would result in a scrape flutter (musically speaking, a wobbly vibrato, as can be heard in Case 2), whereas severe distortion (high amplitude stick-slip as in Case 1) will generate a very complex spectral pattern.

70 Obtained with Sonic Visualiser (www.sonicvisualiser.org), 2048 samples per window.

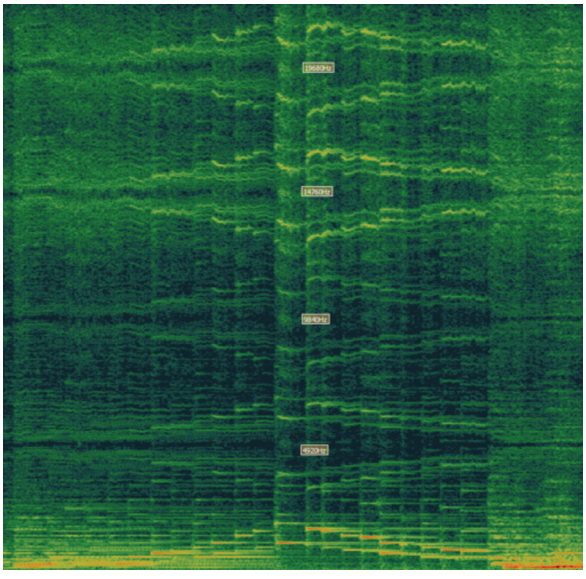


Figure 3. Case 1 pre-lubrication. Baseband and FM at multiples of around 4920Hz.

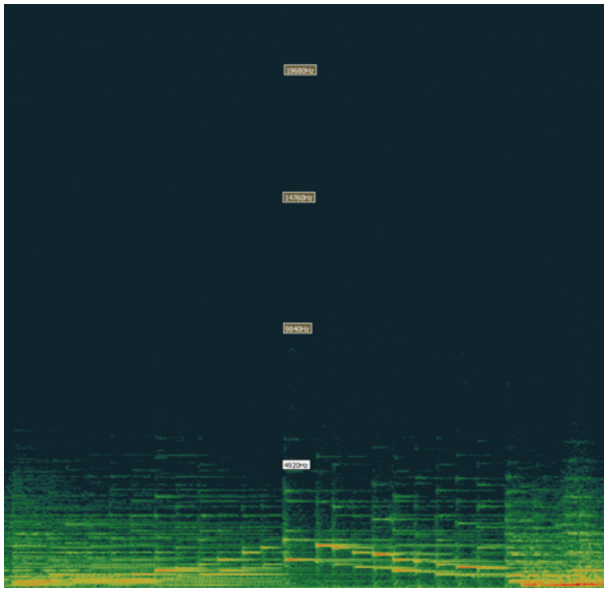


Figure 4. Case 1 post-lubrication. Baseband without traces of FM modulation.

6.1.1. The evolution of FM distortion during playback time

It can be also interesting to analyze the evolution of the modulation frequency thorough the length of this particular tape number n°7 (45min per side — see Table1). This will be related to the ability of the original lubricant to provide smooth tape transport as much as to related mechanical factors such as the tape-to-head friction, the tape tension, the sturdiness and stability of the tape transport, and the working temperature of the cassette deck, among others.

Figure 5 traces the evolution of FM distortion, very low at the beginning, varying during a certain amount of time (see the initially wavy pattern for f_m) but finally severe and roughly constant. In any case the distortion cannot be supposed constant throughout the tape, as, for instance, modulation distortion is quite low and inaudible between minutes 0:00 and 02:30 as well as between 13:00 and 14:00, but almost constant and steady from around minute 23:00 on. As expected, passages with no recorded sound imply no FM distortion.

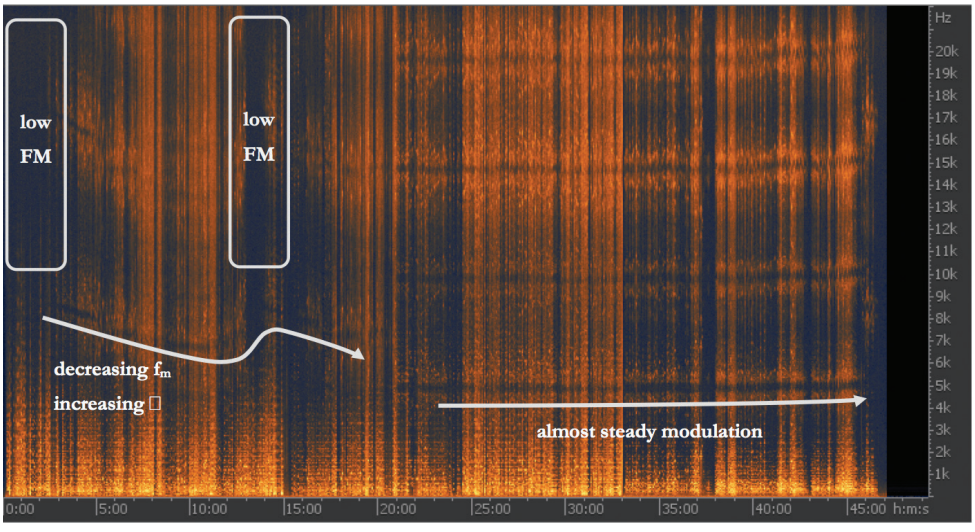


Figure 5. Case 1. Evolution of the modulator frequency fm through time. Pre-lubricated tape #7, side A, channel left (mono).

FM theory states that the extent of the distortion index (in our case, the stick-slip effect) will depend on the modulation index β, which in turn depends on the modulator frequency f_m and the carrier's peak frequency deviation Δf_c (the latter depending on the modulator's amplitude A_m). The modulation index will also define the modulated signal bandwidth (BW), that is, the extent of the side bands throughout the spectrum.[71] These main relationships are compacted in the following equations:

- The modulation index: $\beta = \frac{\Delta f_c}{f_m}$
- Carson's bandwidth rule: $\mathrm{BW} = 2f_m(1+\beta)$

We can deduce from these equations that, the lower the modulator frequency f_m,

- the higher the original tape-to-head friction and the greater the potential tape damage due to excessive tension build-up,
- the higher the modulation index and so the deeper its audible effect , and
- the higher the bandwidth of the modulated signal and so the more difficult to filter out by conventional means in post-production.

Even though not readily visible in the sonogram, the extent of the carrier's frequency modulation Δf_c (that is, the stick-slip amplitude) is the main consequence of this increased tape-to-head friction and thus the increased modulation index β.

71 For an approachable introduction to FM, see http://www.soundonsound.com/sos/apr00/articles/synthsecrets.htm.

6.2 Case 2: a fragment from Tape nº5 (Table 1)

The following is a 36-second sample of Mozart's Piano Concerto 25, K503 played by Alicia de Larrocha at Avery Fisher Hall (NY) on November 12, 1980 with the Philadelphia Orchestra, Ricardo Muti conducting. The sample was recorded in tape #5 (see Table 1).

This live recording was produced nine years after the previous one, but recorded to a fairly old tape model for the time (a BASF SM cassette LH super 90) known today to be prone to SBS. The stick-slip effect is reflected here in a very audible flutter distortion, even though the modulator frequency is not as severe and defined as in Case 1. Again, re-lubrication reduced tape-to-head dynamic friction and allowed for a smoother playback, resulting in a more stable outcome.

6.3 Negative side effects

Even though overall improvement in sound quality was consistent after re-lubrication, some drawbacks were detected:

- After a second-pass re-lubrication, a slight decay in HF response was audible, even with some dropouts, due perhaps to excessive distance loss.[72] Such dropouts were reparable in the digital domain, but eventually disappeared during a second playback.
- Continuous playback of re-lubricated tapes on the same tape deck, a Nakamichi ZX-7,[73] eventually affected tape transport that resulted in a temporal playback failure that lasted for one week. After extended intervals with the device switched on, to maintain internal temperature and favour lubricant vaporization, the deck recovered normal function.[74]

6.4 Four months after re-lubrication

In order to verify lubricant vaporization, an informal playback test was conducted four months after re-lubrication. As expected, all tapes exhibited varying degrees of the original SBS problem, a fact that confirms re-lubrication only as a temporal solution for proper digitization.

7. Conclusions

Discarded backing for cassette tapes with SBS, as also any digital means of sound restoration at a post-production stage due the complexity of the distortion pattern, re-lubrication has shown promise as a way to deliver — albeit temporally — playable cassette tapes to digitise.

When planning and implementing a prototype to allow for re-lubrication, care has been taken to ensure the following aspects:

- Added lubricant agents should decrease tape-to-head friction without significant increase of spacing loss (HF loss).
- Being that re-lubrication is a temporal solution, lubricants should vaporize from the tape and tape deck in the short or mid-term without causing damage. Nonetheless, the tape deck might become over-flooded with lubricant and become temporally non-operative.
- Lubricants should be applied evenly and uniformly along the tape length (not using manually applied q-tips) with a motorized, externally controlled transport for duration and speed (that was implemented in our case with an Arduino microcontroller).

72 The loss of head output is proportional to d/λ, where λ is the recorded sound wavelength and d the distance between tape and replay head.
73 This was not the case nevertheless for a Nakamichi CR-7, also used extensively.
74 This problem was also observed by Hess (2007:260) and Dietrich Schüller in a recent article at IASA Journal nº42 - Schüller, D. (2014:35) "Magnetic tape stability: talking to experts of former tape manufactures."

- Tape transport should be done in the least obtrusive way, keeping tape within its cassette (be it the original one, or after removing tape to a new cassette shell).
- Future improvements in the propototype should include guide rollers to reduce friction along the tape transport.

I would like to thank Elena Elía and Maria Ferré, curators from the Alicia de Larrocha Archive, as well as Alicia Torra de Larrocha, for their kind support and permission to investigate and show practical examples of tapes with SBS. I am also indebted to Paul Poletti, Perfecto Herrera, and Enric Guaus, professors from the ESMUC Sonology Deparment, for reviewing the drafts of this document. I would finally like to thank Margarida Ullate, Marcos Sueiro and Ferran Conangla for their encouragement to write this document.

8. References

Agilent Technologies. "Spectrum Analysis Amplitude and Frequency Modulation: Application Note 150-1." Available at: http://cp.literature.agilent.com/litweb/pdf/5954-9130.pdf.

Carlson, A. Bruce. Communication Systems: An Introduction to Signals and Noise in Electrical Communication. McGraw-Hill, 4th Ed. 2002.

Casey, Marc. "FACET – The Field Audio Collection Evaluation Tool." Indiana University, 2007. Available at: http://www.dlib.indiana.edu/projects/sounddirections/facet/facet_formats.pdf.

Hess, R. "Tape Degradation Factors and Challenges in Predicting Tape Life." ARSC Journal 39.2, 2007. Available at: http://www.richardhess.com/tape/history/HESS_Tape_Degradation_ARSC_Journal_39-2.pdf.

IASA Technical Committee. Guidelines on the Production and Preservation of Digital Audio Objects, ed. by Kevin Bradley. IASA-TC04 Technical Committee, Second Edition 2009. Available at: http://www.iasa-web.org/audio-preservation-tc04.

Reid, Gordon. "Synth Secrets, Part 12: An Introduction To Frequency Modulation." Sound on Sound, April 2000. Available at: http://www.soundonsound.com/sos/apr00/articles/synthsecrets.htm.

Schüller, D. "Magnetic tape stability: talking to experts of former tape manufactures" IASA Journal, issue 42, January 2014.

"HONEY, I BURNT THE TAPES!" A STUDY ON THERMAL TREATMENT FOR THE RECOVERY OF MAGNETIC TAPES AFFECTED BY SOFT BINDER SYNDROME-STICKY SHED SYNDROME

Federica Bressan, Department of Information Engineering, University of Padova, Italy
Sergio Canazza, Department of Information Engineering, University of Padova, Italy
Roberta Bertani, Department of Industrial Engineering, University of Padova, Italy

"*I often receive questions on baking reels from archivists — how to do it, when to do it, and if it should be done at all. I would not be surprised if there are portions of collections out there that were accidentally destroyed by a well meaning archivist.*"[75]

Magnetic tape is an important medium in the capturing of information and has had widespread use in audio, video, and computer applications over the past 60 years. Libraries, archives, museums, government agencies, and commercial organisations have relied on magnetic tape for storing a considerable part of their information. The critical concern is primarily the change in physical properties of the magnetic tape, rather than the loss of magnetic characteristics[76]: magnetic tapes have proved to be rather stable in this aspect, and if a significant loss of magnetic characteristics is present, it is usually due to careless exposure to magnetic charges.

The lack of diagnostic tools to assess the state of preservation of tape collections forces the inspections to rely mainly on visual examinations and evaluators' expertise[77], while recovery methods are still subject to intuitive expedients and trial-and-error approaches. The lack of scientific knowledge on the optimal recovery methods leaves the way open to ill effects that might unintentionally damage the audio documents. In particular, the treatment discussed in this article is recognised to be "an invasive procedure that is not fully understood."[78]

By presenting a set of exploratory analyses conducted on magnetic tapes, this articles aims at raising awareness of the risks entailed by the treatment commonly used for the recovery of damaged tapes. On a higher level, it confirms that the field of audio preservation is still open to scientific research[79], and that knowledge advancement is better achieved in collaboration with disciplines such as chemistry, materials science, and engineering.

Most tape is made by coating the surface of a plastic film base or backing with a paint or "ink" containing magnetic particles homogenized in a binder that adheres to the film and dries by evaporation. The coating is usually so thin that it is only a small fraction of the over-all tape thickness.[80] Although the base is magnetically inert, it must meet stringent requirements of thickness, strength, and stability, in order to give a reasonable playing time in a compact reel. A tape about 50µm thick fills an 18 cm diameter reel with 365 meters of tape, which equals to a half hour at 7.5 inch/s. In addition to the base and binder, most tapes produced since the early 1980s show a back coating that acts as an aid to tape packing on the hub and reel.[81]

75 AES, 2008, p. 24.
76 Ibid.
77 Bigourdan, J., Reilly, J.M., Santoro, K., Salesin, G., "The preservation of magnetic tape collections: A perspective," IPI, 2006.
78 Casey, M., "Facet (field audio collection evaluation tool) — format characteristics and preservation problems, version 1.0," Indiana University, 2008, p.32.
79 Schüller, D., "Magnetic tape stability: talking to experts of former tape manufacturers," IASA Journal (42), 2014.
80 Camras, M., "Magnetic recording handbook," Van Nostrand Reinhold Company, 1988, P. 97.
81 Gibson, G.D., "Magnetic tape deterioration: Recognition, recovery and prevention," in Proceedings of the IASA annual Conference, 1996.

Figure 1. Sticky residue of a magnetic tape affected by SBS-SSS. Source: Centro di Sonologia Computazionale (CSC), University of Padova.

The degradation of all types of audio media is mainly due to their intrinsic chemical instability[82], aggravated by inadequate handling, storage conditions, and poor manufacture. The effects of the process of degradation are diverse and carrier-dependent: "degradation of magnetic tape is complex and not yet well understood."[83] One of the problems most often observed in magnetic tapes is characterised by undesirable shed, stickiness, or squeal, usually treated with prolonged exposure to heat. The authors embrace the terminology proposed by Hess[84], where the broad term "soft binder syndrome" (SBS) is applied "to all tapes that show stickiness, shedding, and/or squealing, whether they respond to baking or not."[85] The authors also agree with the additional subdivision proposed by Casey[86], where tapes that squeal but do not shed nor respond to treatment are classified as tapes with "unidentified problems" (SBS-UP) as opposed to "sticky shed syndrome" (SBS-SSS). This article focuses on tapes affected by SBS-SSS. Figure 1 shows a close-up of replay heads with sticky residue from a tape affected by SBS-SSS.

1. Motivation

Thermal treatment is a popular procedure that can temporarily revert the effects of the SBS-SSS. The procedure was first introduced in 1993 by the Ampex Systems Corporation[87] with the US Patent describing "a method of heat treating magnetic recording media comprising maintaining the magnetic recording media at a sufficiently elevated temperature for a sufficient time to overcome the adverse consequences of undesirable shed, stickiness or squeal." The patent recommends "a temperature of at least 50°C for at least 8 hours," however "lower temperatures and/or shorter times can restore media sufficiently to enable play-back." The factor that determines the temperature and the duration of the treatment is the state of deterioration of the audio document, but the patent does not provide indications on how to relate this information.

82 Schüller, D., "The ethics of preserving audio and video documents," UNESCO, 2006.
83 Casey, M., Gordon, B., "Sound Directions: Best Practices for Audio Preservation," Harvard University and Indiana University, 2007, p. 29.
84 Hess, R., "Tape degradation factors and challenges in predicting tape life," ARSC Journal 39(2), 2008, pp. 240–274.
85 Ibid., p. 251.
86 Casey, M., 2008, p. 33.
87 Medeiros, D., Curtis, J.L.S., Parry, R., Underwood, J., "Restored magnetic recording media and method of producing same," United States Patent, 1993.

The patent refers to its own results as "unexpected"[88] and "surprising,"[89] besides admitting that the theory behind it is not ascertained: "*it is believed* that the heat restoration process according to this invention, to some extent, may reverse certain hydrolysis" (italics of the authors). According to this "belief," more recent sources claim that thermal treatment is aimed at "removing the moisture that has accumulated in the binder" — although apparently this is only "thought" to happen.[90]

Despite this controversial scenario, thermal treatment continues to be largely applied and rightly so, considering that it is effective in most cases — although the reason is not known. Nevertheless, the careful archivist should be aware that the knowledge about thermal treatment "is merely anecdotal and will require further study."[91] Fortunately, further studies are in fact being carried out[92] and the care that the archival community has for novel solutions in the documents' best interest clearly shows at conferences, in journals, and mailing lists.

In the authors' experience, most tapes respond to "baking", but some do not, and a few are even damaged by it (an example is shown in Figure 1). The authors decided to plan a first set of chemical analyses during a research project aimed at the digitisation of unique audio documents with a great historical and economic value[93], for which no risk could be taken. The ultimate goal of this study is the definition of a scientific protocol for the treatment of SBS-SSS, which may spare many recordings from the consequences of unaware treatments — in terms of temperature, duration, and equipment (instead of a precision incubator such as the one shown in Figure 2, relatively expensive, "the most common equipment is the American Harvest Snackmaster Pro FD50 Food Dehydrator"[94]; even the home made solution of the hair-dryer-in-a-cardboard-box is said to "work well"[95] — sic!).

Other moot questions on thermal treatment are: the recommendable humidity level in the incubator during the treatment, which is not indicated in any of the sources; the duration of the benefits ("incubating the tape returns the tape to a playable condition for weeks or months after treatment"[96]; "this remedy is temporary; the tape will revert over time."[97]); and the risks involved with the treatment. "Although some report having 20-or-more successful 'bakes', there is no published or documented information on how many times a tape can be baked, cycling back and forth between the sticky-firm-sticky succession before it fails completely or before the signal is distorted or altered beyond use."[98] In fact, there is "little knowledge about how exposure to increased heat may impact the tape artifact itself."[99]

88 Medeiros, D., et al., 1993. "In this invention it has been unexpectedly found that deteriorated magnetic recording media [. . .] can be restored to playable and excellent quality media by heat treatment at a sufficiently elevated temperature for a sufficiently long time [. . .]."

89 Medeiros, D., et al., 1993. "It has also surprisingly been found that the heat treatment according to this invention can be carried out with the magnetic recording media such as tape in its cassette, on its reel, or retained by other tape housings [. . .]."

90 Medeiros, D., et al., 1993. "It is commonly thought that baking a tape will temporarily remove the moisture that has accumulated in the binder" (italics of the authors), from http://en.wikipedia.org/wiki/Sticky-shed_syndrome (last visited December 8th, 2014).

91 Gallegos, C., "And the survey says. . . ok! but the data says!," IASA Journal 38, 2012, p. 24.

92 Schüller, D., 2014.

93 Audiovisual archive of the Fondazione Arena di Verona, Italy (2009-2011). See: Bressan, F., Canazza, S., "Towards a procedure for quality control over large collections of digitized audio data: The case of the Fondazione Arena di Verona," in C. Grana, R. Cucchiara (eds.) Multimedia for Cultural Heritage, Springer, 2012.

94 Norris, S., "Tape baking" (contribution to Stanford University's audio preservation manual, "Introduction to Audio Preservation"), Stanford University, 2007.

95 Rivers, M., "Baking magnetic tape to overcome Sticky-Shed Syndrome," 2000.

96 Hess, R., 2008.

97 National Recording Preservation Board, "Capturing analog sound for digital preservation: Report of a roundtable discussion of best practices for transferring analog discs and tapes," 2006.

98 Gibson, G.D., 1996.

99 Norris, S., 2007.

Figure 2. Precision incubator suitable for the thermal treatment of magnetic tapes. The model shown in the picture is a Memmert INP 400 with natural convection. Source: Centro di Sonologia Computazionale (CSC), University of Padova.

2. Description of the analyses

The chemical analyses described in this section are not particularly innovative in the chemical field, but they had never been used to study audio magnetic tapes and the effects of thermal treatment. This shows that the collaboration with other well-established scientific disciplines can still significantly benefit the field of audio preservation and the methods adopted in this field.

The main goal of the analyses was to characterize the tapes, i.e., to understand their exact physical composition, in order to plan recovery methods that take into account the behaviour of each different material at varying environmental conditions including time (aging). Magnetic tapes are a complex case in this study, because they are made of several materials (substrate, etc.), whereas chemical characterization is usually performed on individual materials.

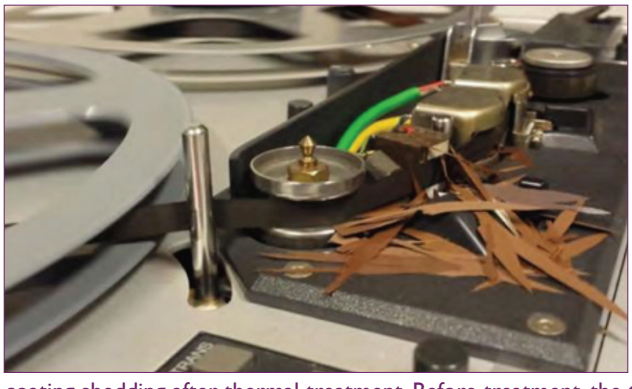


Figure 3. Magnetic coating shedding after thermal treatment. Before treatment, the tape showed some stickiness and shedding. After treatment the shedding was gone, but the magnetic coating was coming off in flakes as shown in the picture. Source: Centro di Sonologia Computazionale (CSC), University of Padova.

2.1 FTIR spectroscopic analysis in ATR

Infrared spectroscopy is a widely used technique that for many years has been an important tool for investigating chemical processes and structure. The combination of infrared spectroscopy with the theories of reflection has made advances in surface analysis possible. The fundamentals of Attenuated Total Reflection (ATR) spectroscopy are based on the evanescent wave

and how it is related to the concept of internal reflection. The concept of internal reflection spectroscopy originates from the fact that radiation propagating in an optically dense medium of refractive index n1 undergoes total internal reflection at an interface of an adjacent medium of lower optical density (refractive index n2 < n1). This wave is termed evanescent and is derived from the Latin root evanescere, meaning "to tend to vanish or pass away like a vapor." The above phenomenon occurs only when the angle of incidence exceeds a critical angle θ_c determined by $\sin\theta_c = n1/n2$. Samples are examined directly, without preparation. Infrared radiation internally reflects through a crystal (ZeSe Diamond) penetrating the sample by only a few microns. The absorbing / scattering of the light is collected and measured to produce a spectrum which is characteristic for the compound being analised. The instrument used for the analyses is a Nicolet Nexus 5700.

2.2 ThermoGravimetric analysis

Thermogravimetric Analysis (TGA) measures the amount and rate of change in the weight of a material as a function of temperature or time in a controlled atmosphere. Measurements are used primarily to determine the composition of materials and to predict their thermal stability at temperatures up to 1000°C. The technique can characterise materials that exhibit weight loss or gain due to decomposition, oxidation, or dehydration.

The analysis has been carried out with a linear temperature increase with a rate of 15°C per minute. The instrument used for the analysis is a TA Instruments SDT 2960 Simultaneous DSC-TGA. The analysis has been carried out under nitrogen atmosphere.

2.3 Electronic microscopy

The Scanning Electron Microscope (SEM) is considered to be a non-destructive type of analysis.[100] It uses a focused beam of high-energy electrons to generate a variety of signals at the surface of solid specimens which are subsequently collected by a detector. The signals that derive from electron-sample interactions include secondary electrons (that produce SEM images), backscattered electrons (BSE), diffracted backscattered electrons (EBSD), photons (characteristic X-rays), visible light (cathodoluminescence–CL), and heat.

These signals reveal information about the sample including external morphology (texture), chemical composition, and crystalline structure and orientation of materials making up the sample or a selected area of the surface of the sample (areas ranging from approximately 1 cm to 5 microns). A 2-dimensional image is generated with magnification ranging from X20 to approximately X30,000 and spatial resolution of 50 to 100 nm.

Samples must be solid and they must fit into the microscope chamber that undergoes into a stable vacuum on the order of 10^{-5} - 10^{-6} torr. (Samples likely to outgas at low pressures are usually analysed by "low vacuum" and "environmental" SEMs or ESEM). The instrument used for the analysis is a Philips XL30 TMP Microanalisi XRF-EDS.

2.4 Acetone extraction test

The acetone extraction test is able to provide valuable information on tape binder stability. The degradation products of the polyurethane binder were found to be soluble in acetone, and the weight percent (wt.%) of extractable was considered to be a measure of the degradation. Tape binder degradation is the result of polymer breakdown that occurs in reaction with

100 In this field, non-destructive means that the analysis can be repeated on the same sample more than once. But from the viewpoint of audio preservation, this test is destructive because it requires that the sample is prepared (i.e., gold coating), which is an irreversible modification of the tape. The fact alone that a small piece of tape must be cut to obtain the sample (approximately 1 cm) would not make the test destructive.

humidity (i.e., hydrolysis). Hydrolytic breakdown causes a change in the structure of the polymeric chain, producing low-molecular-weight fragments. These end-fragments are compounds that are mobile and tacky, and they are likely to be extractable in acetone.

The acetone extraction test was chosen based on its ability to measure an increasing proportion of extractable end-fragments from the polyurethane polymer as binder hydrolysis proceeds. Measuring the percentage of extractable in acetone provides an indication of tape condition and reflects tape playability. Such a measurement indirectly detects the presence of low-molecular-weight products and is a good indicator of either degraded or unstable polyurethane binder. However, other components such as lubricants might also be soluble in acetone, and this may alter the results: for this reason, the authors have planned a study to analyse the composition of the residue. Since tape formulation may vary in significant ways, it was expected that the wt.% of extractable may also vary from one type of tape to another regardless of the degree of binder hydrolysis. Significant variation due to differences in format, manufacturer, or production batch was expected, besides a number of tape samples that were completely destroyed after the test, preventing any further measure of the weigh. The number of tapes on which the test could not be performed due to this behaviour are significant (about half of them): this fact was not reported in the previous study[101] that inspired the one presented by the authors, which makes it even more important to find alternative tests, such as the acidity test (extraction in water), which will be performed in the future precisely on the tapes that degrade completely in acetone.

Sample	Description
1. Sample preparation	Sample weight: approx. 0.5 mg. Length of tape sample was based on tape width (e.g., 18" sample for 1" tape, 36" sample for 1/2" tape). Four test samples were prepared for each tape tested.
2. Conditioning	Sample was conditioned to 21°C, 50% RH, for at least one hour.
3. Weighing	Sample was placed in a weighing bottle and weighed on precision scale (±0.0001 gram).
4. Acetone extraction	Sample was accordion-folded and immersed in 30 ml of acetone for 30 minutes.
5. Drying	Sample was retrieved and rinsed in acetone. Then, it was placed on filter paper for 15 minutes to drain and to let the acetone evaporate. Sample was placed in dry oven at 50°C for 15 minutes.
6. Conditioning	Sample was conditioned to 21°C, 50% RH, for at least one hour.
7. Reweighing	Sample was placed in a weighing bottle and weighed on precision scale.
8. Calculation	Acetone extractable was expressed in wt.% based on weight loss of sample. Final determination was expressed as average value based on four determinations for each tape tested.

Table 1. Acetone extraction method used by Bigourdan, et al., for testing magnetic tapes.[102]

101 Bigourdan, J., et al., 2006, p. 25.
102 Bigourdan, J., et al., 2006, p. 27.

Extraction time. Bigourdan, et al.,[103] reports that some preliminary tests show that the wt.% of extractable is influenced by a variety of factors, most notably the duration of the acetone extraction. Thirty-minute immersion in acetone provides repeatable results. Shorter extraction times lead to inconsistent results, and longer extraction times do not significantly increase the amount of extractable compounds. Average values were determined based upon four evaluations for each extraction time and tape width. It was shown that increasing the duration of acetone extraction beyond 30 minutes did not significantly alter the final results for tapes. The values determined for each set of four measurements conducted on each tape displayed small differences.

Previous works[104] also suggest a 20-minutes extraction time, but in the present study a 30-minute extraction time was adopted.

Based on the preliminary tests, Bigourdan, et al.,[105] finalised an acetone extraction method to be used in the research, which the authors replicated herein. The method provides reproducible results within an acceptable range. The data discussed in the following sections were determined following the procedure described in Table 1.

It is worth mentioning that a different physical test (friction test) is suggested by Bigourdan, et al.,[106] aimed at "detecting the changes in the tape binder over time" and which was inspired by the work of the Eastman Kodak Company on motion-picture films in 1971.[107] The test involves placing a length of the tape sample on the surface of an inclined plane. A rider is placed on top of the sample strip that has point contact with the surface. The inclined plane is raised until the rider slides. The idea behind this application of the friction test is that binder degradation increases the stickiness of the tape surface, and increased stickiness, in turn, necessitates raising the device plane higher in order to initiate the sliding of the rider. The coefficient of sliding friction was measured as a tangent of the inclined plane to the horizontal. Contrary to the test conducted in the present work, the friction test just described is non-destructive. The author has not been able to try this test yet.

3. Results and discussion

Ten tape samples (labeled from A to L) have been analysed with the techniques described in the previous section. Some tapes came from the sound archive of the Arena di Verona, Italy[108] and some from the Centro di Sonologia Computazionale (CSC) of the University of Padova, Italy. All of them contained audio recordings (i.e., were not blank/new) and dated back to the 1980s or earlier. The brand was not always known due to missing box or explicit indication.

The combination of electronic microscopy and the FTIR in ATR allows for the determination of the chemical nature of the tape substrate, of the binder and of the magnetic material. The FTIR technique is fast, non-destructive, relatively inexpensive, and it allows for the identification of acetate tapes, the degradation of which is more accentuate and, most importantly, should never undergo thermal treatment. Acetates are thermolabile, and they would be irreversibly damaged. The most common rule of thumb to recognise acetate and polyester-based tapes is to "hold the tape up to the light and observe whether it appears translucent or opaque. If it appears translucent, it is acetate. If it appears opaque, it is polyester."[109] Another source claims that tapes are "easy to identify: hold the tape pack up to a strong

103 Bigourdan, J., et al., 2006.
104 Bertram, H.N., Cuddihy, E.F., "Kinetics of the humid aging of magnetic recording tape," IEEE Transactions on Magnetics 27, 1982, pp. 4388–4395.
105 Bigourdan, J., et al., 2006.
106 Bigourdan, J., et al., 2006, p. 33.
107 Anvelt, T., Carroll, J.F., Sugden, L.J., "Processed film lubrication: Measurement by paper clip friction test and improvement of projection life," Journal of the Society of Motion Picture and Television Engineers 80(9), 1971, pp. 734–739.
108 Bressan, F., Canazza, S., 2012.
109 Norris, S., 2007.

light and look through the pack itself. Acetate-based tapes are translucent, and light may be seen through the layers. Polyester tapes are opaque and no light is visible through the tape pack."[110] These rules of thumb are generally true but not infallible: the results of the FTIR Spectroscopic analysis in ATR shown in Table 2 revealed that the shiny side of tape samples A and B was made of cellulose acetate, despite their appearance which was not translucent. Failing to recognize acetate tapes can potentially destroy them irreversibly, hence the importance of 100% safe methods for their identification (possibly based on objective measurements and not on the human sensory system).

The large variety of materials shown in Table 2 is striking, even among the polyester-based tapes, and suggests that a "one size fits all" recipe for recovery is not optimal.
Another important observation about the FTIR analysis in ATR shows a negligible presence of water on the tapes' surface. This contradicts the popular sources that claim that thermal treatment is aimed at "drying" tapes, literally "extracting" the water that they have absorbed during years of storage in humid environments ("the binder [. . .] soaks up water and causes the urethane to rise to the tape's surface"[111]). Water is considered to be responsible for the stickiness exhibited by the tapes: "hydrolysis [is] the process by which the chemical that bonds the recording oxide to the polyester base absorbs moisture from the air."[112]

Sample	Brand	Shiny side	Matt side
Tape A	TEAC	cellulose acetate	polyvynil chloride - vynil alcohol
Tape B	AGFA	cellulose acetate	not identified[a]
Tape C	MAXELL	co-polymer (poly-vinyl butirrale - vinyl alcohol - vinyl acetate)	poliurethane
Tape D	TDK	polyester	polyester
Tape E	BASF	polyurethane	not identified[a]
Tape F	unknown	polyurethane	polyester (stearate)
Tape G	3M	PET	poliurethane
Tape H	BASF	polyurethane	co-polymer (tetrafuoloethylene - esafluoropropylene (TEFLON 100))
Tape I	unknown	polyurethane	not identified[a]
Tape L	unknown	polyurethane	not identified[a]

Table 2. The table summarizes the results of the FTIR spectroscopic analysis in ATR. The first column reports the tape samples. For each sample, the material composing the shiny side and the matt side is indicated. Tapes are identified only by the brand, because the model was unknown for all but three (Tape sample E: BASF SPR 50 LHL).
Table footnote a: The presence of degradation products or of a mixture of materials does not allow the identification solely on the basis of FTIR.

110 Casey, M., 2008, p. 5.
111 Kaltseis, S., Hubauer, A., "Tape dehydration as part of the 'journale' project: On dealing with sticky-shed syndrome," IASA Journal 38, 2012, p. 41.
112 National Recording Preservation Board, 2006, p. 2.

This belief is confirmed by the many web pages that propose food dehydrators in place of thermo-incubators for treating the syndrome. Food dehydrators use heat source and air flow to reduce the water content of foods: "dehydrating is a method of food preservation in which *moisture is removed* from the food"[113] (italics of the authors). Removing water from magnetic tapes, in whatever form, seems to be pointless, since the analyses showed that the presence of water was less than 1% in all tape samples. Hess and Casey had already pointed out that "the mechanism by which baking (also called incubation) renders a Sticky Shed Syndrome tape playable has been misunderstood."[114]

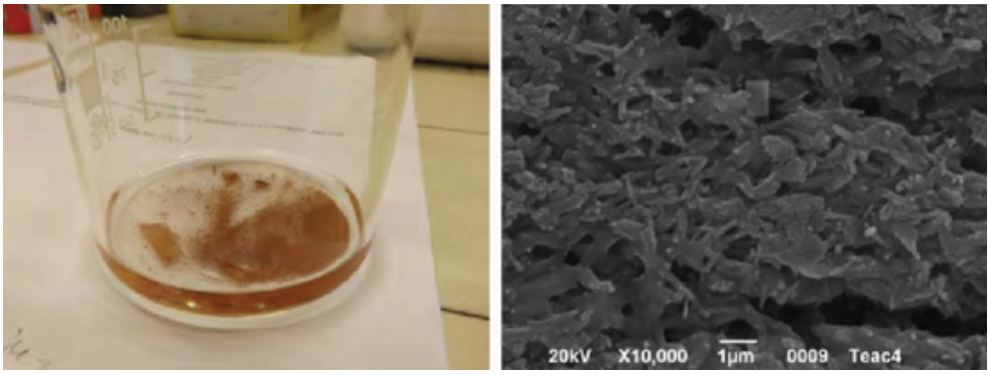
At the same time, the quality of some FTIR analyses was too poor to allow the characterisation of the materials (in particular, the matt side of the tape samples B, E, I, and L). The reason might be a mixture of components, some of which have probably originated from the process of hydrolysis, or which have been in the tape since manufacturing. This calls for further study on the chemical nature of the degradation products that can originate from the process of hydrolysis. The authors intend to conduct more studies on the residue of the acetone extraction test, namely on the tape samples that have completely melted or that have been destroyed in incubation. In fact, the acetone extraction test has been particularly interesting. The outcome was unexpected, as the source that inspired the test in this work does not report any case where the tapes melted or got destroyed, which was the case of tape samples A, B, and G (Figure 4(a)).[115] Another work on the experimental results of the acetone extraction test does not report similar cases either.[116] The test could not be performed on the melted/destroyed samples. The reasons might be the nature of the materials or the process of degradation involving the tapes.

Previous scientific literature does not report of works where audio magnetic tapes have been observed by means of electronic microscopy. The ESEM does not require the preparation of the samples (e.g., gold coating), but the SEM analysis — which does — reaches a greater magnification and allows to observe the different crystalline structures of the magnetic particles, such as in tape sample A (Figure 4(b)). Different structures suggest the presence of different types of iron oxides, corresponding to different chemical and magnetic properties. The types of iron oxides are at least four:

1. wüstite (FeO), crystallizes in cubes
2. magnetite (Fe_3O_4), crystallizes in octahedra
3. hematite (αFe_2O_3), crystallizes in the rhombohedral system
4. maghemite (γFe_2O_3), crystallizes in the tetragonal system

Figure 4(b) suggests the presence of two different types of iron oxide, since two different shapes are observed. In order to determine them accurately, future work might include an X-Ray Diffraction (XRD) analysis: the differences among the types of iron oxide is significant to the study on magnetic tapes in that it involves aging (behavior in time) and reactivity to water (hydrolysis).

113 Website of well-known producer of food dehydrators and roaster ovens: http://www.nesco.com/.
114 Casey, M., 2008, p. 30, and Casey, M., Gordon, B., 2007, p. 31.
115 Bigourdan, J., et al., 2006.
116 Cuddihy, E., "Aging of magnetic recording tape," IEEE Transactions on Magnetics MAG-16(4), 1980, pp. 558–568.



(a) Acetone extraction test (b) Electronic microspcopy

Figure 4. Tape sample A after the acetone extraction test (left) and observed by means of electronic microscopy (right). The first number from bottom left of the figure on the right is the power of the electron beam (20 kV); the second is the magnification rate (X10000); the third is the scale (the white segment above indicates the proportion, 1 µm); the progressive number in the analysis session; the sample identification number.

The ESEM also allows to determine which side of the tape carries the magnetic coating, which is not always easy to do with a visual inspection: the tape sides come in different colours (from light brown to black) and often with a shiny side and a matt side, but either can carry the magnetic coating. The ESEM allows analysing (i) the morphology of the tape, including damages of mechanical origin (gouges and hollows), and (ii) the distribution of the magnetic material on the tape surface.

The study of the thermal behaviour of the tapes by means of TGA measurements has been considered of great interest, since the initial motivation for this experience was the thermal treatment used for compensating the effects of the SBS-SSS. The results of the TGA showed that below 150°C the weight loss is extremely limited (less than 1%). Typically, this loss is due to adsorbed water, with more or less strength. These results suggest that the measurements might be repeated in the future with a slower heating ramp, with the aim of highlighting the liberation of adsorbed water or other volatile substances. Figure 5 shows an example of TGA graphics for a tape sample.

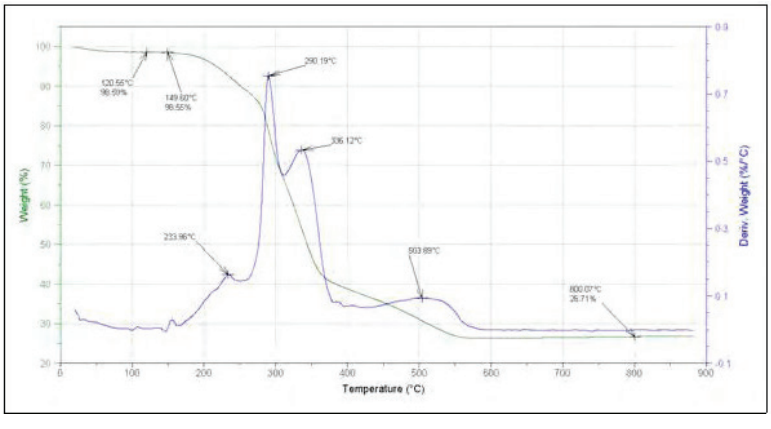


Figure 5. Example of TGA output. The green line indicates the tape sample weight (%), and the blue line the derivative tape sample weight (%/°C).

Two of the tape samples that have been analysed in this work were affected by SBS-SSS (samples I and L). The results indicate that the entity of their degradation was not severe, since the tapes were not melted nor destroyed during the acetone extraction test. However, the weight loss of the samples is consistent with the literature about damaged tapes (6.30% and 5.80%, against an average 1.35% of the samples in better condition). This indicates that the magnetic coating is not perfectly adherent to the substrate. Moreover, the residue that the tapes affected by SBS-SSS leave on the audio heads of the recorder has been analysed, and the presence of iron suggests that a portion of the information is physically detached from the coating. The entity of the modification on the audio signal induced by the detachment of the sticky residue is an interesting matter for future investigations.

4. Conclusions and further work

The aim of this article was to raise awareness in the archival community on the risks that are currently being taken when restoring magnetic tapes with thermal treatment due to the lack of a scientific understanding of the effects of said treatment. Nevertheless, the authors agree that the "lack of understanding of the sticky shed problem does not justify inaction on the part of audio archivists, since sticky shed grows gradually worse over the years."[117] Until further knowledge is gained, and precise recovery methods are devised, it is ok to keep "baking" tapes, but it is very important to be aware of the risks and, of course, to carry out the procedure with professional equipment (precision incubator).

The authors are currently conducting additional analyses to find out possible differences on tape samples before and after treatment, both at physical level and in the audio signal. The analyses are not only finalised at identifying the modifications that affect the tape during the treatment, but also to answer to this question: is the audio signal altered by the treatment? If so, how? If the treatment makes the tape playable again, then it is considered to be successful, but at what cost for the sound spectrum?

The authors also wish to keep investigating the products of tape degradation by means of the acidity tests, in order to determine hydrosoluble substances, generally of acid nature, produced by hydrolysis. Another aspect to explore is the acidity of the tape surfaces by means of a chemical method developed at the Department of Industrial Engineering of the University of Padova. The research schedule includes the Atomic Force Microscopy (AFM) analysis, finalised at studying the morphology of the surfaces; the Gas Chromatography-Mass Spectrometry (GC-MS); and the broadband dielectric relaxation spectroscopy.

5. References

AES. "AES recommended practice for audio preservation and restoration — Storage and handling — Storage of polyester-base magnetic tape." AES, New York, NY (1997 (r2008)).

Anvelt, T., Carroll, J.F., Sugden, L.J. "Processed film lubrication: Measurement by paper clip friction test and improvement of projection life." Journal of the Society of Motion Picture and Television Engineers 80(9), 734–739 (1971).

Bertram, H.N., Cuddihy, E.F. "Kinetics of the humid aging of magnetic recording tape." IEEE Transactions on Magnetics 27, 4388–4395 (1982).

Bigourdan, J., Reilly, J.M., Santoro, K., Salesin, G. "The preservation of magnetic tape collections: A perspective." Tech. Rep. NEH GRANT PA-50123-03, Image Permanence Institute, Rochester Institute of Technology, Rochester, NY (2006).

117 Norris, S., 2007, p. 3.

Bressan, F., Canazza, S. "Towards a procedure for quality control over large collections of digitized audio data: The case of the Fondazione Arena di Verona." In: C. Grana, R. Cucchiara (eds.) Multimedia for Cultural Heritage. First international Workshop MM4CH 2011. Revised selected papers, no. 247 in Communications in Computer and Information Science, pp. 103–113. Springer, Modena (Italy) (2012). Accessible at: http://www.dei.unipd.it/ bressanf/share/pub/articles/2012_bressan_canazza_MM4CH_small_onlyArticle.pdf.

Camras, M. *Magnetic recording handbook*. Van Nostrand Reinhold Company, New York, NY (1988).

Casey, M., Gordon, B. "Sound Directions: Best Practices for Audio Preservation." Harvard University and Indiana University (2007).

Casey, M. "Facet (field audio collection evaluation tool) — format characteristics and preservation problems, version 1.0." Tech. rep., Indiana University (2008). Accessible at: http://www.dlib.indiana.edu/projects/sounddirections/facet/facet_formats_large.pdf.

Cuddihy, E. "Aging of magnetic recording tape." IEEE Transactions on Magnetics MAG-16(4), 558–568 (1980).

Gallegos, C. "And the survey says... ok! but the data says!" IASA Journal 1(38), 20–26 (2012).

Gibson, G.D. "Magnetic tape deterioration: Recognition, recovery and prevention." In: Proceedings of the IASA Annual Conference. IAML/IASA, Perugia (Italy) (1996). Accessible at: http://www.unesco.org/webworld/ramp/html/r9704e/r9704e11.htm.

Hess, R. "Tape degradation factors and challenges in predicting tape life." ARSC Journal 39(2), 240–274 (2008).

Kaltseis, S., Hubauer, A. "Tape dehydration as part of the "journale" project: On dealing with sticky-shed syndrome." IASA Journal 1(38), 40–45 (2012).

Medeiros, D., Curtis, J.L.S., Parry, R., Underwood, J. "Restored magnetic recording media and method of producing same." United States Patent (1993).

National Recording Preservation Board, U.S. "Capturing analog sound for digital preservation: Report of a roundtable discussion of best practices for transferring analog discs and tapes." Tech. rep., The National Recording Preservation Board (Library of Congress) (2006).

Norris, S. "Tape baking" (contribution to Stanford University's audio preservation manual 'Introduction to Audio Preservation'). Tech. rep., Stanford University (2007).

Rivers, M. "Baking magnetic tape to overcome Sticky-Shed Syndrome." (2000).

Schüller, D. "Magnetic tape stability: Talking to experts of former tape manufacturers." IASA Journal 1(42) (2014).

Schüller, D. "The ethics of preserving audio and video documents." Tech. rep., UNESCO, Paris (France) (2006).

AN ANALYSIS OF THE BROADCASTING MIGRATION PROCESS FROM ANALOGUE TO DIGITAL FORMAT: A COMPARISON OF BOTSWANA TELEVISION AND NAMIBIAN BROADCASTING CORPORATION

Thandie Puthologo, University of Namibia
Ruth M. Abankwah, University of Namibia

1. Abstract

The paper is based on an empirical study that explored the digital migration process at the Botswana Television Services (BTV) and Namibian Broadcasting Corporation (NBC) to understand the challenges posed by the migration process. The study was guided by the diffusion of innovation theory. A mixed design methodology was used. Purposive sampling was used to target 21 key informants. Semi-structured face-to face interviews were conducted with the management of the digital migration project at BTV and NBC, while questionnaires were distributed to the other staff working on the digital migration project. The study also revealed a correlation between the literature consulted and the findings of the study with regard to the digital migration process. The findings revealed that digital migration brings a lot of benefits to both the broadcasters and television viewers. The study also revealed challenges that include: lack of skills, shortage of staff, lack of funds to upgrade from analogue to digital, and a general lack of awareness about the digital migration process. It was also evident that Botswana was more than Namibia in meeting the set deadline of 2015. The major recommendation from the study was that the governments of Botswana and Namibia should be more supportive to the concerned national television broadcasters in their efforts to migrate media from analogue to digital.

2. Introduction

The global digital switchover from analogue towards digital broadcasting poses a challenge to developing countries. Digital broadcasting may place a burden on consumers, as they upgrade TVs and radios in countries where TV and radio penetration is low. Since the opening of airwaves in some countries in Southern Africa (Botswana and Namibia included), there were concerns about access to various forms of communication, and to broadcasting in particular.[118] However, conversation to digital broadcasting may be inevitable when the production of analogue equipment stops. Television stations are upgrading from the old analogue to digital broadcasting, which will bring many advantages for the broadcasters as well as the consumers. The digital migration process is taking place at BTV and NBC.

3. Background to NBC

The Namibian Broadcasting Corporation (NBC) is Namibia's national television broadcaster. It was established in 1990 and has a factual monopoly on the national free to-air television. NBC was established in line with the Namibian Broadcasting Act, Act 9 of 1991. The migration process in Namibia was set in motion in the year 2000 by the International Telecommunication Union (ITU) and an international deadline of June 2015 was agreed on.[119]

4. Background to BTV

Botswana's national television broadcaster went live on air in July 2000. The station has a mandate to air 65% local content and 35% international programming. The vision of BTV is to broadcast for every citizen. BTV broadcasts government and public information to citizens through informative and entertaining television programmes. A Reference Group was established in February 2008 to kick start the digital switchover/migration process.[120] Botswana's transition to digital broadcasting started in earnest in 2008 with the appointment of a digital

118 Fardon, R & Furniss, G. *African Broadcast Cultures Radio: In Transition*. James Currey Publications, 2002.
119 Namibia Broadcast Corporation. *Digital Migration*. 2012. Retrieved from http://www.nbc.na/co_aboutus.
120 Go digital. What is digital migration? 2008. Retrieved from http://www.godigital.org.bw/godigital.htm.

migration task force led by the Chairperson of the National Broadcasting Board (NBB).[121] In February 2010, the task force addressed critical policy issues that covered standards to adopt for set top boxes, signal distribution, licensing, budget, and the exact timeline for each stage and activity.[122]

5. Statement of the problem

A treaty agreement was signed on the 16th of June 2006 at the conclusion of the International Telecommunication Union (ITU's) Regional Radio Communication Conference (RRC-06) in Geneva that marked the beginning of the end of analogue broadcasting. The agreement stipulates that the transition period from analogue to digital broadcasting should end on 17 June 2015.[123] Although the digital migration process is taking place in Botswana and Namibia, the digital switchover poses major infrastructural problems to the national broadcasting stations.

6. Study objectives

This study sought to:

1. Determine the status of television broadcast in Botswana and Namibia.
2. Determine the strategies the broadcasters are using.
3. Identify the benefits of digital migration for Namibia and Botswana.
4. Determine the challenges the broadcasters in Namibia and Botswana are facing.
5. Find out what NBC and BTV are doing to inform their audience about the digital migration.
6. Determine the conditions under which audiovisual media materials are stored.

7. Significance of the study

The study adds to the existing knowledge in the area of digital broadcasting. It will be used by academicians and researchers to fill a gap in knowledge. The recommendations from this study can be used to guide national broadcasters in their attempts to manage the switchover from analog to digital broadcasting more effectively. It will benefit other broadcasters in Africa, and other parts of the world, who are in the process of digital migration.

8. Theoretical framework

In modern and postmodern society, there is a constant flow of new products, ideas, solutions to problems, new interpretations, and other kinds of innovations. Diffusion of innovation theory applies to mass media communication in two ways: the innovation of new media products and the role media plays in spreading innovation. With each development in media technology, new forms of communication must be adopted by people. It is the broadcaster's responsibility to bring the audience media technology and make them aware of them since there is a constant change in the media. The diffusion of innovation theory is therefore relevant to the study. The researchers used the diffusion of innovation theory because digital migration is an innovation to the broadcasting world. It transmits TV pictures and sound as computerized bits of information.[124]

121 Gaotlhobogwe, M. *Now Botswana go for Japan-Brazil digital std*. Gaborone: The Monitor. 2013.
122 Schuman R., and Mogobe, T.T. Botswana Switches to ISDB-T for Digital TV. 2013. Retrieved from http://www.com/AboutUs/News/Newsletter/Botswana-switches-to-ISDB-T-for-digital-TV.
123 Stork, C. and Kanyangela R. Digital TV Switchover Economic Impact Assessment. 2010. Retrieved from http://www.nbc.na/resources/final%200n%20the%20Digital%Switchover%Economic%Impact%20Assesment pdf.
124 Potter, W. J. *Media Literacy*. California: Sage Publications. 2005.

9. Digital transition

International developments show that analogue TV services are being phased out. Places like India, the Netherlands, Europe, and the United Kingdom completed the analogue switchover before the end of 2007. Digitisation and Broadcasting was the theme of the 7th Biennial Conference of Africa Broadcasters, AFRICAST, held in Abuja, Nigeria, October 2008. At the conference Africa resolved that digitization of broadcasting is not only necessary but also imperative in Africa. This is because it has the potential for revolutionizing the media and communication activities within the continent, creating better business opportunities and redefining national values. African countries, therefore, must strive towards meeting the ITU deadline of June 17, 2015 for broadcasting to transit from analogue to digital, otherwise, they stand the risk of being isolated from the world's broadcasting community.[125] Digitization has far-reaching implications and daunting challenges for governments, broadcasters, regulators, and the people. The success of the transition will depend, on the co-operation of these parties.[126]

10. Media development

In terms of media development, broadcasters are currently witnessing progressive migration from analogue to digital production, digital television encourages an increase in the number of programmes available, improves quality and accessibility, and creates new media services. However, the move to digital broadcasting brings with it other crucial challenges regarding regulation planning, pluralism of information, media development and access for all new digital equipment, and increasing dependency beyond national borders in the sector.[127] The move to a digital world offers opportunities for Television broadcasters to engage in data casting, as well as multicasting of standard digital (SDTV) signals with a digital channel or several SDTV channels.[128]

11. Benefits of digital migration

The transition from analogue to digital TV can bring a number of benefits that include: better quality television service; potentially better TV coverage even with the same number of broadcast locations; less transmit power; more spectrum efficient, which therefore enables the distribution of many more TV channels in the same spectrum; lower protection ratio, and therefore less sensitive for interference and enables more indoor and mobile reception of TV signals; no signal loss or degradation of the signal through the transmission or storage medium[129] and higher picture definition, because a digital signal can be compressed far more than an analogue signal.[130]

12. Challenges

Whereas the bulk of Americans rely on cable and satellite television services, Africa is very dependent on terrestrial broadcasting. African countries should realize that, no matter what effort they make to achieve total digitization, some of the challenges associated with the transition would still remain due to the peculiarities of the African environment, e.g., high temperature and high/low relative humidity).

125 APC. The transition to digital broadcasting in Africa. 2011. Retrieved from http://digmig.apc.org/en/why-does-digital-broadcast.matters-to-africa.
126 Akintaro, S. Bumpy Road for Africa. 2013. Retrieved from http://www.ittelecomdigest.com/cover12-feb.htm.
127 Berger, G. *Challenges and Perspectives of Digital Migration for African Media*. Dakar: Danika Marquis. 2010.
128 Albarran, A.B. *Management of Electronic Media*. (3rd Ed). Belmont Thompson Learning. 2006.
129 Craft, J.E, Frederic A.L & Godfrey D.G. *Electronic Media*. Wadsworth: Thompson Learning. 2001.
130 Cringely, R.X. *Analog to Digital Advantages*. Retrieved from *http://electronics.howstuffworks.com/digital-convertor-box2.htm*.

In order to receive digital television transmission/signals the consumer need either to replace the analogue TV set with a set equipped with a digital tuner; or adapt the current analogue TV set by using of an external Set Top Box that will convert digital signal to analogue.[131]

The end of analogue broadcasting and the production of the new equipment are likely to give rise to serious problems in Africa such as problems of maintaining infrastructures that remain analogue. Digital broadcasting brings other crucial challenges regarding regulation planning, pluralism of information, media development, and access for all the new digital equipment and increasing dependency beyond national borders in the sector.[132]

NBC's greatest challenge is transforming the broadcast into a digital multi-channel. However, the absence of policy creates tension between stakeholders due to the uncertainties in the regulatory environment. NBC is behind schedule due to funding shortage.[133] In the case of Botswana, more frequencies for analogue TV broadcasting are a challenge. The costs are still a matter of concern to the broadcasters. They should be weighed against benefits.[134]

Another challenge is that the analogue signal cannot be credibly switched off until almost all viewers have migrated to digital due to universality of access to television. Before switchover in any country, only part of the country's population can be reached with the digital signal.

Those who are reached need to spend more to upgrade their reception equipment because the capacity to increase the power of the digital signal will be made available only then.[135]

The transition requires broadcasters to invest in new transition plants and that viewers buy reception equipment to decode the digital signal. The incentives for viewers to switch to digital television depends on the cost of this equipment and the availability of digital services with valuable content.

13. Methodology

This study applied a mixed method approach using a combination of qualitative and quantitative research designs. Data was gathered using self-administered questionnaires and semi-structured interviews. The population was the national television broadcasters of BTV and NBC. Snowball sampling was also used to identify subjects who in turn identified others in the population. Purposive sampling was used to identify key informants of the technical team of NBC and key informants of the engineering department of BTV who were in a better position to provide the required information. The data was collected during June and July of 2013. Quantitative data was analyzed using Microsoft EXCEL, while qualitative data was analyzed thematically using content analysis.

131 ICT Consultants. Summary report on the digital migration process. Gaborone. 2010.
132 Berger, G. *Challenges and Perspectives of Digital Migration for African Media*. Dakar: Danika Marquis. 2010.
133 Dreyer, A. *Namibia's progress with digital migration*. Windhoek: CTO. (n.d.)
134 Gaotlhobogwe, M. *Now Botswana goes for Japan-Brazil digital std*. Gaborone: The Monitor. 2013.
135 Adda J, Ottaviani M. *The transition to digital television 1-2*. 2004 Retrieved From http://papers.ssrn.com/sol3/papers.cfm?Abstract_id660649.

14. Findings

14.1 The status of the television broadcasters

Before 2015, the analogue terrestrial TV transmission stations that are registered with ITU will be protected but after 2015, there would be no protection for analogue TV transmission broadcasting. This implies that if Botswana does not implement digital migration, the country may suffer external interferences with the signal. Nonetheless, ICT Consultants advise that in order to receive digital television transmission/signals the consumer will need either to replace the analogue TV set with a set equipped with a digital tuner; or adapt the current analogue TV set by means of an external Set Top Box which will convert digital signal to analogue.[136]

The digital migration process is bound to bring a lot of benefits for Botswana and Namibia. The audience is said to enjoy brighter pictures, clearer sound with a wider variety of what they can watch. Digital migration could also benefit those that are unemployed since it creates job opportunities. The set top boxes will have radio stations on them, providing even more options for the audience. However, challenges faced by broadcasters differ from country to country. The main challenge is funding. Digital migration is a big project and it requires a lot of money for it to run smoothly. The challenges depend on the level of development of a given country. Thus, the findings show that Namibia faced more challenges than Botswana.

Different deadlines were set by different countries but the international deadline for all SADC countries is June 2015. It seems that most countries had to postpone their set target dates because things had not worked out as they had planned so the project was delayed a bit. Although things did not go as planned, the countries are determined to do what is possible to meet the deadline.

The findings also indicate that Namibia and Botswana are not using the same standard of migration for various reasons. Both broadcasters have their own strategies on how they run their project and the findings show they are each working at their own pace.

14.2 Broadcasting strategies used

Unlike some countries such as the Unites States of America, which rely on cable and satellite, Africa is very dependent on terrestrial broadcasting.[137] The results from this study revealed that NBC uses the European standard because it is flexible and the cost of equipment is relatively low. On the other hand, BTV opted for the Japanese standard because it is the most robust digital TV standard in operation in the world and it can also provide three modes of transmission from the same transmitter at the same time, i.e., fixed, mobile, and portable. It can therefore be argued that there is no particular strategy that is right or wrong. Each country chooses a standard that suits their needs.

14.3 Awareness of television viewers

The results show that the NBC audience was not informed about the 2015 deadline, while BTV was playing radio and TV advertisements to inform their viewers about the media developments. Nonetheless, both countries said that they had awareness campaigns in the pipeline.

136 ICT Consultants. Summary report on the digital migration process. Gaborone. 2010.

137 Southwood. R. (2011). *Snapshot of progress of analogue to digital migration in Africa: outcome of ATU survey*. Balancing act Africa

14.4 Challenges faced and steps taken to address them

Berger states that the end of analogue broadcasting and the production of the new equipment are likely to give rise to serious problems in Africa such as problems of maintaining infrastructures which remain analogue. This implies that the broadcasters will face challenges in acquiring the set top boxes that are required after the analogue signal is switched off. In addition, the move to digital broadcasting brings other challenges regarding regulation planning, pluralism of information, media development, access for all to new digital equipment, and increasing dependency beyond national borders in the sector. This is the case at BTV and NBC. This explains why the Chief Technical Officer of NBC stated that Namibia's switch from analogue to digital broadcasting brought a lot of challenges to the broadcasters. The findings indicate that NBC's greatest challenge is how to transform the broadcast into a digital multi-channel. There is still uncertainty on what the television channels will play.
Researchers such as Adda & Ottaviani (2004) argue that before the switchover, only part of the country's population can be reached with the digital signal. This explains why the chief technology officer of NBC stated that there were plans to implement the switching off of the signal phase region by region. In addition he said that those who are reached need to spend more to upgrade their reception equipment instead of switching off because the capacity to increase the power of the digital signal will be made available only then. The absence of policy causes uncertainties in the regulatory environment in Namibia. The findings show that NBC was lagging behind schedule due to funding shortage. Unavailability of skilled people in NBC and shortage of manpower pose a challenge in Namibia.

With respect to the audiovisual media resources (tapes, DVDs, DV Cam), some of the places visited did not seem to have appropriate equipment for controlling relative humidity and temperature. Although storage conditions at the Sound Radio Archives in Namibia appear to be satisfactory, one air conditioner for the whole storage place is inadequate. Moreover, the absence of equipment for controlling humidity, temperature, fire, and water damage means that the audiovisual materials are in danger. However, at the Botswana TV archives, the building seemed to meet standard requirements but the workers were not aware of the appropriate equipment required to control temperature, humidity, and environmental pollutants.

15. Conclusions

The main aim of this study was to explore the challenges faced by the NBC and BTV since it was most likely that they may face difficulties in switching from analogue to digital broadcasting. The study's aim to find out about the digital migration process has been achieved. It cannot be assumed that all the countries that are switching from analogue to digital will face the same digital migration process, although the benefits are similar. However, the study findings suggest that the challenges differ from country to country, as in the case of Botswana and Namibia.

The findings show that government plays a major role in the digital migration process because the government is responsible for the funding the project. It is up to the countries to see the strategies that best suit them; there are not specific guidelines that they need to follow. The findings also indicated that the two countries are doing their best to meet the deadlines.

16. Recommendations

The following recommendations are drawn from the above conclusions and they are directed to broadcasters who are in preparation for their digital migration process. It is recommended that:

1. Regulatory bodies create awareness for innovation.
2. The television broadcasters should educate themselves more on what is to be expected in order to address the challenges.
3. Broadcasters should produce quality local programmes that will allow the audience to enjoy the benefits of the new digital television innovation.
4. Broadcasters in Botswana and Namibia should concern themselves with the quality and the state of broadcast equipment.
5. The governments of the two countries, Botswana and Namibia should empower their citizens so that they can benefit from the benefits of digitization.
6. The governments of the two countries should ensure that the digital set top boxes are affordable and accessible for the audience.
7. BTV and NBC should work jointly and give each other tips and solutions on the digital migration process.
8. The two broadcasting corporations should improve the storage conditions for the AV materials in their custody. They should ensure that appropriate equipment for monitoring temperatures and relative humidly is provided.
9. The broadcasters need to ensure that the set top boxes are readily available for purchase for the digital migration before the switchover.
10. The viewers also play a role in the digital migration process so they should not be excluded in the digital migration process.
11. It is up to the countries to devise the strategies that best suit them; there are not specific guidelines that they need to follow.

17. Bibliography

Abascal, J. *Public policy treatment of policy treatment of digital terrestrial television (DTT)*. Madrid: Hogan & Hartson LLP. 2005.

Adda J. and Ottaviani M. *The transmition to digital television 1-2*. 2004. Retrieved From http://papers.ssrn.com/sol3/papers.cfm?Abstract_id660649.

Akintaro, S. Bumpy Road for Africa. 2013. Retrieved from http://www.ittelecomdigest.com/cover12-feb.htm.

Albarran, A.B. *Management of Electronic Media. (3rd Ed)*. Belmont Thompson Learning. 2006.

APC. The transition to digital broadcasting in Africa. 2011. Retrieved from http://digmig.apc.org/en/why-does-digital-broadcast.matters-to-africa.

Balance Act. Namibia: Digital broadcast Migration needs N$350 million. 2011. Retrieved from http://www.balancingact-africa.com/news/broadcasting/issue-no115/investment/namibia-digital-broa/bc

Berger, G. *Challenges and Perspectives of Digital Migration for African Media.* Dakar: Danika Marquis. 2010.

Blanche, M.T., Durrheim, K., and Painter, D. *Research in practice: Applied methods for the social sciences.* 2nd Edition. Cape Town: UCT Press. 2006.

Bless, C., Higson-Smith, C., and Kagee, A. *Fundamentals of Social Research Methods An African Perspective (4th Ed).* Lusaka: Juta & Co Ltd . 2006.

Brink, H. Fundamentals of Research Methodology Health Care Professionals. Cape Town: Juta &Co, Ltd. 1996.

Castillo, J.J. *Research Population.* 2009. Retrieved from http://explorable.com.research.population

Craft, J.E, Frederic A.L., and Godfrey D.G. *Electronic Media.* Wadsworth: Thompson Learning. 2001.

Creswell, J.H. *Qualitative Inquiry and Research Design: Choosing Among Five*. USA: Sage Publications. 1998.

Cringely, R.X. *Analog to Digital Advantages*. (n.d.) Retrieved from http://electronics.howstuff-works.com/digital-convertor-box2.htm

Denzin, N.K and Lincoln, Y.V. *Qualitative Research (3rd Ed).* CA: Sage Publications. 1994.

De Klerk, E. *Namibia on track in digital migration.* Windhoek: New ERA Publications. 2013.

De Vos, A.S, Strydom, H., Fouche, C. B., and Delport, C.S.C. Research at Grassroots: For the Social Sciences and Human Service Proffessions (2nd Ed). Pretoria: Van Schaik Publication. 2002.

Dreyer, A. *Namibia's progress with digital migration.* Windhoek: CTO. (n.d.)

Fardon, R. and Furniss, G. *African Broadcast Cultures Radio: In Transition.* James Currey Publications. 2002.

Flick, U. *An introduction to qualitative research.* London: Sage Publications. 2009.

Fourie, P.J. *Media Studies: media history, media and society (2nd Ed)*. Cape Town: Juta & Co. 2007.

Gaotlhobogwe, M. *Now Botswana go for Japan-Brazil digital std.* Gaborone: The Monitor. 2013.

Go digital. What is digital migration? 2008. Retrieved from http://www.godigital.org.bw/godigi-tal.htm

Gomm, R. *Social Research Methodology A Critical Introduction*. New York: Palgrave Macmillan. 2008.

Gray, D.E. *Doing Research in the real world.2nd Ed.* London: Sage Publications. 2009.

Gray, P., Williamson, J., Karp, D. and Dalphin, J. *The Research imagination, an introduction to qualita-tive and quantitative method.* Cambridge: Cambridge University Press. 2007.

Henry, G.T. *Practical Sampling.* Newbury Park, CA: Sage. 1990.

ICT Consultants. Summary report on the digital migration process. Gaborone. 2010.

Kindem, G. and Musburger, R.B. *Introduction to Media Productions the Path to Digital Media Production* (3rd Ed) UK: Focal Press. 2005.

Kombo, D.K and Orodho, A.J. *Research Methods***.** Nairobi: Kenya University, Institute of Open learning. 2002.

Kruger, F., Mitchell, B., and Welman C. *Research Methodology.* (3rd Ed). South Africa, Cape Town: Oxford University Press Southern Africa. 2005.

Mampone, G. Digital Migration in South Africa and the SADC region. 2009. Retrieved from http://www.connect-world.com/cwiml/index.php/magazine/global-ict/itom/3318-digi-tal-migration-in-south-africa-and-the-sadc-region.

Namibia Broadcast Corporation. *Digital Migration*. 2012. Retrieved from http://www.nbc.na/co_aboutus

O'Shaughnessy, M. and Stadler, J. *Media and Society*. 5th Ed. Oxford University Press. 2012.

Onwuegbuzie, A.J., Collins, K.M.T. *A Typology of mixed methods sampling designs in social science research*. Qualitative Report. 12:281–316. 2007.

Potter, W.J. *Media Literacy.* California: Sage Publications. 2005.

Punch, K.F. *Introduction to social research. Qualitative and quantitative approaches. (2nd ed)*. New York: Sage Publications. 2005.

Richards, L. *Handling Qualitative data.* 2nd Ed. London: Sage Publications. 2009.

Seale, C. *Researching Society and Culture* (2nd Ed). London: Sage Publication. 2009.

Schuman, R. and Mogobe, T.T. Botswana Switches to ISDB-T for Digital TV. 2013. Retrieved from http://www.com/AboutUs/News/Newsletter/Botswana-switches-to-ISDB-T-for-digital-TV

Southwood, R. *Snapshot of progress of analogue to digital migration in Africa: outcome of ATU survey.* Balancing act Africa. 2011.

Stangor, C. Research Methods for the Behavioural Sciences. (4th Ed) Belmont: Wadsworth, Cengage Learning. 2011.

Stork, C. and Kanyangela, R. Digital TV Switchover Economic Impact Assessment. 2010. Retrieved from http://www.nbc.na/resources/final%200n%20the%20Digital%Switchover%Economic%Impact%20Assesment pdf.

Trochim, W.M. *The Research Methods Knowledge base*. (2nd Ed). USA: Pearson Education Company. 2002.

Webster, S. *Educational Research: Competence for Analysis and Applications*. 6th Ed. New Jersey: Macmillan. 1985.

VIRTUAL MEDIA IN AN OAIS-ENABLED ENVIRONMENT

Sebastian Gabler, NOA Audio Solutions, Austria

1. User expectations in time

The general public more and more is accustomed to media-centric access. The user interface of about any technical equipment aims to detach the user from the actual technology. Instead, complex functionality is presented as a "service" — easy to consume. For sound and audiovisual media the struggle of content with transmission format constraints is however all but new: Radio musicians of the 1940s report that they had to adapt tempo to the remaining broadcast time, playing live on air[138], and the duration of the CD Audio was anecdotally optimized to hold Karajan's performance of Beethoven's Ninth.[139] No matter if the anecdote holds true or not, the otherwise contended playing time of the CDDA and many other engineering efforts historically prove the wish to reproduce performances coherently. More recently the buyer of the latest BD release of David Lean's *Lawrence of Arabia*[140] may enjoy not only the full 227 minunte, shiny 2012 re-master from 8 K scans without leaving the chair to change media, but will as well be able to dwell across the Interval to Maurice Jarre's epic Intermission music often left out in previous releases and screenings.

Self-service facilities are another key driver. A member of the Academy Awards jury, handed an access copy of a movie on a BD, may or may not be aware that for his or her convenience not so long ago several reels would have had to be concatenated, incurring manual work. A customer of iTunes can listen to all 22 songs of Led Zeppelin's Remasters Album in one go, while a user of a self-made CD rip will have to live with switching folders at the end of disc 1, following the carrier-oriented CDDB data model.

For digital access, offering appropriate coherence is no longer a matter of physical constraints; it ultimately depends on a suitable data model.

2. Terminology

Archival Information Package (AIP): "An Information Package, consisting of the Content Information and the associated Preservation Description Information (PDI), which is preserved within an OAIS."[141]

Archive: "An organization that intends to preserve information for access and use by a Designated Community.[142]" Remark: The terms OAIS and Archive are equivalent in the CCDM reference model; they are used synonymously in this article.

Content Information, short Content: "A set of information that is the original target of preservation or that includes part or all of that information. It is an Information Object composed of its Content Data Object and its Representation Information.[143]"

Context Information: "The information that documents the relationships of the Content Information to its environment. This includes why the Content Information was created and how it relates to other Content Information objects.[144]" Remark: at first glance, the TC-03 definitions of Primary and Secondary Information may seem as specialisations of

138 "Ich habe die Frühlingssonate noch nie so langsam gespielt", Bruno Lenz (1911-2006), vice concertmaster of Bavarian Radio Symphony Orchestra, in a personal conversation with the author, 1996.
139 The final truth of this anecdote is not proven, see: http://app.handelsblatt.com/unternehmen/management/norio-ohga-vom-kopilot-zum-kommodore/2957156.html.
140 http://www.nytimes.com/2012/09/30/movies/lawrence-of-arabia-mended-returns-to-screen-and-blu-ray.html.
141 CCSDS 650.0-M-2, 1.7.2.
142 idem.
143 Idem.
144 idem

Content- and Context information. There are however subtle differences between the two, and one can locate a dilemma in the TC-03 notion specifically during migration to digital: Whereas carrier parameters are certainly secondary once digitised, for the replay of the physical carrier they are a part of the primary Representation Information, meaning the content information cannot be retrieved at that stage without them. While going deeper on such aspects is not in the scope of this paper, the example still shows that information management has some specific challenges on the backdrop of Long Term Preservation, and that the OAIS terms are very helpful in that regard.

Reasoner: A Semantic Reasoner is a rules engine that is able to apply decisions, based on a set of axioms. Often, Reasoners use first-order quantifications, such as "For every person, if this person is a Philosopher, the person is a Scholar."

3. The 4th dimension

Time is the core criterion that differentiates sound and audiovisual from any other Content Information. Time is manifest as a continuum once we commence the (re)production of music, drama, film, or a news broadcast, and entails for the programme's duration.

There are many possibilities to store and present information aligned to a timeline. Among others, these may be marker lists (text), optical disk sub code, or XML documents. The alignment is given by a range, i.e., the distance of a "start" to the corresponding "stop" event, an event class, and sequence information.

Different event classes may require different time measures depending on their context, i.e., samples, frames, or bars/beats, to name but a few. One could try to establish different time regimes depending on the context, and relate them as required. That would be a daunting task. To the rescue, digital media provide an obvious solution to provide time information that is both generic and precise enough to support automated business procedures.

All digital media is time-discrete, and the common denominator is the sampling frequency of audio (8 kHz-192 kHz, or higher), which aligns to common moving image frame rates. A timeline resolving resolution to 1 µs is sufficient to define rounded positions of any PCM sample — or picture frame. Using an "oversampled" timeline allows the aggregation of the aforementioned event classes on the same timeline. This has the useful side effect of accommodating Content editions of different time bases, such as the 48 kHz proxy of a CD recording (44.1 kHz), or the 12 fps proxy of a movie.

4. Carrier-orientated preservation

IASA TC04 presents a mainly carrier-centric approach to preservation.

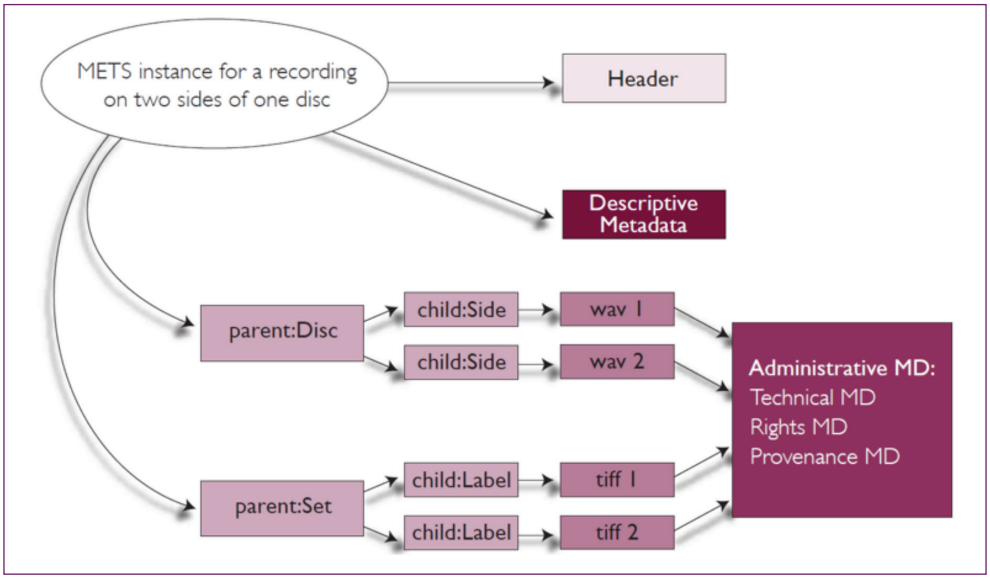


Figure 1. TC04 METS object.[145]

In the above example, the Content Information is the Carrier itself in both the digital form and the parent physical item. "wav n" stores the stream extracted from the discs' grooves, whereas "tiff n" results from scanning the respective labels. Following TC-03.3, the wave files are Primary Information, and the label scans are in the Secondary Information realm. The intrinsic access options for this AIP are as well very much like the physical counterpart: To listen to the recording, we would have to load the audio files, one by one, into a suitable player.

With this approach, apart from creating an "Eternal Media File" that may be migrated with no future information loss, the user will be able to understand the genealogy of the digital files back to their preceding physical carrier. The model could be expanded by information on how the original performance was recorded, if such information was available by the previous acquisition process or current research.

However, we should be aware that carrier migration alone may be insufficient when it comes to building of a Digital Media Archive. Pure copying will not satisfy current and future use cases, as it limits access to the features of the parent medium. Nevertheless, the safe-harbouring of the extracted signal is a required transition step that a Digital Media Archive cannot go without.

5. Virtual media

In the following, some parameters are presented to characterise the idea of Virtual Media.

5.1 Media content centric

The proposed approach assumes that the consumer is interested in the reproduction of certain content, not in the act of replaying a number of reels, disc faces, or tapes. To this end, the media modelling aims to be independent of the physical properties of underlying carriers.

145 IASA-TC04 Second Edition, 20.

5.2 Carrier mapping

Physical boundaries of media carriers are moving targets. After a less-standardized period of 35 years of silent film, the standard 2000 ft 35mm film reel, colloquially referred to as "Two-Reeler" featuring a playing time of 22 minutes, was established with the introduction of sound film around 1930.[146] It is still in use today. However, the birth of digital cinema goes together with the obsolescence of an access scenario, i.e., involving a projectionist who syncs up the reels manually during projection. Similar scenarios exist in radio production where several ATRs have to be synced up for the reproduction of programmes exceeding the typical 2400 ft (app. 30 minutes at 15 IPS) reel. Specifically here, it may even be that carrier limits do not align with content structure, e.g., a chapter border like a musical movement. Instead, carriers may overlap recorded signal to be queued up with virtually no interruption.

Carriers containing heterogeneous Content present a challenge for archivists as well. Also this scenario is often the result of pragmatic decisions in the past that had little to do with content-related considerations, but rather with the price of reel spools. Addressing these scenarios requires a many-to-many mapping of Carriers to Content.

5.3 Virtualized content

Getting serious about long term content preservation means both accepting the facts from the past and changing them, if required, using the means of digital media. The archive taking the role of the projectionist during access therefore has to be able to handle coherent sets of media for any Content object. That includes seamless playback across volume (carrier) borders. As physical rendering of a high-resolution copy comes at a prohibitive overhead of close to 100% storage payload, it is preferable to re-use the concatenated extractions of the carriers.

5.4 Alignment of context information

As previously defined, Context Information refers to the environment of Content, but as well to the relations of different Content objects. When providing context for A/V content pertinent during access, the archive is required to be aware of the actual time range. That is in the first place obvious for any kind of segmentation context. As inter alia information, the showdown scene of a Western movie is usually towards the end, but the archive will have to indicate the exact sequence and position of the scene to provide tangible results. For an entire news broadcast as well, there may be dozens of subjects, contributors, and rights holders. However, which one is relevant for a certain segment makes a significant difference for the information to be eventually manageable.

5.5 Support of different encodings

For the foreseeable future, archives will have to provide different encodings of content for various access scenarios. A typical scenario is the low-resolution access copy, which may differ in time or spatial resolution from the AIP. Virtual Media aim to unify the information among these versions, thus improving efficiency for content creation and access. Section 3 of this paper provided in-depth information on which consequences different encodings have on time handing.

5.6 Long term preservation context

The creation of Virtual Media is done against the backdrop of Long Term Preservation. At the same time, it aims to support present and future access scenarios, as much as it aims at supporting future migrations. This comes with a strong bias towards mathematically lossless

146 http://en.wikipedia.org/wiki/Reel.

encoding of the content, as only linear formats have the property to support automated signal-integrity quality checks. In this respect, Virtual Media are independent of chronology.

5.7 Access virtualisation

From the long-term perspective, it is safe to predict that user access scenarios will change. This is certainly true for access media formats (codecs and wrappers), but the Designated Community, too, may change, or there may be different communities to serve to simultaneously. One example the author has been working with in the recent past is Fonoteca Nacional, Mexico. The institution offers in-house access for researchers or aficionados[147], but has also started a public web service accessible over the Internet.[148] While the latter does not have online access to the actual Archive, Content and Context information still come from the same source, as provided in the AIP production in a dissemination process that is fully automated.

6. A suitable class model

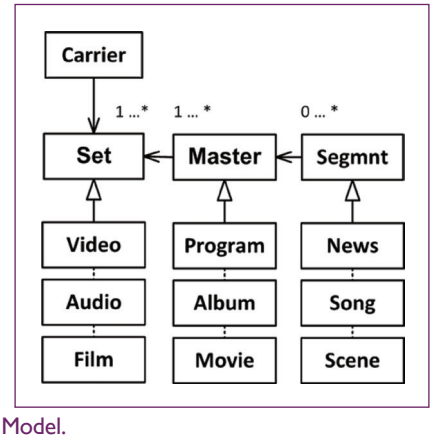


Figure 2. Virtual Media Class Model.

Figure 2 shows a UML schema of a possible approach to the matter. While traditionally flat implementation would be possible, the model should be understood as using semantically linked classes. The classes Carrier, Set, Master, and Segment have specialisations that make them usable for various Content and Media types. Each specialisation features different fields to describe the pertinent parameters.

6.1 Carrier

Carrier refers to the dedicated container where the complete Content, or part of it is stored. It may be a physical media carrier, or a media file or file set. Specialisations would be, for example, a film reel, an audio disc, a video cartridge, an open reel audiotape, or any kind of media file (e.g., DPX sequence, wav, or mov file). Structurally, it is equivalent to Volume.

6.2 Set

The Set class comprises the carrier items required for the reproduction of content, and their correct sequence.

147 http://www.fonotecanacional.gob.mx/index.php/fonoteca-nacional/espacios/audioteca-octavio-paz.
148 http://www.fonotecanacional.gob.mx/index.php/servicios/red-de-fonotecas-virtuales.

6.3 Master item

The Master Item, or Master points to Set, providing the coherent Content so that it can be reproduced directly. The Master may have specialisations of, for example, Opera, Concert, Movie, TV Programme, Radio Programme, or Compilation, to name but a few. The Master class would be a suitable target to build the AIP for a content-centric archive, however there are alternatives, such as building the Master Item as an Archive Information Collection, consisting of Parts.[149] (This is the approach followed by iTunes and many Computer Aided Media Production Systems.)

6.4 Segment

Segment points to Master, and describes any kind of segment information. It is the structural equivalent of Chapter. Specialisations of Segment may be "Song" (-> Album), Shot (-> Movie), Work and Movement (-> Concert), or Scene (-> Movie or Opera).

7. Automation aspects

A major pain point for every archive is its annotation workload. Numbers occasionally proposed by A/V archivists gravitate between 6–10 times the man hours required for physical preservation of the related carrier item for the completion of the metadata required for an AIP. This concurs with personal experience. For born-digital material the scale factor may be substantially higher, as ingesting of this kind of content information is sped-up and automated to a high degree. Linking metadata to media content is a demanding and exhausting task as it is not limited to text work, but requires working with visual and auditory events simultaneously.

7.1 Segmentation

Providing chapter information with the media is an established method in A/V production. Therefore, mature tools and methods exist that will be handled by even semi-skilled operators. Either cue sheets are typed into a text editor, or markers are set in a Wave Editor or NLE. This method is applicable to the vast majority of linear A/V carriers. The required result is a map of the chapter information, e.g., in an XML file, providing sequence, time, and hierarchy information of each event.

For some physical carriers, such as RDAT, CDDA, but as well for born-digital Content in BWF or MXF files segmentation, information may be retrievable during extraction. In some cases, auxiliary information provided by an editor workstation can be parsed as well. Even OCR-ed cue sheets containing time code lists may be considered.

7.2 Rule-based processing

Context information generated and validated in the production process of the AIP, such as access rights, provenance, and technical parameters can be post-processed and packaged on rule-basis. These rules will select the data to be included with the AIP, e.g., parsing them from process logs. The processing will be triggered automatically in an automated workflow engine.

The automated creation of Content segments and linking of the media requires advanced logics, e.g., in the form of a sematic Reasoner. NOA's MediaLinkingRulesXML is an example of such a Reasoner.

149 See CCSDS 650.0-M-2, 4-46.

8. MediaLinkingRules

MediaLinkingRules is an example of how to support the building of accessible Content, Content segmentation, and Context by employing automated rules. These rules include ontology and logical elements that, for example, allow building and maintaining a Part object of certain duration for every instance of a marker type, and aligning the Context information with it. The reverse process is supported as well, which is helpful for any advanced transformations, see section 10.1 in this article.

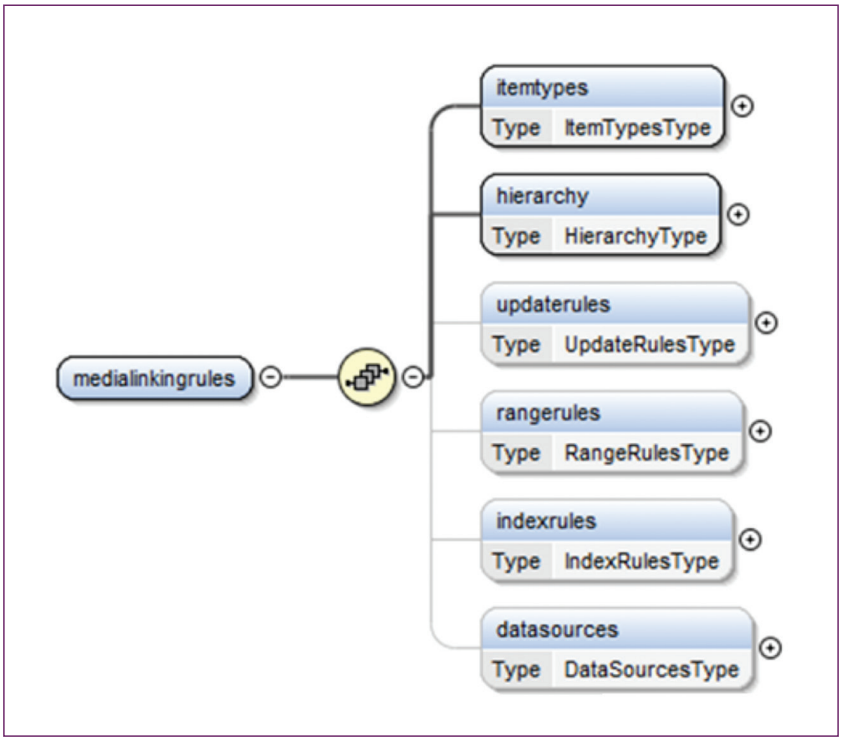


Figure 3. MediaLinkingRules schema.

8.1 Itemtypes

A list of the item categories maintained by the rules, e.g., Carriers, Set, Master, and Segment with their specialisations.

8.2 Hierarchy

The hierarchy definition establishes a tree hierarchy, mapping item categories to the required roles of carrier, and their relations.

```
<medialinkingrules>
  <itemtypes>
    <!-- ... -->
  </itemtypes>
  <hierarchy>
    <itemtype id="1000" nameinfo="CarrierSet" role="master">
            <itemtype  id="500"  nameinfo="Carrier"  linktype="10000"
role="ingest"/>
      <itemtype id="50010" nameinfo="Album" linktype="10010">
        <itemtype id="50020" nameinfo="Title" linktype="10020"/>
      </itemtype>
    </itemtype>
  </hierarchy>
</medialinkingrules>
```

8.3 UpdateRules

Define the data handling per update mode upon creation or update of a target item instance.

```
<medialinkingrules>
  <itemtypes>
    <!-- ... -->
  </itemtypes>
  <hierarchy>
    <!-- ... -->
  </hierarchy>
  <updaterules>
    <updaterule name="album-create-rule" mode="create update">
      <updatefields>
                <field  name="Item.StringId"  mode="create">Metadata.
GetNextUid('Record - ID', 1, 'U')</field>
        <field name="Item.Float01">@@MediaDuration@@</field>
      </updatefields>
    </updaterule>
  </updaterules>
</medialinkingrules>
```

They include a mode rule, depending if a change should be infered only on creation or als well on update of the target, and field definitions. I.e., in the above example, the UID of the target would be generated during creation, but it would remain unchanged during an update.

8.4 RangeRules

RangeRules provide for a default format to describe the running order of Segments, and of the Carriers. Along with the Index information of the carrier members, the absolute position can be detected.

8.5 IndexRules

IndexRules provide for a default format to express the set information, e.g., amount and position of carriers. IndexRules and RangeRules both provide options to convert a customized numbering schema to the default format.

8.6 Data sources

Data sources define types of data sources to be used during the execution. These may be XML structures, such as Marker Lists that are generated during production, but they could equally be existing data in the same database, or an external source.

9. Building of virtual media

From criteria mentioned in the OAIS Reference Model, that is an AIP consists of Content, Provenance, Rights, Fixity, Reference, and Context,[150] there are no specific circumstances to be mentioned in the context of Virtual Media. In each individual Archive, decisions will have to be taken which SIPs will have to contribute, which mile stones have to be set up along the process, and which Packaging parameters will finally contribute to the final result, so that the AIP satisfies the set criteria required for access by the Designated Community.

What is specific to A/V is the required building of a coherent time relation of all parts of the AIP or AIC. For this, the following common use cases exist:

9.1 Concatenation

The content may be reproduced by playing several set members in their correct sequence. If these members contain taper areas, an Edit Decision List function is required to exclude these ranges from the Master. Automated rule models can support concatenation in most cases. Concatenation includes the processing of timeline, media, and time-related metadata information. It is necessary to establish the global context for any sequence information, for example Track 3 on Carrier 2 in the global context can be seen as Track 002.03, or maybe even as Track 77 (or any other current global counter). Figure 4 outlines the schema of a concatenated Media Object, including Context information.

150 CCSDS 650.0-M-2, 4.2.2.3.

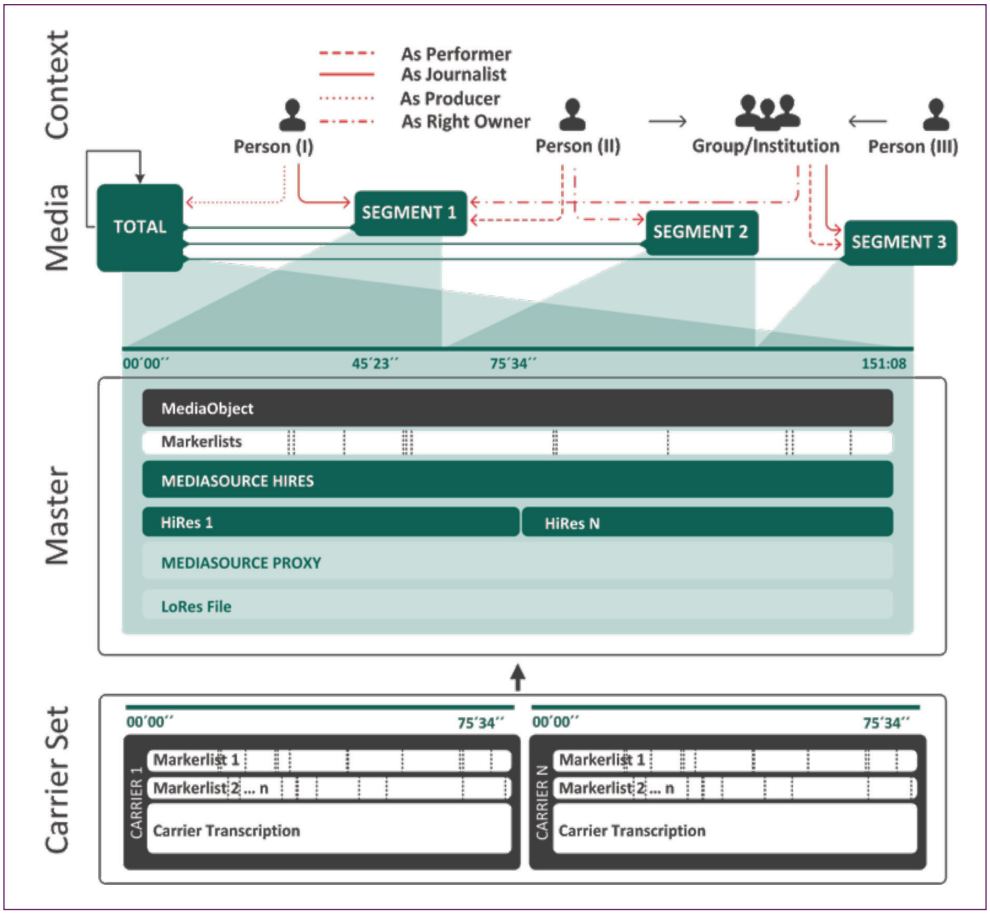


Figure 4. Media Object.

9.2 Re-use

If the content is playable coherently on the original carrier or the transcript thereof, it can be re-used. Leaders or footers may be excluded from the target Master Range. As well, segmentation of heterogeneous content on a single carrier (Mix Tapes) falls under the re-use scenario in Virtual Media. In fact, Re-use can be seen as a specialisation of Concatenation — there is only one member in the Set.

9.3 Multiple master

The case of multiple, heterogeneous content is common in Broadcast. For economic reasons, and as carrier playing time extended over time, multiple programmes have been copied to a single carrier. Here, during the building of the Master, the opposite of the concatenation case is taking place: Multiple Masters will reference a single set, and each of them will have segmented ranges for Content, Fixity, time-related metadata, and Context. The approach mentioned in 10.1 also supports this scenario.

10. Conclusions and outlook

As demonstrated, Virtual Media offers a concept to manage A/V Content with efficiency and agility. It follows from the core principle that media are (re-)producing in time and it aims to render tangible access experience for the Archive's users. Using other components of the Archive, such as Rights Management and Access Services, they offer a foundation of automated procedures and help to avoid redundant effort for access scenarios.

10.1 Ambiguous segments

Segmentation of Media typically does not lead to uniform results. Commonly, there will be multiple levels of segmentation, depending on the context. For example, an Opera may be divided into Acts, Scenes, Arias and Recitative, which may have further divisions. A BD or DVD movie may be divided into chapters that have Scenes and Shots. Therefore, segments need to be implemented in a way that they can change their hierarchy as required by the context. For MediaLinkingRules, one possible solution is to define multiple instances of the rules, each describing one of the required hierarchy levels.

10.2 Re-mastering

Re-mastering is not an actual use case for building a Master Item. Instead, it subsumes any pre- and post-processing to render a coherent content stream from bits and pieces. This includes re-splicing of physical material, re-synchronisation of specific media sources (audio or subtitle tracks), or DSP processing. This may be an iterative process. From the OAIS perspective, re-mastering is required if the SIPs cannot be used for the direct production of an AIP. In fact, it is a borderline case, as in many cases the original SIPs and the re-mastered SIP will have to be preserved, at least if the process is meant to be reversible.

DEALING WITH ISSUES OF TECHNOLOGICAL OBSOLESCENCE AT THE OREGON STATE ARCHIVES: DIGITIZATION OF ROLS AUDIO DICTATION TAPES

Austin Schulz, Oregon State Archives, USA

Archivists are frequently faced with the dilemma of how to preserve and make accessible information created using defunct technology. The archivists at the Oregon State Archives are no different. For almost two decades, landmark legislation important to Oregon's heritage, such as the 1967 and 1969 Beach Bills establishing public ownership of land along the Oregon Coast, remained inaccessible because the equipment needed to listen to the audio tape was broken and replacement machines, as well as parts, were nearly impossible to find. This is because legislative audio recordings from the 1967 and 1969 legislative sessions were recorded on a proprietary media called Rols[151] dictation tape created by Eastman Kodak specifically for the Rols machine, which used "2 ½ inch wide strips of Rologram, a magnetic film that could be cut off and attached to relevant documents unlike other audio formats at the time."[152] Each roll could take up to 30 hours of normal dictations or 7 ½ hours without pause and was designed so that notes could be written directly on the film using any pen or pencil. This film system was touted as having three main advantages over ordinary tape. It could be posted flat, filed as a permanent record, or split between several typists.[153]

The European machines used to record and playback Rols audio were "designed by Aparatbau of Hamburg, Germany, made in Holland by Elac and sold in Europe as Sankey Rols Office Dictating Machines. In the U.S. they were marketed beginning in the 1960s, by Sawyers Inc. of Portland, Oregon and sold as Sawyer's Rols Dictator-transcriber Machines and later by the GAF Corporation."[154] It was during this 1960s period that the Oregon State Legislature, who had been recording committee hearings on 7 inch reel-to-reel audio tapes, decided to adopt the new Sawyers Rols dictation machines to record all committee hearings during the 1967 and 1969 sessions. At the end of the legislative sessions for these years, the Rols recordings were transferred to the custody of the State Archivist along with a machine capable of playing the recordings for use by patrons. Written summaries rather than full transcriptions accompanied the transferred recordings. These written records summarized committee hearings and highlighted the major points of discussion. They also reflected discussion and testimony by legislators and interested parties on proposed legislative acts. Researchers use these written summaries to determine which of the audio recordings might contain information relevant to their research. When combined with the audio recordings, these materials provide legal researchers with information about the legislative intent of a proposed bill or they provide clarification for vague or ambiguous statutory language.

For many years patrons were able to use the summaries and listen to the recordings using the only Rols machine at the State Archives. However, because of the proprietary nature of both the Rologram film and Rols machine, we were not able to make duplicate copies of the audio or transfer the recordings to a more common media. This resulted in our lone ma¬chine being heavily used by researchers, taking its toll on the equipment. By the early 1990s, our Rols machine was no longer functioning and had to be sent out for repair as replacement equipment was no longer available. Unfortunately, the business that agreed to repair the non-functioning machine closed up shop suddenly and took the State Archives machine with them. At this point the we no longer had a means of playing back the 1,474 Rols audio recordings produced by the Oregon State Legislature. Patrons were left with access to only the abbreviated written materials, while the audio recordings containing the only verbatim record of the 1967 and 1969 legislative ses¬sions, sat locked away due to technological obsolescence.

151 In all of the promotional materials rols is not capitalized.
152 VADS University for the Creative Arts, 2008.
153 Sawyers Inc., 1965.
154 VADS University for the Creative Arts, 2008.

However, that would all change in 2007, when a researcher working on a documentary history of Oregon's Beach Bill contacted the State Archives. Although we were able to provide access to the written records from the Legislature for this important legislation, we had to explain that the audio was unavailable due to technological obsolescence. Fortunately, the researcher was able to track down a Rols machine owned by the inventor's son living in Europe. The researcher brokered a loan of the equipment to an audio restoration company in New York City, making it possible for the State Archives to get one audio recording duplicated and digitized. An estimate for digitizing all 20 of the Beach Bill Rols audio recordings by this company in 2008 was $75,000. This was far more than the State Archives could afford to spend, especially given that only a very small portion of the audio would be digitized. We still had no feasible way to transfer the Rols audio recordings to a newer format or even a way to playback this audio for patrons to access.

During the intervening years, the researcher was able to secure a machine and donated it to the State Archives with the belief that it was functional. Unfortunately, while we were able to get the new machine to power on and briefly hear sound for one of the Rols tapes, it became clear that there was a problem with the machine. In the hope that this new player could be repaired, staff searched online and contacted local audio repair shops but were unable to locate somebody willing to work on the machine. Most of the repair shops cited the lack of parts for and information about this relatively unknown format as the reasons they were not able to attempt to repair the Rols machine. Given the lack of alternatives and using the patent drawings, we determined that one of the compression spring switches, which allowed the reading arm of the Rols player to change direction was broken. Once again, the State Archives was left without a way to play the Rols audio or transfer the audio to another medium. Our luck changed in 2013, when a functioning machine, complete with all of the accessories, was listed for sale on eBay. Realizing that we may never again see a Rols machine, let alone have the opportunity to buy a functioning machine, the State Archives purchased it for $3,000.

Image 1. The above photo shows the working Rols audio player that was purchased with one of the Rols dictation tapes loaded onto it. The device was designed without a take-up reel so the audiotape just spools off onto the floor as it plays or records.[155]

155 Oregon State Archives, 2013.

With the acquisition of the player, we were now able to listen to the recordings; but because of the rarity of the equipment, difficulty in securing parts or repair services, and the fragile condition of the recordings, the State Archives decided that patrons would not be able to use the original tapes and equipment and that staff would run the machine for them. Because of the proprietary nature of the equipment, staff members were prevented from easily transferring the audio to a more accessible format and we needed to find a solution so that all could benefit from being able to listen to these hearings.

Reference Archivist, Austin Schulz enjoys tinkering with electronics and was confident that he could create an adapter that would allow the State Archives to digitally record the audio directly from the Rols machine. However, the first step was to learn how the newly acquired device worked, since only one of our current staff members had actually used a Rols machine. This task was made much easier because of the patent diagrams, description and user's manual that were donated along with the non-functional Rols machine. These documents provided descriptions of the features and parts of the machine as well as directions on use, when the original patent was filed.

Marcel Jules Helene Staar filed his U.S. patent for the Dictating Machine Drive Mechanism used in the Rols machines on March 22, 1962.[156] The patent drawings provide excellent detail on nearly all parts of the Rols machine with the primary exceptions being the earphones and foot operated controls. These appear to have been considered but not incorporated at the time his patent was filed because they are only mentioned briefly in the specifications:

> "The transcriber may use a headpiece, including an earphone, for listening to the dictation and may employ foot operated controls for advancing and backspacing the tape during the transcription process. It is contemplated that the same machine will be used for dictation and transcription, separate means for connecting the transcription equipment and foot controls being provided as suitable."[157]

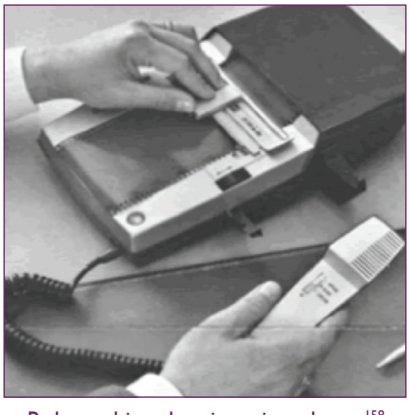


Image 2. 1968 GAF Corporation Rols machine showing microphone.[158]

The Rols machine, purchased by the State Archives came equipped with two accessory sockets, located side-by-side in the same positions as those in the original patent drawings. On the left was the headset socket that required the use of proprietary headphones (sold separately) that allowed one to listen to the recorded audio, but they had to be used with the secretarial

156 Staar, 1964.
157 Staar, 1964.
158 Morton.

foot control (sold separately) to operate the machine playback and rewind functions. The microphone/secretarial foot control socket on the right was used for the microphone (included) or the secretarial foot control, both provided playback and rewind functions. Pressing the foot control all the way would cause the audio to rewind while applying only slight pressure would engage playback of the recorded audio.[159] This information provided Mr. Schulz with two possible avenues through which he might be able to digitally record the RoIs audio. The first was using the microphone speaker to play back the audio and attempt to capture it through another microphone but that would require a very quiet room and likely result in lower quality audio. The second option was to attempt to connect an adapter to the proprietary headphones which would provide the best quality audio and could be done at any computer.

Mr. Schulz elected to focus on the proprietary headphones as the Reference Unit had at least three pairs and provided him with the opportunity for successfully recording the RoIs audio with the best quality while not endangering the ability to provide audio playback in the future. After a bit of trial and error trying to figure out how the headset functioned, Mr. Schulz came up with a workable solution. Detaching the cord from the binaural headset speaker exposed two very small metal posts. Luckily the two posts were just far enough apart that he was able to attach thin wire leads using solid 24-guage, 2-conductor, intercom wire and carefully wrapped the exposed copper wires around each of the two exposed metal posts. In order to playback and eventually digitize the mono audio recordings created by the RoIs machine, Mr. Schulz attached the opposite ends of the wire leads into a 3.5 mm mono Male to 3.5mm stereo Female adapter.

At that point, the State Archives had a prototype adapter that would allow us to connect modern headphones or a 3.5 mm audio cable for recording the audio onto another medium. Playback of the RoIs audio recordings, using this adapter required use of the secretarial foot control accessory which fortunately was included with the functional machine that was purchased. As designed, the foot control required the operator to apply a specific amount of weight in order to engage the playback function; however, too much pressure would cause the foot pedal to engage the rewind function. Due to our small staff size and reference desk duties, it was not feasible for us to have an individual constantly operating the foot control in order to digitally record the audio, so we needed a solution that would allow us to monitor the audio without constantly pressing the foot control.

This solution came in the form of a book, *Oregon Geographic Names*[160] which happened to be just heavy enough to engage the playback function but not cause it to rewind. With this configuration, we were able to playback the RoIs audio from the RoIs machine to the audio input on a computer using an audio cable from the new headphone jack. With the "hardware" prob¬lem solved, we had to select software in order to digitally record the audio and decided to use Audacity, an open source audio recording program that allowed us to record the audio and save .WAV and .MP3 formats.

Once the process was complete and shown to work, the State Archives announced that this previously unavailable audio was now ready to be heard, much to the delight of some of our patrons:

> Mary Jean Winter Way to go, Austin! Your ingenuity and perseverance is directly rescuing parts of My History so my descendants can access it.... Many libraries/historical societies have old equipment/data storage they just don't know what to do with, and it just sits & decays (and all its history with it). A heartfelt "Thanks" to you for saving this bit of our heritage!
> Like · Reply · 1 · April 4, 2013[161]

159 Sawyer's Inc., 1964.
160 McArthur, 2003.
161 Oregon State Archives, 2013.

Image 3. The above photo shows from left to right: headphones without the cable attached; Rols audio player; audio wire and its packaging; computer; and in front of that is the foot pedal used to both play the Rols audio and rewind it depending on the amount of pressure applied to the pedal. The thicker dark cable coming off of the Rols audio player goes to the foot pedal and the smaller one usually attaches to the headphones (far left) but was removed to allow staff to attach wire leads to the new headphone adapter. Finally, an audio line hooks into the new headphone adapter and plugs into the front of the computer (black cable).[162]

Digital recordings of the Rols tapes can only be done on a 1:1 basis — one hour of audio equals one hour to record. Because of the time it takes to adjust the recording software settings, make the digital recordings and perform some basic cleanup of the quality, we are only able to complete between 1 and 2 recordings per day. However, some of the audio recordings were damaged along the edges, where holes in the Rologram film are used to advance and rewind the recordings. In these cases, the only way to make the film advance was to repair the torn holes which we did using acid-free polypropylene film tape. Once completed, these repairs allowed the audio recordings to ad¬vance properly during playback so that digital recordings could be made.

The last steps involved identifying each digital recording with appropriate metadata and importing each recording in the Oregon Records Management Solution (ORMS), which not only ensures the audio will be accessible far into the future but also allows patrons to access the audio from their home computers. We have prioritized conversion based on impor¬tance of legislation for research use and are focusing our digitization efforts on landmark legislation, beginning with the 1967 Oregon Beach Bill. There were a total of 12 Rols dictation tapes with legislative discussions relating to 1967 HB 1601 (Oregon Beach Bill) and one reel to reel audio tape which amounted to over 20 1/2 hours of legislative committee audio that had been previously unavailable to researchers. These new digital recordings are now available on the State Archives website at: http://sos.oregon.gov/archives/Pages/records/legislative_tracings.aspx where the patron can type in "Beach Bill" or "HB 1601" and the results are displayed on the screen. Once the result link is clicked on, the audio begins playing.

162 Oregon State Archives, 2013.

In addition, this same process was used to convert many other important pieces of legislation also originally recorded on Rols format. These include the 1969 Beach Bill (over 14 hours on 9 Rols), 1969 Bottle Bill (over 14 hours on 6 Rols), 1967 Minimum Wage Law (9 hours on 5 Rols) and the 1969 Oregon Land Use Law (almost 15 hours on 8 Rols), and all are available to Oregonians and researchers everywhere via our online web portal at http://records.sos.state.or.us/. The State Archives continues to move forward by digitizing more Rols audio recordings of Oregon landmark legislation and in time would like to complete the digitization of the 1,474 Rols audio recordings in our holdings.

Our project to digitize the original Rols audio recordings relating to the 1967 Oregon Beach Bill, was nominated and awarded the 2014 Oregon Heritage Excellence Award, presented each year to:

> "…recognize individuals, businesses and organizations for outstanding efforts on behalf of Oregon heritage, drawing public attention to these efforts and raising the quality of heritage-oriented activities. The Oregon Heritage Commission presents the Heritage Excellence Awards to honor those that have made the most of available resources and skills and are given for exceptional and meritorious work by organizations, businesses or individuals."[163]

The mission of the Oregon State Archives is to preserve and make accessible the permanently valuable records of Oregon's government. Technological obsolescence is a real issue for all archivists today and not all records can be transformed. However, in the case of the Rols audio tape, the perseverance and ingenuity of our staff has brought back to life Oregon legislation once thought to be lost forever.

References

McArthur, L. A. *Oregon Geographic Names.* Portland: Oregon Historical Society. 2003.

Morton, D. *The History of Recording Technology*. Retrieved 2014-12-04 from http://www.recording-history.org/public_php/recorder_search_results.php.

Oregon Parks & Recreation Department: Oregon Heritage: Oregon Heritage Commission. *Oregon Heritage Excellence Awards 2015* . Retrieved 2014-12-10 from http://www.oregon.gov/oprd/HCD/OHC/Documents/2015__HeritageExcellenceAward_Application.

Oregon State Archives. Configuration of Rols Audio for Digitization. Salem: Oregon State Archives. 2013.

Facebook, Oregon State Archives. Retrieved 2014-12-04 from https://www.facebook.com/OregonStateArchives/photos/pb.328291870571259.-2207520000.1418663603./491536247580153/?type=3&theater.

Oregon State Archives. 2013-04-04. Rologram film being ejected from Rols playback machine. Salem.

Sawyers Inc. Introducing a Totally New System of Dictation... the Rols Dictator-transcriber. Chicago: H. A. Bohm & Co. 1965.

Sawyer's Inc. A Totally New System of Dictation. Portland: Sawyer's Inc. 1964.

163 (Oregon Parks & Recreation Department: Oregon Heritage: Oregon Heritage Commission, 2014)

Staar, M. J. *Patent No. 3,124,360* . United States of America. 1964.

VADS University for the Creative Arts. *Vads the Online Source for Visual Arts, "Things Seen."* 2008. Retrieved 2014-12-04 from http://www.vads.ac.uk/diad/article.php?title=252&year=1969&article=d.252.32.

PUTTING ARCHIVAL AV MEDIA INTO CONTEXT: AN ARCHIVAL APPROACH TO PROCESSING MIXED-MEDIA MANUSCRIPT COLLECTIONS

Megan McShea, Archives of American Art, Smithsonian Institution, USA

1. Introduction

The Archives of American Art is a research unit of the Smithsonian Institution that has been collecting archival materials documenting the history of Art in America since 1954. Like many organizations in the "manuscript repository" category, the Archives does not collect audiovisual material as its primary collecting focus or mission, but it does collect it in substantial quantity and variety nonetheless. It comes into the archives in the papers of artists who experimented with media, galleries who recorded events, art historians who made recordings as part of their research, journalists who produced radio and television programs about art, and many other sources that used audiovisual media as it became available to consumers in the twentieth century. At the latest count, there are about 15,000 analog and digital audiovisual objects in about 800 of approximately 5,000 total collections. Recordings exist in nearly 40 different audio, video, and motion picture film formats. Approximately 90% of these materials are in analog, not digital, audiovisual formats.

The Archives also has an oral history collection, which consists of an additional 2,000 interviews with artists and art world figures, comprising over 5,000 hours of audio created on open reels, cassettes, minidiscs, and SD cards. The Archives' oral history program is well documented. Most interviews have been transcribed, and each interview is individually cataloged. There has always been a sense of responsibility at the Archives for making these recordings, created by the organization, accessible for research. In contrast, the moving images and sound recordings that were among the collections of personal papers and business records that were being collected from other sources did not receive the same careful attention. The state of intellectual and physical access to these collection materials varied, but in general, they were poorly understood, and have been inconsistently and often inaccurately documented and described over the years, through several generations of archives staff. This was as true for collections considered processed[164] as it was for those that were considered part of the processing backlog. Indeed, even in collections considered processed, often the audiovisual material in them was still just as poorly understood, inaccurately documented, and inconsistently described. As such, they constituted a sort of insidious, hidden backlog of inaccessible material within collections that were no longer considered part of the Archives' processing backlog.

To address this issue, the Archives undertook a three-year project to investigate methodologies for processing mixed-media collections; that is, collections in which archival audiovisual documents and paper documents exist together.[165] The project's goal was to devise strategies to make analog audiovisual materials found in manuscript collections more accessible via traditional processing workflows. The project's approach was to process a group of media-rich collections that represented a range of content, format, and condition of material, and to refine existing guidelines for arrangement and description along the way, with the overarching goal of better addressing the needs of the audiovisual material through the processing workflow. The collections selected for the project all related to contemporary art movements such as performance art, video or new media art, environmental art, conceptual art, and installation art. This subject area was chosen because the documentation found in these types of collections often includes significant audiovisual recordings.

164 The Society of American Archivists' Glossary of Archival and Records Terminology defines archival processing as "The arrangement, description, and housing of archival materials for storage and use by patrons." See http://www2.archivists.org/glossary/terms/a/archival-processing.

165 *Uncovering Hidden Audiovisual Media Documenting Postmodern Art*, funded by the Council on Library and Information Resources' "Cataloging Hidden Special Collections and Archives" funding program. See the project page on the Archives of American Art's website at http://www.clir.org/fellowships/hiddencollections (accessed November 26, 2014).

2. The problem

For many archival repositories, processing workflows and descriptive tools for making collection content accessible are already in place, and are based on professional standards and best practices for archival arrangement and description.[166] And yet, while these standards and best practices are designed to be effective and efficient for making archival collections intellectually and physically accessible for research, they are woefully lacking in specific guidance for handling or describing audiovisual materials. Among the audiovisual specialists in the archival profession, professional discourse has focused on audiovisual recordings in isolation, rather than in collections, addressing issues of preservation, digitization, online access, and item-level description. While these are all urgent and essential issues facing archives that collect audiovisual material, for manuscript repositories under pressure to tackle their backlogs and make their collections accessible for research, this discourse has produced little that could help with the many decision points that arise in the course of processing collections, to ensure that audiovisual media are physically and intellectually accessible for research when the processing is complete.

On the one hand, then, general archival standards and best practices lack specific guidance for handling audiovisual material, and on the other, standards and best practices available for audiovisual media lack guidance for managing audiovisual material in the context of its collection of origin. The result of this lack of guidance is that archivists in the thick of processing large volumes of mixed-media collections are left to figure out for themselves how best to handle audiovisual media. As a result, collections with audiovisual components face a variety of possible fates. They may be set aside, put to the back of the queue, leaving the media to languish. Or perhaps, anticipating problems, they are not collected at all. Or, archivists may try to use standards for item-cataloging in their archival description, which, while appropriate for certain types of collections, creates a bottleneck for processing archivists trying to work through hundreds of linear feet of material a year. Or, a repository's audiovisual specialists might remove the materials from their collections of origin for a special format workflow that may or may not maintain the relationships between the media and other records in the collection.

Another issue facing the Archives of American Art regarding mixed-media collections was a lack of planning tools. In 2005, inspired by Mark Greene and Dennis Meissner's "more product, less process" paper[167], many archivists began to set ambitious goals to dramatically increase their rate of processing and eliminate backlogs. The paper called on processing archivists to ditch their pieties about archival processing, to work faster and smarter and make more collections accessible for research. Like many archival repositories, the Archives of American Art rose to this challenge and began to implement a minimal processing program. In the course of planning, however, it was assumed that collections that had significant audiovisual material would be more difficult, and take longer, but there was no way to know how much longer based on existing metrics. As a result, collections with significant audiovisual media in them were left out of these pilot MPLP efforts. Reflecting on this, another goal of the present project was to begin to establish metrics for processing tasks involving audiovisual materials to prevent these collections from being left behind in overall work planning.

166 There are multiple relevant published standards, but for example, see ***Describing Archives: A Content Standard***, Second edition. Chicago: Society of American Archivists (http://files.archivists.org/pubs/DACS-2007.pdf, accessed 1 December 2014); the Encoded Archival Description Tag Library, Version 2002, Official site maintained by the Library of Congress: http://www.loc.gov/ead/tglib/element_index.html; Roe, Kathleen. 2005. ***Arranging and Describing Archives and Manuscripts (Archival Fundamentals Series II)***. Chicago: Society of American Archivists; and ICA Sub-committee on Descriptive Standards. 2000. ISAD(G): ***General International Standard Archival Description***. Ottowa: International Council on Archives (http://www.ica.org/10207/standards/isadg-general-international-standard-archival-description-second-edition.html, accessed 1 December 2014).

167 Mark Greene and Dennis Meissner, "More Product, Less Process: Revamping Traditional Archival Processing." American Archivist 68:2 (Fall/Winter 2005), available at http://archivists.metapress.com/content/c741823776k65863/fulltext.pdf (accessed November 26, 2014).

In response to these circumstances, evident at the Archives of American Art but reflecting a general issue across the profession, the primary goal of the Archives' project was to create tools for processing archivists that aim to integrate best practices for audiovisual material with best practices for traditional archival processing, providing guidance that will enable arrangement and description of mixed-media collections so that audiovisual material is just as accessible, both intellectually and physically, as other kinds of records in the collection.

3. Background

To provide a little context, when the Archives of American Art began this project, some of its big audiovisual issues had been addressed already. There was an audiovisual survey tool in place for collecting basic data on the audiovisual media in collections, and a retrospective inventory had been conducted, providing staff with significantly better information about the audiovisual holdings than had existed previously. There was also a process in place to survey new material upon accession, in order to prevent the accumulation of more undocumented, untrackable material. However, this database was not public-facing, so it did not address the problem of research access.

The Archives also had developed the necessary procedures and infrastructure for making digital access copies of the most common audiovisual formats found in its collections so that researchers could watch and listen to most of the sound and video they might find in the course of their research, and the Archives could then store and re-use the digital access files created. Several outsourced preservation projects had also been carried out to re-format many of the most at-risk and deteriorated audiovisual materials in the collections, which had been discovered in the survey.

However, even with this progress in collection management, preservation, and digitization, processing archivists at the Archives had no guidance for properly arranging and describing audiovisual media in the course of collections processing. As with many manuscript repositories, the processing pass at a collection is central to the Archives' research access strategy, and the finding aid is considered the fullest form of description of the repository's collections. The logical next step in improving the stewardship of audiovisual materials was to create tools and guidelines for archivists processing these collections, to enable them to make the most of the processing pass at collections to make audiovisual materials discoverable and understandable to researchers.

4. Project goals: tools and guidelines

The project resulted in the creation of tools for planning processing and guidelines for arrangement and description that could be adopted by any archivist processing collections with an audiovisual component. Planning tools produced by the project include 1) benchmarks defining expectations for different levels of processing, 2) metrics for how long media-specific tasks could be expected to take and how much the size of collections changed when processed, and finally 3) a ratings system to help archivists assess the pre-processed state of media in collections and its needs. Although more data is needed than that produced by this relatively small project, these ratings, metrics, and benchmarks may eventually allow archivists to predict the rate of processing for media-rich series in whatever state they are found, processed to whatever level of processing is planned.

Guidelines for arrangement and description developed during the project included instructions for when and how to replace media housing and how to seat media in collection containers, basic guidelines for intellectual arrangement of media in collections, and detailed guidelines for description of audiovisual media in Encoded Archival Description (EAD).

5. Planning tools: benchmarks

The benchmarks developed for this project were designed to make explicit what is expected of processing archivists at each level of processing, specifically for audiovisual media. At the Archives, levels of processing for all collections are defined as preliminary (tasks completed upon accession), minimal (the standard now for all but specially-funded processing projects or collections that will be fully digitized), intermediate (only undertaken with special funding), and full (typically undertaken when a collection is to be fully digitized).

For audiovisual media, preliminary processing involves a brief, minimal identification of media in the accession record for a collection, and a more detailed survey of the audiovisual media. At the Archives, when a new collection is accessioned that contains audiovisual media, the collecting archivist includes the extent, location, and general content of the media in the accession record. The audiovisual archivist then conducts a more detailed survey of the media, documenting its condition, the condition of its housing, format characteristics like recording speed and size, date, content description, and an assessment of the uniqueness of the media and its likely rights status. With this information, the media and its current state are documented and can be tracked, regardless of when the collection gets slated for further processing.

More detailed processing has three defined levels: minimal, intermediate, and full. Although it is always difficult to create rules that apply to all collections since each collection presents a unique case, a few rules were established to guide archivists in their decision-making about audiovisual media in the collection. For instance, for minimal processing, re-housing of media in damaged or unsupportive housing is not required; nor is playback of poorly-labeled media. Unlike intermediate or full processing, archivists processing to a minimal level can use the term "unidentified" to describe unlabeled media. They are encouraged to describe labeled media in the aggregate, so that even if individual tapes have more detailed labels, they do not have to include every detail available in their finding aids. Instead, they can list a date range and higher-level description of a group as a whole. With these few established benchmarks, archivists working on minimal-level processing projects, which are typically large-scale and fast-paced, can make note of media without letting it slow their pace. The benchmarks are meant to be flexible, however, so archivists can use their judgment to decide if the media merits the extra effort required to provide more granular intellectual access, or to provide greater physical protection to collection material found in poor condition.

For intermediate and full processing, archivists are explicitly required to play poorly labeled media, if it is stable and if the playback equipment is available, in order to provide an adequate description. For film, they must inspect the leader and head of the film to discover titles and dates. They are required to re-house media that is in substandard housing. Description also gets more complex at higher levels, and there are a range of enhancements archivists can consider to provide more granular and nuanced intellectual access.[168]

6. Planning tools: metrics

Metrics were collected throughout the project to investigate how long processing tasks take for audiovisual media, the factors affecting those rates, and changes in overall extent of collections after processing. Data on extent changes showed that an increase in collection size is typical, with the median increase being 27%.

168 See Appendix A for a draft of project benchmarks for levels of audiovisual processing.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	collection title	project	initial l.f.	initial AV l.f.	final l.f.	final AV l.f.	total survey hours	AV survey hours	condition rating	AV condition rating	Processing level	est. processing rate	est. processing hours	total processing hours (AV + all other record types)	AV processing hours (a portion of total processing hours)	total finding aid hours (AV + all other record types)	AV finding aid hours (a portion of total finding aid hours)	total hours (survey + processing + finding aid)	total hours per lin ft (largest measure)	total AV hours (survey + processing + finding aid)	hours AV processing per AV l.f. (AV survey + AV proc + AV f.a. divided by AV lf)	Factors effecting AV processing speed
2	Ian Butterfield	CLIR	15.4	4	15	4.2	15.5		2	1		15 hrs/ft	10 weeks	182	90.5	38.5		236	15.3		21.5	about 1/3 poorly labeled, no transcripts, not digitized
3	Robert Wiegand	CLIR	7.5	5	10.3	6	11.5	3.5	4	4		20 hrs/ft	5 weeks	105	66.75	39		144	15.1		11.7	all media played to be identified for description
4	Marion Gore / K	CLIR	1.4	1	2.2	1.2	1	0	4	4		10 hrs/ft	1 week	6	1	4		11	5		1.2	all digitized, item records for all AV
5	Finch College	CLIR	19.2	1.8	20.4	2.3	19	1	3	3		15 hrs/ft	340 hours	180.5	10.5	60		259.5	12.7		5	most AV digitized; complex arrangement and description questions for AV

Image 1. Audiovisual Processing Task Tracking spreadsheet.

Tasks that were timed included surveying the audiovisual material, arranging and re-housing it, and writing and entering the description in Archivist's Toolkit, which is the tool used at the Archives to author finding aids. Calculating the data collected, it was found that audiovisual portions of collections took an average of 13.85 hours per linear foot to process, and the processing times for mixed-media collections as a whole averaged 15.3 hours per linear foot. These collections were all considered processed to the "full" level, that is, the highest level of processing.

Although the project collections represent a small sample, it is interesting to compare these numbers to the rates of processing for collections that do not contain substantial audiovisual material, which average 18.1 hours per linear foot for full processing at the Archives. It was significant to discover that large audiovisual components of collections do not necessarily result in longer processing times, and in fact, on average they seem to take less time than collections without media. And in the AV-rich collections, the audiovisual portion is taking less time than the non-AV portion. The assumption used to be quite the opposite of this. As more metrics are gathered, including rates for minimal processing of mixed-media collections, they will surely provide more insights. Already, these preliminary numbers indicate that mixed-media collections need not be excluded from processing projects based on concerns about processing speed.

7. Planning tools: ratings

The metrics also helped identify factors that affected the rate of processing. As with any type of archival material, audiovisual media in unprocessed collections present a wide range of needs. Three factors in particular emerged in the course of the project that seemed to affect the rate of processing the most: re-housing needed, playback needed to identify content, and analysis needed to determine relationships among media objects and relationships between media objects and other documents in the collection.

Using these factors, two rating scales were created to help archivists assess what level of work will be required to process the audiovisual media in a collection. The housing rating is simply a range from a poor rating, indicating that all media need to be re-housed, to an excellent rating, meaning no media need to be re-housed. The audiovisual access rating combines an assessment of how much playback and analysis are needed to properly arrange and describe the media. If everything needs to be played and analyzed to determine the content and the relationships among records, it gets a poor access rating. And conversely, if nothing needs to be played or analyzed, it gets an excellent rating.[169]

To give some concrete examples, a collection might contain audiovisual media that is all unlabeled and has no corresponding paper documentation describing its content, in which case extensive playback will be required to arrange and describe it. Conversely, if everything is well labeled, seems to have been created in an orderly way, and there are transcripts or shot lists, it will have a higher access rating. The audiovisual access rating also has to do with complexity. One obvious series of interviews in the same format will be a lot easier to arrange than multiple media productions, with multiple versions and production elements in multiple formats, where everything has been boxed together and needs to be sorted out.

169 See Appendix B for the complete audiovisual housing and access rating scales.

Eventually, it may be possible to combine the metrics and ratings to estimate processing time for specific collections. For example, a poor rating might mean processing an average of two pieces of media per hour, while an excellent rating is forty per hour. This project did not generate enough data to produce a reliable formula for such a calculation, but as more data is generated moving forward, one could feasibly use the ratings to predict processing time for collections of different sizes and in different states, being processed to different levels. Even without a formula, the type of assessment described in the ratings system could improve collection planning and management. For instance, when considering whether a repository has the resources to provide access to a collection it is considering acquiring, an assessment and rating of the audiovisual media could provide a rationale for decision-making. A mixed-media collection with a low AV access rating would be resource intensive to process, or, a collection might be enormous but easily processed despite its size, because of its high AV access and housing ratings. Such assessments could help archivists build and manage collections in a way that is responsive to available resources.

8. Guidelines: re-housing

Guidelines developed for this project are designed to assist processing archivists with the tasks of re-housing, arranging, and describing audiovisual media. The variety and complexity of archival audiovisual media, and of the repositories that collect it, make it difficult to provide guidelines that can apply to every possible circumstance in every setting. Guidelines written for this project were designed to summarize published standards[170], and to apply those standards to common circumstances specific to mixed-media archival collections.

Re-housing guidelines[171] address both housing and the physical orientation of audiovisual media in storage containers, particularly in cases where audiovisual material is found in containers with other types of records. Archival repositories have a variety of storage resources and therefore will have different approaches to housing and storage of special formats. At the Archives of American Art, audiovisual materials in mixed-media collections are kept in their collection of origin, rather than removed to a special format storage area. Currently, although the general collections storage areas are effectively climate-controlled, there is no storage alternative for materials that would benefit from a cool or cold climate. Without the ability to improve on the storage climate for audiovisual media, there is no rationale for separating these materials from their collections of origin. The re-housing guidelines created for this project are designed to spell out what is expected of processing archivists at the Archives regarding re-housing, and to help them to improve the physical stability of audiovisual material for long-term storage as they physically arrange collections. Generally speaking, archivists should apply their knowledge of archival materials and their physical vulnerabilities to the housing of audiovisual media. This means getting rid of deteriorating, dirty, or unsupportive housing, and photocopying or scanning original housing to preserve the information it carries. Specific supplies, seating, and handling instructions vary by media format.

9. Guidelines: arrangement and description

As with any other type of archival record, the arrangement and description of audiovisual media should provide intellectual and physical access to all records, regardless of media, and should preserve and express the relationships between the records within a collection. The EAD and DACS standards are effective in supporting these goals, but they do not provide consistent or thorough guidance regarding audiovisual material. And although audiovisual cataloging specialists have made significant progress in standards development for item- and collection-level description of audiovisual media, there is no published guid-

170 See Peter Z. Adelstein (2009), 2nd Edition. ***IPI Media Storage Quick Reference***. (https://www.imagepermanenceinstitute.org/webfm_send/301); and ISO 18923 (2000), ***Imaging Materials – Polyester-base Magnetic Tape – Storage Practices***. Geneva: International Organization for Standardization.

171 See Appendix C for re-housing guidelines created for this project.

ance for describing archival audiovisual media in finding aids. In fact, the DACS standard even refers to item-level standards for those looking for guidance in describing audiovisual materials in their collections.

Although item-level standards provide a reference-point for the elucidation and definition of certain elements of description in finding aids, a wholesale adoption of item-level standards for the description of audiovisual materials can be problematic. Finding aids provide a hierarchical structure meant to express relationships among records in a collection and to make use of efficiencies in multi-level description, where a component can inherit description from higher levels. Item-level descriptive information systems tend to be flat and do a poor job of expressing relationships among records so described. They also tend to repeat common metadata in each record, which is anything but efficient. Also, as DACS states quite explicitly, the level of description for a particular component of an archival collection is supposed to match the level of processing; the flip side of this is that more detailed description means more laborious processing. While some recordings might merit such time and effort, many do not, and a high level of detail may mislead researchers as to its importance in relation to other records in the collection that have been more efficiently described. If item-level description is the only tool a repository has for describing its audiovisual material, it may be tied to that process even when the material could just as easily be described in a single aggregated component or a simple list in a finding aid.

And finally, item-level records are very good at capturing the many possible metadata elements that exist for audiovisual media that do not exist for paper records. However, following the "more process, less product" approach now widely accepted as archival best practice, a critical assessment must be made of how much the researcher gains by knowing many of the format details one could include in the description of recordings. At the Archives of American Art, guidelines direct archivists to limit their description to a minimum of what is necessary for physical and intellectual access. That is, include what is necessary for researchers and archives staff to understand what the content of a recording is, how it relates to other documentation in the collection, and how it may be accessed. Many of the details regarding its recording characteristics and technical specifications can be left out of the finding aid. If researchers are interested in such details, they can be discovered when the material is accessed for research.

That said, archivists must ensure their arrangement of audiovisual material in a collection and its description is clear and makes sense of the material, which can often be complicated by multiple versions, formats, and production elements. If the media does not make sense to the processing archivist, it is not going to make sense to the researcher. Disambiguating versions and components of archival media is the sense-making of processing work. If this work has not been done, the material has not been processed.

Other principles of arrangement and description will be familiar to any processing archivist. First, as with any format, preserve relationships among records. In any mixed-media collection, chances are at least some of the audiovisual media is related to paper or other types of records in the collection. These relationships should be preserved in the arrangement and expressed in the description. Media should not automatically be segregated from the paper records. Also, audiovisual media can be effectively described in the aggregate. If a collection contains thirty cassettes of annual meetings with detailed notes on their cases, "annual meetings, 1975-1993, 30 sound cassettes" is an adequate description for a minimally processed collection. Archivists can guide the researcher to key documents in series descriptions that will help them unlock the content, and they can go back to heavily used collections to provide more detail in their descriptions if merited. At the other extreme, an overemphasis on format where audiovisual media is concerned can also lead to under-described material. An inventory of media types is not an adequate description of archival recordings, although such description is commonly found in finding aids. The DACS guidance for devising titles applies here as anywhere: "When devising title information, compose a brief title that uniquely identifies the material, normally consisting of a name segment, a term indicating the nature of the

unit being described, and optionally a topical segment…."[172] In other words, the description of audiovisual components should use some combination of names, genres, locations, and subjects to devise a succinct and unique description of the recording's content.

A chronic problem in the adoption of EAD has been the tendency to retrofit description to display, leaving the metadata compromised and out of standard. This is particularly true for description of AV components, where style sheets may not have accounted for metadata elements particular to AV materials. For example, the existence of a copy or a location gets noted in a unit title. The issues this creates become painfully apparent when migrating or sharing metadata between systems. In this era of aggregating and linking descriptive metadata, it is increasingly important to follow standards for tagging metadata so that the code that underlies the archival description is clean, or in standard. If a style sheet has not been designed to display the metadata elements used in standardized audiovisual description, the style sheet must be corrected.

The instructions for describing audiovisual material in EAD at the Archives of American Art[173] were designed to be a local document integrating guidelines for AV description with local guidelines for general archival description, with a few notes on arrangement as well. They provide detailed instructions and refer specifically to local practice, and will be updated as tools evolve. As of this writing, the guidelines specify where certain types of metadata are to be entered in an Archivist's Toolkit environment, and metadata elements are based on the EAD 2002 standard. The guidelines were developed through a process that began with a close review of the EAD 2002 tag library and DACS (second edition), a review of the Archives' EAD and DACS implementation, consultation with archivists at other organizations on their usage of EAD for describing audiovisual material, and finally a refinement and interpretation of the standards to establish local rules. Because of the variety of institutional practices and contexts, the Archives' guidelines would likely need review and adaptation to be adopted by other repositories. The Archives also anticipates a significant revision with a future migration to ArchivesSpace and EAD3. Still, the guidelines provide possible answers to many of the questions that arise in the course of processing audiovisual components of mixed-media collections, and as such, they fill a gap in existing standards.

10. References

Adelstein, Peter Z, *IPI Media Storage Quick Reference, second edition*. (Rochester: Image Permanence Institute, 2009), accessed December 1, 2014, https://www.imagepermanenceinstitute.org/webfm_send/301.

Greene, Mark and Dennis Meissner, "More Product, Less Process: Revamping Traditional Archival Processing." *American Archivist* 68:2 (Fall/Winter 2005), accessed December 1, 2014, http://archivists.metapress.com/content/c741823776k65863/fulltext.pdf.

ICA Sub-committee on Descriptive Standards, *ISAD(G): General International Standard Archival Description.* (Ottowa: International Council on Archives, 2000), accessed December 1, 2014, http://www.ica.org/10207/standards/isadg-general-international-standard-archival-description-second-edition.html.

International Organization for Standardization, *ISO 18923: Imaging Materials – Polyester-base Magnetic Tape – Storage Practices*. (Geneva: International Organization for Standardization, 2000).

172 Rule 2.3.3. ***Describing Archives: A Content Standard***, Second edition. Chicago: Society of American Archivists (http://files.archivists.org/pubs/DACS-2007.pdf, accessed 1 December 2014), p. 17.

173 A draft of the EAD guidelines is currently available to the public at http://goo.gl/NmnhXh. Eventually, they will be linked from the project web page at http://www.aaa.si.edu/collections/projects/clir.

Library of Congress. *Encoded Archival Description Tag Library, Version 2002*, accessed December 1, 2014, http://www.loc.gov/ead/tglib/element_index.html.
Roe, Kathleen, *Arranging and Describing Archives and Manuscripts (Archival Fundamentals Series II)*. (Chicago: Society of American Archivists, 2005).

Society of American Archivists, *Glossary of Archival and Records Terminology*. (Chicago: Society of American Archivists, 2005), accessed December 1, 2014, http://www2.archivists.org/glossary/terms/a/archival-processing.
-- *Describing Archives: A Content Standard, Second edition*. (Chicago: Society of American Archivists, 2013), accessed December 1, 2014, http://files.archivists.org/pubs/DACS-2007.pdf.

Appendix A: Benchmarks for levels of processing for collections containing audiovisual material

The following guidance has been developed for archivists processing AV-rich collections, specifically outlining what is expected at each level of processing, and what treatment AV should receive to be considered processed to that level.

1. Preliminary

- Location and extent of audiovisual materials in collection is noted by the collecting archivist, as well as general formats and content
- AV archivist surveys the audiovisual material, grouping media intellectually and noting:
  1. specific condition of the media and its housing,
  2. format characteristics like recording speed and size,
  3. dates,
  4. content description taken from labels on media or accompanying documentation,
  5. an assessment of the uniqueness of the media, and
  6. its likely rights status

2. Minimal – processing archivist uses the following strategies to arrange and describe AV:

  a. group media with related documentation found in collection;
  b. use existing labels and/or broad categories to describe;
  c. media can be described in the aggregate, either as a group of related media of a particular genre, or as part of a mixed-media component.
  d. do not play media to describe; unlabeled media can be described as "unidentified" sound recording, video recording or motion picture film.
  e. Do not re-house media (encouraged but not required)
  f. EAD/AV description guidelines must still be followed, with collection-level <accessrestrict> note, series-level scope notes including media description, and component-level <physdesc> and <extent> noting count and specific formats found

3. Intermediate – expectations of processing archivist:

  a. Media that is poorly labeled must be played or inspected to provide adequate description, as long as it is stable and in a format AAA can play
  b. Media should be re-housed during processing if existing housing is broken, unsupportive, or deteriorating.
  c. Motion picture film should be inspected to help identify and date for description
  d. Media can be described in the aggregate, either as a group of related media of a particular genre, or as part of a mixed-media component.
  e. Or, if item-level metadata is a significant access point, a simple item-level component list can be created, e.g. a list of interview subjects or episodes of a broadcast series.

4. Full – expectations of processing archivist:

- **a.** Media that is poorly labeled must be played or inspected to provide adequate description;
- **b.** Motion picture film should be inspected to help identify and date for description
- **c.** item-level components are typically created for all media, with cross references, <physfacet> notes, or <scopecontent> notes to clarify content and enhance access.
- **d.** Media should be re-housed during processing if existing housing is broken, unsupportive, or deteriorating.

Appendix B: Access and housing ratings for assessing processing needs of collections containing audiovisual media

In order to guide processing archivists and to work towards a system for estimating the rate of processing for AV-rich collections, a ratings system for two aspects of collections was developed. They are the AV housing rating, and the AV access rating. The access rating rates the existing physical and intellectual accessibility to AV material prior to processing, e.g., how well-labeled or otherwise well-documented it is in the collection, and how straightforward or complex the intellectual arrangement of the AV material may be. The housing rating rates the extent of re-housing work needed for the AV material in a collection.

Although it bears some similarity to the Columbia/Mellon ratings system that AAA uses in its general collections survey, the AV ratings function differently in that they assess the state of AV materials prior to processing, and help the archivist understand and estimate the amount of work to be done. For more information on the Columbia/Mellon ratings system, see "Special Collections Materials Survey Instrument" (http://library.columbia.edu/services/preservation/survey_tools.html). Note that the physical condition of AV materials does not factor into processing planning because processing archivists are not responsible for preservation of media content. AV condition is tracked via a preliminary AV survey taken for each collection containing AV upon accession, and preservation issues are addressed through a separate workflow.

The AV Access rating can be used in combination with the AV housing rating to evaluate the processing needs of AV in any collection, and to help estimate the time it will take to carry out the arrangement and description of AV portions of collections.

AV access rating:

1. Poor – large AV portions where the bulk of AV items need to be played/inspected in order to be described/arranged
   - items unlabeled and no corresponding documentation of content is found (transcripts, shot lists, inventories, etc.);
   - OR items labeled but there are complex arrangement issues, like many copies and production elements from a media production, or poorly understood relationship between media and paper records that needs analysis
   - or media from many projects boxed together and need sorting/viewing/inspecting

2. Fair – large AV portions where some media must be played/inspected to be described/arranged
   - some items labeled, some not;
   - OR items unlabeled but have corresponding documentation, so a sample of AV can be taken to verify documentation;
   - OR items poorly labeled but form an obvious series, so playing a sample of each series is appropriate to describe;

3. Good – small AV portion needing playback, or large AV portions where bulk of AV items do not need to be played to be arranged/described
   - items well-labeled and described in other documentation
   - arrangement is straightforward

4. Very good – Small amount of AV material in the collection
   - needed interventions will not add significantly to processing time.

5. Excellent – bulk of AV Items digitized, with item records in DCD
   - already described at the item level, item records can be consulted for finding aid description.

AV housing rating:

1. Poor – large AV portions with most or all AV material needing re-housing and/or special collection containers
2. Fair – large AV portions with more than half of AV materials needing re-housing and/or special collection containers
3. Good – large AV portions with little rehousing needed, or small AV portions
4. Very good – small amount of AV material in the collection, re-housing needs of AV material is not a significant factor in processing time
5. Excellent – Bulk of media in collection have already been preserved, physical items should already be re-housed

Appendix C: Instructions for re-housing audiovisual media during processing

These instructions outline the expectations for processing staff regarding housing of AV media during collections processing. The steps below are considered basic measures for providing adequate housing for AV media. Supplies mentioned in this document are all available .

Minimal processing does not require re-housing of AV media, although it is still encouraged if media housing is broken, deteriorating, or unsupportive.

Additional measures for improving the storage condition of AV media in our collections may be implemented through other collection management projects, such as rewinding and coring film, or improving the wind and/or reel for open reel tape, but those types of activities are not required during processing at any level.

1. Re-housing:

A. In general:
   - Remove any acidic or damaged housing as you would for any other record.
   - Media housing should provide structured support for media, and be acid-free, and vented or loose. Some original housing is sufficient if it meets these criteria. Original paper or plastic housing that does not have acid stains or discoloration is adequate and can be left alone.
   - When replacing housing, unless the original housing is completely blank, photocopy old housing on acid-free paper and keep the copy of the original container in its entirety with the media object. Be sure to photocopy printed information on the original media housing that relates to the media such as brand, footage length, tape thickness, etc. This information is important to retain.
   - Photocopies of original housing can be placed in collection folders along with re-housed media. You can also affix a pocket envelope to the new media housing with double-sided tape and put the photocopy in the pocket.

- Four-flaps are not adequate housing for most media because it is not supportive and media on reels or in cassettes can still be crushed. Four-flaps will only work for flat media – i.e. grooved discs.

B. Magnetic media:
   - Put audio reels, cassettes, and VHS videocassettes in new plastic containers if the original housing is missing, acidic, broken, or unsupportive. If original housing is clean, unbroken, and doesn't show signs of being acidic, leave the tape in its original housing.
   - for open reel tapes, add hold-down tape to loose ends; use white paper tape or silver tape
   - Plastic video containers that are dirty can be cleaned and retained. Replacement containers are not available for U-matic, ½" video reels (Usually square and labeled "SONY helical scan"), various Beta-type video, MiniDVs, HDCam, and other video tapes, so original containers should be used. Clean if necessary.

C. Motion picture film:

   Technically, all films in archival storage should be on cores (plastic hubs in the center of the reel with no sides/flanges), with leader at the head and tail, in plastic vented cans, and stored flat. Most films in our collections are not currently stored to this standard, but this type of film re-housing is labor-intensive and is not expected of processing archivists. If film is on a reel and is becoming at all damaged by the flanges of the reel where they touch the edge of the film, it should be wound onto a core and stored flat regardless of size. See AV archivist for help with this.

   However, the following actions are considered basic processing tasks for any archivist with film in their collections:
   - Film in airtight (difficult to open) or rusted metal cans or cardboard boxes should be re-housed in plastic, vented cans. Clean metal cans with loosely fitting lids are acceptable to retain.
   - If replacing film cans, be careful not to let films on cores with loose winds unravel. Place the new can over the film in its original can, and flip it over to transfer the film to the new can intact.
   - Photocopy original housing if it has any labeling on it and keep photocopy with film reel.
   - If end of film is loose, tape it down with white paper tape. Do not pull the end to tighten the wind – this can scratch the emulsion and damage the images on the film.
   - Film with odor (usually vinegar) can be wrapped in buffered tissue paper within the can to absorb some of the acids and help prevent the off-gassing from damaging other materials in the container. Use tissue paper approved for film-based photographic materials.
   - If it is a unique or fragile film, and it is not cored/leadered, it is probably worth re-housing the film to better standards while the collection is being processed. Please bring such films to the attention of the AV archivist.

D. Grooved discs:
   - Many old discs have glass bases underneath the lacquer or acetate coating on the surface of the record and are very fragile. Glass-based discs should be encapsulated between two stiff boards, tied with cloth tape, and should not have anything heavy stored on top of them.
   - Contemporary vinyl records are more durable and don't require encapsulation. You can tell if a record is vinyl if it is somewhat flexible. Glass or aluminum-based discs are inflexible, and glass discs are generally much heavier than aluminum.
   - Pre-cut sleeves for 10" and 12" diameter discs are available. Sleeves can also be fashioned out of folder-weight paper, using the 4-flap method. See the AV Archivist for help identifying and re-housing grooved disc materials.

E. CDs and DVDs:
   - Tyvek or polypropylene sleeves are adequate housing for CDs and DVDs. If already housed in a jewel-case, this is adequate.

2. Seating in collection containers:

A. In general:
   - When AV are scattered among other documents, place AV in folders like any other record.
   - When there are large quantities of AV, you can consider not using folders. Sometimes it's a better use of space. If no folders are used, AV items must still be adequately labeled with container numbers and/or unit titles corresponding to the finding aid for reference staff to be able to locate them in the box from your folder listing.

B. Magnetic media:
   - All sound reels, sound cassettes, videocassettes, and video reels should be stored vertically, not flat. It does not matter which edge they rest on.

C. Motion picture film:
Housing of films in collection containers is determined by two factors, a) whether the film is on a reel (with sides/flanges) or a core (a plastic hub with no core), and b) can size.

   - Small films on reels, like 8mm or Super8, or 16mm films smaller than 12" in diameter, can be stored vertically in folders.
   - For film on reels larger than 12" in diameter, it is usually okay to store a 16mm film flat in a large-format flat box, whether it's on a reel or core.
   - If film is on a core, it is better to store it flat. Multiple small cored films can go into a single can if stored flat.
   - Film cans less than 7" diameter with a single cored film in them can be taped shut and stored vertically.
   - Film cans less than 12" diameter can also be stored flat in regular collection boxes, especially when there is a group of reels that can be stacked. Film cans larger than 12" must be stored in large-format flat boxes. Be sure to label stacked cans adequately for reference staff to be able to identify films listed in your folder list, either with markings on the can itself, or on tape labels, encapsulating cans in folders, or affixing paper pockets that can be labeled.
   - Any film cans stored vertically should have their lids taped to make sure can's don't open in the folder.

D. Grooved discs:
   - Discs 12" in diameter or larger should be stored flat in large-format flat boxes, without anything heavy on top of them. Smaller discs can be filed vertically in folders.

E. CDs and DVDs are best stored vertically in folders and not stacked.

VOICES OF SOUTHERN PATAGONIA: DIGITAL PRESERVATION OF SOUND MATERIAL

Gustavo Navarro, Universidad Nacional de la Patagonia Austral, Unidad Académica San Julián, Argentina

1. Introduction

Currently, both information and artistic output are carried out mainly in digital forms. The preservation of this material sets out new problems to keep it usable and available, since technologies for storing it are replaced by new generations that are more powerful and often incompatible with their predecessors. These discussions about developments for the preservation of digital heritage have taken place in certain regions in the world, mostly English-speaking areas, for some years while developments in Latin America are still scarce.

My work lies in the elaboration of strategies aimed at preserving the sound digital heritage of the Patagonia Argentina region, taking into account the degree of urgency, local circumstances, available resources, and future predictions.

This work in collaboration with Municipal Archives of the province of Santa Cruz provides, in addition to knowledge obtained in the exchange, potential benefits from sustainability on the basis of inter-institutional agreements, and the setting up of shared standards, either to achieve interoperability between programs or to engender a common understanding of practices that help to achieve the desired objectives of preservation.

The discussion of nodal topics included:

- The definition of processes in the management of heritage preservation and the selection of what deserves to be preserved.
- Establishing control of materials, i.e., their identification and description, as well as the aspects of the management of rights.
- Data protection.
- Methods to provide and maintain access to collections.

The methodological proposal of collaborative work was based on the combination of an analytical-descriptive perspective and a normative-of application perspective. The actions proposed for the project were of three types:

1. Research and exchange of knowledge to consolidate a critical unit of knowledge on the topic from the analysis of policies and strategies. A handbook of good practices was written.
2. Exchange of experiences on technological aspects of the preservation of digital sound objects from the analysis of available technologies.
3. Transfer to the community. Reuse of the material was facilitated for academic tasks and teaching research in an attempt to encourage technological innovation and to enable such material not only to be displayed but also to be mobilized.

As a result of interviewing 25 former inhabitants of the province, 30 hours of recordings were generated during the project. Also, work on the definition of quality control systems for the archive was carried out, making sure that the recorded material contain all required fields based on the requirements of OAI-PMH[174] and that the metadata are correct.

Work was done thanks to IASA's financing support.

174 http://www.koluel.org/oai-pmh-repository/request.

2. South Patagonia Region

The South Patagonian region has a particular social structure. In the early decades of the 20th century, it was the destination of various groups of immigrants, including Welsh, English, Spanish and Italian, and later, Polish, Bulgarian, Lithuanian, Yugoslavian, Ukrainian, and Arabian. Today and since the end of the 20th century, there is increased Bolivian and Paraguayan immigration, mostly because of opportunities for work in mines and in the petroleum industry.

Its inhabitants offer histories of conflicts, domination and resistance, genocides, and union struggles, which have often been silenced by national and foreign media. These stories began to be recovered some decades ago by those who undertook the generation of just memory policy. In recent years, the link between history and memory has occupied a central place, with regard to the central axes where the recovery of subjectivity was articulated, that is, the assessment of the subject's viewpoint and the consideration of popular sectors as agents of historical processes, and the concept of history as speech or narrative. This means that the recovery of subjectivity implies a fragmentation of totalitarian speeches and the construction of counter-hegemonic interpretations in political and cultural aspects.

Human Rights, from the viewpoint of social actors' collective memory are a current subject in education and a pending challenge, since they are the struggling strategy against any kind of authoritarianism, exploitation, and discrimination, still present in geographically isolated and socially peripheral towns, such as those in the Patagonian east central region. A preservation policy of the historical heritage is missing there.

On one hand, local municipal libraries count on documentary material, most of which is going through a deterioration process on account of a lack of funding for the maintenance and sustainability of preservation projects. On the other hand, many of the existing documentary sources, such as the local press, cater to the "official history," being insufficient without the testimony from protagonists (oral recordings) and the material from private recordings. It is through the written support that the history and culture of victors and domineering people prevail, ignoring the voice of the defeated and silenced, which rarely goes beyond production scope. The oral tradition acts as the only mechanism for generation-to-generation transmission of a huge historical and cultural heritage, made up by individual and group ideas, testimonies and experiences. Due to its value, oral tradition is increasingly regarded as an intangible cultural heritage, which includes diversity, minorities and threatened voices.

3. Project objectives

The objective of this project is the collective construction by the different actors of local communities of an open access database enabling the recovery and preservation of social memory and the diffusion of this memory through integration in knowledge networks using open software technologies. Therefore, the project intends to boost the educational system's capacities for democratic formation by providing reflection and training tools.

This project will help to add discussions about how to design a memory pedagogy that is able to contribute to the formation of critical citizens capable of thinking about their past in order to think about their present and imagine a fairer future for themselves. The promotion of teaching the past and the recent past lies in the idea that Human Rights are a social conquest, a result of human actions and, therefore, when transmitting them, notions of responsibility, participation, and inclusion get reinforced. It is through education —understood as a provision of the past in permanent dialogue with the present and the future — that it is possible to invite the young to think, discuss, release new questions, and look for new answers to be able to take a stand in front of their reality. In this sense an education, supported in memory and Human Rights, constitutes an essential contribution for the construction of a fair, equitable nation.

Furthermore, the project is enshrined in the principles proposed by UNESCO:

i. Strengthen the contribution of culture to sustainable development
ii. Promote the role of culture in development policies for social cohesion
iii. Improve access to information and knowledge

The objectives of the project are:

- To build a memory-supported pedagogy from developing a recovery and preservation program of digital recording (testimonies, audio support) with the participation of community institutions and entities.
- To familiarize the social actors of towns with methodologies which allow them to be self-managed and responsible protagonists of digital recording construction.
- To collaborate in the management and development of recompilation and digitization of sound material projects in local public libraries.
- To create a "word fund" fostering the output of testimonial work and oral history through competitions, seminars, workshops, and other similar events.
- To develop situations for training and assistance to lecturers in the Instituto Provincial de Formación Docente (IPES) [Provincial Institute for Teacher Education] and educational centers specialized in Human Rights teaching.

4. Participating groups

Direct beneficiaries of the project are third-level and second-level students of the provincial education system in the communities of Puerto San Julián, Puerto Deseado, Comandante Luis Piedra Buena, and Puerto Santa Cruz (east central region of Santa Cruz province, Argentina) and the overall community through the institutions and organizations taking part in it, including:

- Polimodal School N° 24 "17 de Agosto", Puerto Deseado
- Salesian Polimodal Institute, Puerto Deseado
- Historical Archive Palmiro Pedemonte, Puerto Deseado
- Historical Archive Adolfo Oroz, Puerto Santa Cruz
- Private Archive of 'Estancias' "Monte León"

The final result of this project was the construction of an open-access e-infrastructure for the preservation and distribution of differently supported documentary material —testimonial audio, sound archiving — of the towns in the east central region of Santa Cruz province, aiming at materializing its availability to be used in the education system and the overall community. The collective construction of this digital archive creates a significant device for citizen participation, being an innovative resource for classroom work. Documentary material constitutes an important input for curriculum spaces regarding Human Rights teaching.

5. Background

The project was born in 2010, when the project "Archive Memories of the Patagonia Austral Koluel" [175] was created, which began efforts to move and organize sets of documents, from their digitization to specific treatment for their public consultation. The plan served as a guiding document for Koluel work by helping Municipal Archives to build and keep unique digital collections and to provide online access to them. Koluel also provides a varied curriculum of workshops focused on digital conversion, metadata for digital collections, software of management fo digital collections, and related areas of emerging technologies for the Archives.

175 http://www.koluel.org/.

6. Choosing Omeka

One of the first decisions we had to make was what management system we would use for building and delivering the directory on the web. Aiming at highlighting the archive collections and the software trials that could be used for the future construction of the collection, three possibilities were evaluated: Plone, Fedora, and Omeka. Each of these systems was appraised against our expectations for digital collections management systems:

- Attractive visual design, easily customizable (topics)
- Easy installation
- Extensible design approach that enables the alteration of existing functionalities and the addition of new functionalities
- Flexible approach to metadata
- Support for web standards (CSS, XHTML, RSS)
- Functions of import and export that use standardized data formats (CSV, XML, JSON)

Plone is a content manger and cannot solve the metadata issue plainly; it requires deep knowledge of programming.

The second system under exam is Fedora, but we found it to be too sturdy for updating purposes.

Our interest in the implementation of a digital exposition tool, rich in functions, led us to consider Omeka,[176] a relatively new open-source collection management system that was created by the Centro para la Historia y Nuevos Medios (CHNM) [Center for History and the New Media] at George Mason University in the US. Omeka developers describe their platform as a next generation web publication platform for museums, historical societies, scholars, enthusiasts, and educators.

Another feature that the staff of Koluel found attractive was the strong and flexible approach of Omeka to metadata representation. In Omeka, archives can work either with the Dublin Core standard, the imports of other metadata sets of their choice, or by creating their own vocabulary of customized metadata. Omeka is designed to meet the requirements of institutions that lack technical personnel and large budgets.

7. Scope and specifications of the project

The digital collection directory project (Koluel) that we executed using Omeka established a collection policy based on the desire of representing as many collections as possible in light of our limited personnel and time. A collection can be included in the Koluel directory provided that:

- The owner of these resources is authorized to allow free online access.
- The collection includes at least 30 resources, e.g., images, audio files, means of localization.
- The collection is not a small exhibition that offers only a handful of digitized resources.

8. Expositions

Omeka was developed based on the specific needs of museums, historians, and archives. The origins of the software in the field of cultural institutions can explain why, based on the standards of archives, there are limited options for intellectual control in the management site. However, its development in the Centro de George Mason de Historia Social y Nuevos Medios [George Mason's Center for Social History and the New Media] also led directly to

176 http://omeka.org/.

one of the greatest strengths of Omeka: exhibition building. Once users have created records within the system, they can easily arrange expositions. A site editor fills out a web form to determine the first level data such as title, slug, and topic; then assigns a metadata section; and finally adds individual records to the section. A given exposition may have several sections thus enabling more complex relationships among digital objects. Some templates give priority to images, while others allow a greater extension of the didactic text-specific exposition.

The Oral History[177] collection offers a good example of how the exposition feature[178] can be used for educational purposes. This exposition brings together interviews from former inhabitants with issues relating to the Patagonia Austral. The strength of the exposition feature lies in its ability to transmit a curatorial perspective in a dynamic and interactive environment that guides the users of an object and also provides contextual information from experts with standardized metadata and social labeling.

9. Conclusions

Omeka has great potential to support the creation of online small and medium-sized digital collections for archives. The software is suitable for archivists and curators to work effectively in the context of their disciplines. The architectural core and design of Omeka software are suitable to allow the software to be improved as the user community increases. It is also a good way of allowing institutions to reuse existing digital collections in new modern web frameworks with the availability of an option of robust CSV import that can bring both metadata[179] and the media into the system.

The continued improvement to Omeka's administrative interface within this architecture will help it to become a more viable solution for creating digital collections of archives. In spite of these limitations, Omeka is very well positioned in its target market of small and medium-sized institutions that need an easy-to-implement, effective, professional tool in order to make digital archive and museum content available on the Web. It is important to measure the functionality, features, and limitations of Omeka against some of the same functions, features, and limitations of a proprietary system. We hope that our experience can help other institutions to assess Omeka as a possible management system for providing access to the results of their digitization projects, as well as to anticipate and to overcome some of the obstacles that we faced.

10. Bibliography

"Dublin Core." In http://www.koluel.org/oai-pmh-repository/request, accessed on May 2013.

"Exposición." In http://www.koluel.org/exhibits/show/testimonios-orales, accessed on May 2013.

International Association of Sound and Audiovisual Archives, Technical Committee. Bradley, Kevin editor. Directrices para la producción y preservación de objetos digitales de audio: IASA TC04. Ciudad del Cabo: Asociación Internacional de Archivos Sonoros y Audiovisuales, 2009.

"Koluel." In http://www.koluel.org/, accessed on March 2010.

"Omeka." In http://www.omeka.org, accessed on October 2007.

"Oral History." In http://www.koluel.org/collections/show/19, accessed on May 2013.

177 http://www.koluel.org/collections/show/19.
178 http://www.koluel.org/exhibits/show/testimonios-orales.
179 Directrices para la producción y preservación de objetos digitales de audio, IASA-TC 04.

IASA Journal is constantly looking for material to publish: articles, reviews, reports of meetings, or new developments.

Please send articles, letters, or reviews you consider of interest to IASA, to the editor at the address given at the back of this issue. Abstracts (maximum 250 words each) may be in French, German, Spanish, or English. Images can be sent as photographs or drawings to be scanned, or as digital images in GIF, JPEG, PDF, PNG, or TIFF formats.

The closing date for copy for the next issue, number 45, to be published in July 2015, is 31 April 2015.

Information for authors

1. Articles should be submitted to the editor for consideration at least two months before published deadlines. If approved for publication, final versions of articles are due no later than the published deadlines.
2. Soft copy as a .doc file for text should be submitted with minimal formatting.
3. Illustrations (photographs, diagrams, tables, maps, etc) may be submitted as low resolution files placed in the .doc file or sent separately. Once the article has been accepted for publication, high resolution copies will be required and should be sent as separate documents.
4. Use footnotes not endnotes.
5. References should be listed at the end of the article in alphabetic order and chronologically for each author and should adhere to guidelines of the Chicago Manual of Style (http://www.chicagomanualofstyle.org/home.html).
6. Authors are encouraged to submit original research or to develop their conference presentations into more detailed accounts and/or arguments for publication in the journal. In principle, articles should be no longer than 5,000 words.

Information for advertisers

Enquiries about advertising should be sent to the Editor. Current rates can be seen on the website at http://www.iasa-web.org/iasa-journal-advertising

Join the IASA Listserv!

Send a message **Subscribe Iasalist@nb.no** + your **Full Name**
(eg Subscribe Iasalist@nb.no name surname) to: Listserv@nb.no

Write only Subscribe Iasalist@nb.no + your Full Name in the **text body.**

Don't add anything else. **Leave the subject field empty.**

You will receive a message to confirm your subscription. Just follow the instructions.

After a few seconds, you will receive a welcome message beginning:

You have been added to the IASALIST mailing list (IASA-list) by Meg administrator@NB.NO…

Please save this message for future reference, especially if this is the first time you are subscribing.

You are subscribed and can start sending messages, questions, answers, etc to the listserv.

IASA's sustaining members

Jörg Houpert
Anne-Conway-Straße 1
D-28359 Bremen
Germany
Tel. +49 421 20144 0
Fax +49 421 20144 948
e-mail: j.houpert@cube-tec.com
http://www.cube-tec.com/

Paul Leitner
Eichetwaldstraße 6
A-5081 Anif Salzburg
Austria
Tel. +43 660 5553155
e-mail: paul.leitner@mediaservices.at
http://www.audioinspector.com/

Jean Christophe Kummer
VertriebsgesmbH
Johannagasse 42
A-1050 Vienna
Austria
Tel. +43 1 545 2700
Fax +43 1 545 2700-14
e-mail: c.kummer@noa-audio.com
http://www.noa-audio.com/

JVC Advanced Media EUROPE GmbH
att. Hiroko Ito
Nording 23
90765 Fuerth
Germany
e-mail: hiroko.ito@jam-eu.com

IASA Journal

- Journal of the International Association of Sound and Audiovisual Archives IASA
- Journal de l'Association Internationale d'Archives Sonores et Audiovisuelles IASA
- Zeitschrift der Internationalen Vereinigung der Schall- und audiovisuellen Archive IASA
- El Journal de Asociación Internacional de Archivos Sonoros y Audiovisuales

The IASA Journal is published twice a year and sent to all the members of IASA. Applications for membership of IASA should be sent to the Secretary General (see list of officers below). The annual dues are €48 for individual members and €190 for institutional members. Back copies of the IASA Journal from 1971 are available on application. Subscription to the current year's issues of the IASA Journal is also available to non-members at a cost of €70.

Le IASA Journal est publié deux fois par an et distribué à tous les membres de l'association. Veuillez envoyer vos demandes d'adhésion au secrétaire don't vous trouverez l'adresse ci-dessous. Les cotisations annuelles se montent actuellement à €48 pour les membres individuels et €190 pour les members institutionnels. Les anciens numéros (à partir de 1971) du IASA Journal sont disponibles sur demande. Ceux qui ne sont pas membres de l'Association peuvent s'abonner au IASA Journal pour l'année en cours au coût de €70.

Das IASA Journal erscheint zweimal jährlich und geht allen Mitgliedern der IASA zu. Aufnahmeanträge für die Mitgliedschaft bei der IASA sind an das Sekretariat (Anschrift siehe unten) zu richten. Die Mitgliedsbeiträge betragen derzeit €48 für individuelle Mitglieder und €190 für Institutionen. Frühere IASA Journale (ab 1971) sind auf Anfrage erhältlich. Der Bezugspreis des IASA Journals für Nichtmitglieder beträgt €70.

El 'IASA Journal' se publica dos veces al año y se envía a todos los miembros de la IASA. Las solicitudes de inscripción a la IASA deben dirigirse al Secretario General (consultar la lista de los miembros directivos a continuación). Las cuotas anuales son de €48 para los miembros individuales y de €190 para los institucionales. Los números atrasados del 'IASA Journal' desde 1971 están disponibles previa solicitud. Las subscripciones a los números del 'IASA Journal' del año en curso también están disponibles para no asociados, al precio de €70.

The executive board of IASA

President:

Ilse Assmann
Head: Media Information Management
M-Net, MultiChoice
Randburg
South Africa
e-mail: president@iasa-web.org

Past President:

Jacqueline von Arb
Norwegian Institute of Recorded Sound
Bjergsted Terrasse 5A
N-4007 Stavanger
Norway
Phone: +47 51 83 40 60
e-mail: past-president@iasa-web.org

Vice President (Conferences):

Bruce Gordon
Eda Kuhn Loeb Music Library
Music Building, North Harvard Yard
Harvard University
Cambridge, Massachusetts 02138
USA
Phone: +1 617-495-1241
e-mail: conferences@iasa-web.org

Vice President (Membership):

Judith Gray
Coordinator of Reference Services
American Folklife Center
Library of Congress
101 Independence Avenue SE
Washington, DC 20540-4610
USA
Phone: +1-202-707-1740
e-mail: membership@iasa-web.org

Vice President (Training):

Pio Pellizzari
Swiss National Sound Archives
Via Soldino 9
CH-6900 Lugano
Switzerland
Phone: +41 091 961 64 00
e-mail: training@iasa-web.org

Secretary-General:

Lynn Johnson
e.tv Pty Limited
Block B, Longkloof Studios
Darters Road Gardens
Cape Town 8001
South Africa
Phone: +27 21 4814414
e-mail: secretary-general@iasa-web.org

Treasurer:

Tommy Sjöberg
Folkmusikens Hus
Dalagatan 7
S-195 31 Rättvik
Sweden
Phone: +46 248 79 70 54
e-mail: treasurer@iasa-web.org

Editor:

Bertram Lyons
AVPreserve
2014 East Washington Avenue
Madison, WI 53704
USA
e-mail: editor@iasa-web.org

Webmanager:

Richard Ranft
Head of Sound & Vision
The British Library
96 Euston Road
London NW1 2DB
England
Phone: +44 (0)207 412 7424
e-mail: webmanager@iasa-web.org

Layout by Smallgoodthing, London, UK.

IASA uses Gill Sans as its preferred font. Gill Sans was created by Eric Gill and published by the Monotype Corporation between 1928 and 1930. Gill Sans is widely admired for its quiet gracefulness and versatility. In the Bit stream font collection, Gill Sans is called Bit stream Humanist 521. Gill Sans was part of a competitive period in the 1920s when various foundries were developing modern sans-serif type faces for various lead type setting technology.

ISSN 1021-562X