International Association of Sound and Audiovisual Archives

Internationale Vereinigung der Schall- und audiovisuellen Archive

Association Internationale d'Archives Sonores et Audiovisuelles

Asociación Internacional de Archivos Sonoros y Audiovisuales

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iasa journal

no 47, January 2017

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48TH ANNUAL CONFERENCE OF THE INTERNATIONAL ASSOCIATION OF SOUND AND AUDIOVISUAL ARCHIVES (IASA)

Integration and Innovation: Bringing workflows and formats together in the digital era

Berlin, Germany 17-22 September 2017

IASA invites everyone engaged in or curious about the discovery, care, preservation and dissemination of our sound and audiovisual heritage, to join us in Germany's vibrant capital city, Berlin, to explore the intersection of workflows and archival formats as manifest in new ways of thinking about, new ways of preserving and new ways of presenting our objects in the digital era.

***** The call for presentations closes on 10 February 2017 *****

This year's conference theme, Integration and Innovation: Bringing workflows and formats together in the digital era, will touch upon and delve deeply into the following sub-themes:

- Managing sound and audiovisual collections in an integrated manner
- New workflows for arranging and describing collections
- Intellectual property and rights management challenges & opportunities
- Selection and appraisal – strategies for acquiring digital content
- How are sound and audiovisual archives innovating in the digital era?
- Programme to include papers, tutorials, and practical workshops

Please find all conference information on the conference website: http://2017.iasa-web.org/.

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

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IASA JOURNAL EDITORIAL BOARD

In order to ensure diverse and clearly-articulated viewpoints in each issue of the journal, the IASA Journal solicits input and guidance from an Editorial Board consisting of the current IASA Editor and President as well as an invited group of IASA member representatives from each continental region throughout the world.

The IASA Journal Editorial Board provides general review and guidance on direction of the IASA Journal, meets once yearly during the IASA annual conference, assesses previous year's journal issues and makes general suggestions for future activities.

Board positions are entirely voluntary and receive no remuneration or financial support from IASA.

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During this year's IASA conference in Washington, DC at the Library of Congress, I noticed continued discussion of trends that are ever-looming in our field: (1) digital video care and management improvements and (2) increased access demands for digital audiovisual collections. We are required to be agile in our ability to provide effortless access to audiovisual archives in the digital landscape; and simultaneously, we are challenged to design long-term storage infrastructure for the preservation of exponentially growing collections of the biggest (in terms of bytes) digital content in existence—high definition digital audio and digital video objects. At the core of our work, while we are attending to the many details of audiovisual archives, most of us are still laying dependable infrastructure for digital preservation of and versatile access to our ever-growing digital archives. This is the reality in which we operate today.

The narratives in this issue of the IASA Journal echo the above trends in general, while also reminding readers of existing efforts that have been longstanding trends in the fields of audiovisual archives. Iain E. Richardson of Vcodex Ltd. In the UK opens the issue with a detailed review of digital video compression codecs, offering the reader his expertise in understanding the capacities and limitations of video as a digital object. Jonathan Ponder from ITHAKA-JSTOR CM Production in the USA follows with a study on the complexities and necessities of preserving audio and video supplemental materials from print journals. As has often been the case in the past, workflows for preservation of print materials reach maturity before those for the preservation of audio and video materials. Ponders' report highlights this opportunity.

Offering a representative glimpse into the activities at public broadcasting organizations across the US, a cadre of fellows from the US's National Digital Stewardship Residencies program contributed a summary of their ongoing fellowships. Most importantly they illustrate the value of building a digital preservation community in public broadcasting. Bringing yet another perspective on challenges associated with the preservation of digital audiovisual materials, Margret Plank of the German National Library of Science and Technology considers scientific video collection stewardship.

Switching to concerns about access and dissemination of digital audiovisual content, Leslie McCartney of the University of Alaska Fairbanks in the US, recounts the evolution and issues she has encountered in providing meaningful and useful online access to oral history recordings. And, Filipa Magalhães and Isabel Pires, both from the Centre of Music Sociology and Aesthetics Studies at the Universidade NOVA de Lisboa in Portugal, offer a case study of Constança Capdeville collection to discuss providing access to music-theatre works with electronic sound on tape.

Rounding out the issue are two distinctly different articles. First a report on the challenges of teaching sound studies that include preservation issues in Malaysia by a team of writers from China and Malaysia—Gisa Jaehnichen of the Shanghai Conservatory of Music in China, and Ahmad Faudzi Musib of Universiti Putra Malaysia. Second, an instructional short with detailed instructions for locating replacement azimuth screws for Tascam compact cassette decks offered to the IASA community by Andrew Thomas from the Church History Department of the Church of Jesus Christ of Latter-day Saints in the US.

It is worth noting that this is IASA's second fully peer-reviewed issue thanks to a cadre of volunteers from our professional colleagues. Their selfless work is helping to improve the quality and accuracy of the content in the IASA Journal. I cannot thank them enough for their time and dedication. Similarly, IASA's newly minted Editorial Board took time this year to review Issues 45 & 45 and to provide recommendations for improvement to the overall look and feel of the journal. Some of their recommendations have been rolled out in this issue, including categorization of articles, and a move away from Chicago Manual of Style referencing to Harvard referencing style. More of their ideas will be incorporated in the upcoming journal (Issue 48), and we will continue yearly review by the Editorial Board moving forward.

The closing date for submissions for the next issue, number 48, is 1 April 2017, to be published in June/July 2017. Please contact editor@iasa-web.org with questions or to submit your work.

With all best regards —

Bertram Lyons, CA
IASA Editor

A successful conference in Washington DC marked the end of the second year and guided the IASA Executive Board into the third and final year of our term. We had a very challenging but in many respects a very rewarding second year of our term.

Our past conference themes have built on each other, and incorporated elements of each host country's history or culture. Our 2015 conference in Paris referenced the famous book by Dumas "The Three Musketeers" and adopted the motto: "All for One — One for All: Common Concerns — Shared Solutions," while the theme of the Washington Conference "A World of Opportunity: Audiovisual Archives and the Digital Landscape" reflected the 'American Dream' that became a symbol for opportunity, prosperity, and success for the United States. The 2017 conference will be held at the Ethnological Museum in Berlin, Germany and the conference theme 'Integration and Innovation: Bringing Workflows and Formats Together in the Digital Era' harks back to the unification of Germany during the 1990's.

Against the backdrop of shared solutions to opportunity and to integration, IASA continuously debates and looks at opportunities not only for the IASA membership, but also for the sound and audiovisual archives community as a whole. As the world becomes politically and socially more fragmented, archives and organisations such as IASA will be challenged in maintaining cohesion to make 'togetherness' a reality. The conference in Berlin will be the ideal place to discuss and to exchange ideas in terms of togetherness in many areas of our work.

In reviewing the second year of our term, we detected a renewed energy in our Committees and Sections. The Technical Committee is working on the TC-06 which we hope will soon be published. The Discography Committee, which almost became dysfunctional, was revived by the energetic Filip Sir and Peter Laurence. Equally busy was our brand-new Organising Knowledge Committee, under the very able leadership of Johan Oomen, Guy Maréchal, and Zane Grosa. The National Archive Committee embarked on an ambitious survey in collaboration with IFLA to look at Legal Deposit regulations across the world. The Training and Education Committee set up a task force to investigate ways in which IASA can proactively identify where training is most needed, using a consistent set of criteria to formulate recommendations on how IASA can best meet that need. The taskforce is led by Will Prentice, who will report back with a framework of recommendations by September 2017.

The Board recognised the importance of social media in drawing attention to IASA and IASA's work. The Board requested social media expert, Karen du Toit from South Africa, to act as our social media coordinator and to ensure our consistent presence on social media. Since April 2016 there has been a significant and steady growth of followers on Facebook and Twitter. Karen also created a LinkedIn Group as well as an account on Instagram. It is too early to say if our strategy of promoting IASA on social media contributes to increased membership, but it is encouraging to see the growth of followers.

2017 is our election year! Lars Gaustad, Gisa Janichen, and Aaron Bittel accepted our invitation to form the Election Committee and Gisa was elected chairperson of the election committee. We encourage you to actively take part in the election and to play a part in readying IASA for the future.

Last–but absolutely not least!–IASA will mark its 50th birthday in 2019. We are looking at setting up a committee to consider how best to celebrate this milestone. One idea is to have the conference in Amsterdam–the birthplace of our organisation. We welcome any ideas about the celebration.

I look forward to seeing you in Berlin in September. As usual Bruce Gordon is already hard at work and Richard Ranft has created the 2017 Conference website where you will be able to find all relevant information to start planning your travel to Berlin. See you soon!

Ilse Assmann
IASA President
January 2017

VIDEO COMPRESSION CODECS: A SURVIVAL GUIDE

Iain E. Richardson, Vcodex Ltd., UK

1. Introduction

Not another video codec!

Since the first commercially viable video codec formats appeared in the early 1990s, we have seen the emergence of a plethora of compressed digital video formats, from MPEG-1 and MPEG-2 to recent codecs such as HEVC and VP9. Each new format offers certain advantages over its predecessors. However, the increasing variety of codec formats poses many questions for anyone involved in collecting, archiving and delivering digital video content, such as:

- Which codec format (if any) is best?
- What is a suitable acquisition protocol for digital video?
- Is it possible to ensure that early 'born digital' material will still be playable in future decades?
- What are the advantages and disadvantages of converting (transcoding) older formats into newer standards?
- What is the best way to deliver video content to end-users?

In this article I explain how a video compression codec works and consider some of the practical concerns relating to choosing and controlling a codec. I discuss the motivations behind the continued development of new codec standards and suggest practical measures to help deal with the questions listed above.

2. Codecs and compression

2.1 What is a video codec?

'Codec' is a contraction of 'encoder and decoder'. A video encoder converts 'raw' or uncompressed digital video data into a compressed form which is suitable for storage or transmission. A video decoder extracts digital video data from a compressed file, converting it into a displayable, uncompressed form. It is worth noting that:

- The original and decoded video material may or may not be identical. If the output of the decoder is identical to the original video, the compression process is *lossless*. If the two videos are not identical, the compression process is *lossy* and it is (generally) not possible to recover the original data.
- There are many different codec formats which can provide widely varying amounts of compression.
- In general, higher compression can be achieved at the expense of reducing the quality of the decoded video.
- A video encoder and decoder must be compatible to work successfully, i.e. they must both conform to a common specification. The decoder needs to know the format in which the encoder compressed the video in order to successfully decompress it. This usually means that the encoder and decoder should use the same codec format.
- Newer codec formats such as HEVC and VP9 may require much more computational power than older formats such as MPEG-1. More processing power may translate into slower encoding and decoding.
- The amount of compression achieved can (and often does) vary dramatically between different codec formats and even between different versions or implementations of the same codec.
- A video codec may be implemented as a software application or it may be built into a device such as a smartphone, computer or camera.

2.2 Why compress video?

Figure 1 compares the resolution of popular video formats:

Format	Pixels per frame
Standard Definition (SD)	720x576 (PAL) or 720x486 (NTSC)
720p High Definition (HD)	1440x720
1080p High Definition (Full HD)	1920x1080
Ultra HD*	3840x2160

* Sometimes referred to as 4K, although the Digital Cinema Initiative 4K specification contains 4096x2160 pixels per frame.

Making certain assumptions about colour depth[1], one second of SD video recorded at 25 frames per second, requires 15.5 Mbytes of storage space. One second of Full HD video at 50 frames per second requires around 176 Mbytes of storage. This means that storing an hour-long Full HD video would require over 630 Gbytes of storage space. A key benefit of compression is that a compressed version of the same 1-hour file might require only a few Gbytes of space. The exact amount of space required depends on a number of factors including the content of the video and the chosen playback quality, as we shall see later. Compression of video can:

- Reduce the amount of storage space required per hour of video, making it possible to store more content in a certain storage capacity,
- Reduce the time taken to copy or move video files between locations by making the files smaller,
- Make it possible to access video material via the internet, by reducing the bitrate required to send or stream video.

Audio-visual material is increasingly captured in a compressed form. Unless your content is created using professional cameras and production tools, it is likely to be compressed during the recording process. For example, if you record video on a consumer device such as a digital camera, camcorder or smartphone, video is captured via the device's camera, encoded and stored on the device's internal storage in a compressed form. 'Born digital' audio-visual material is very often 'born compressed'.

1 4:2:0 sampling and 8 bits per sample, with PAL format for the SD example.

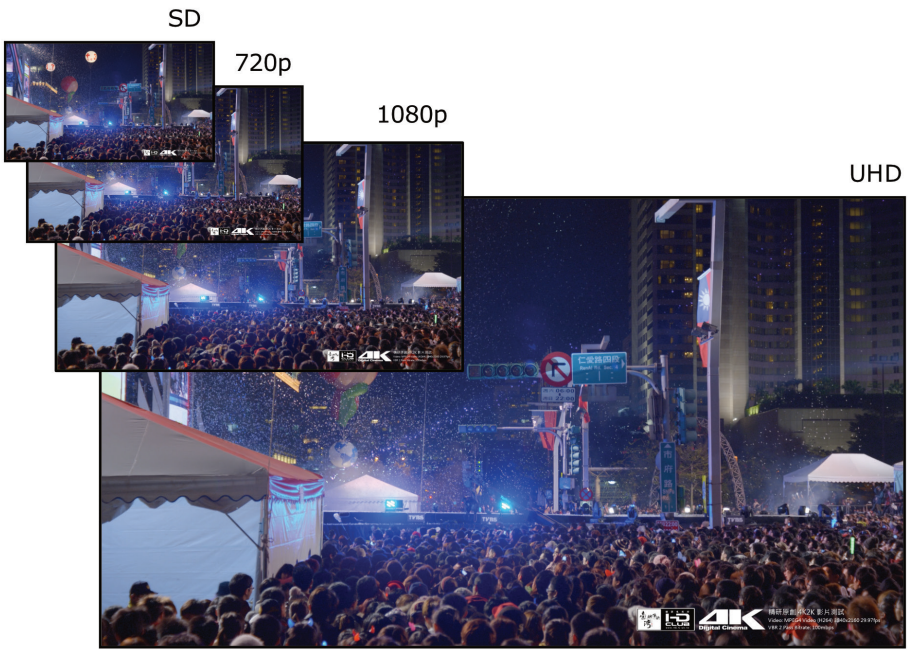

Figure 1 Video resolutions

2.3 How does a codec compress video?

A video codec can compress video material by exploiting two main factors:

1. The characteristics of a typical video scene, and
2. The way humans perceive visual material.

Most of the video material that we watch has certain predictable characteristics that can be used to help compress the video. Pixels or regions that are close to each other in space or time are likely to be correlated, i.e. similar. Within a single video frame, spatially neighbouring pixels are often the same or similar, particularly when they are all part of the same image feature or region. We can often find the same or very similar pixels in a video frame before or after the current frame, either (a) in the same place, if there is no movement from frame to frame, or (b) in a nearby location, if there is movement of the camera or the objects in the frame. A video encoder exploits these spatial and temporal similarities in several ways to compress video. For example, during prediction, each block of pixels in a frame is predicted from nearby pixels in the same frame or from pixels in another, previously processed frame.

When we look at a visual scene, we only take in or attend to a relatively small amount of information (Anderson, Charles, et al., 2005). Many factors are at work, including the sensitivity of the human visual system to detail and movement, our attention to and interest in what is actually in the scene and our innate response to unusual or unexpected details. A human observer is not capable of paying attention to every pixel in a high definition video display. A (lossy) video encoder exploits this by discarding much of the visual information in a scene, removing fine details and small variations that would typically not be noticed by the viewer.

2.4 What's inside a video encoder?

Most video compression encoders carry out the following steps to process and compress video, converting a series of video frames into a compressed bitstream or video file (Figure 3).

1. Partitioning: The encoder partitions the video sequence into units that are convenient for processing. A video clip is typically partitioned into -

- Groups of Pictures (GOPs) : Random access points, each including an independently-decodeable frame
- Frames : A complete video frame, sometimes described as a Picture (Figure 2)
- Slices or Tiles : Regions within a frame
- Macroblocks (or Coding Tree Units, CTUs) : The basic unit of processing, a square region of pixels, ranging in size from 16x16 up to 64x64 pixels depending on the codec format
- Block : A square or rectangular region within a macroblock or CTU.

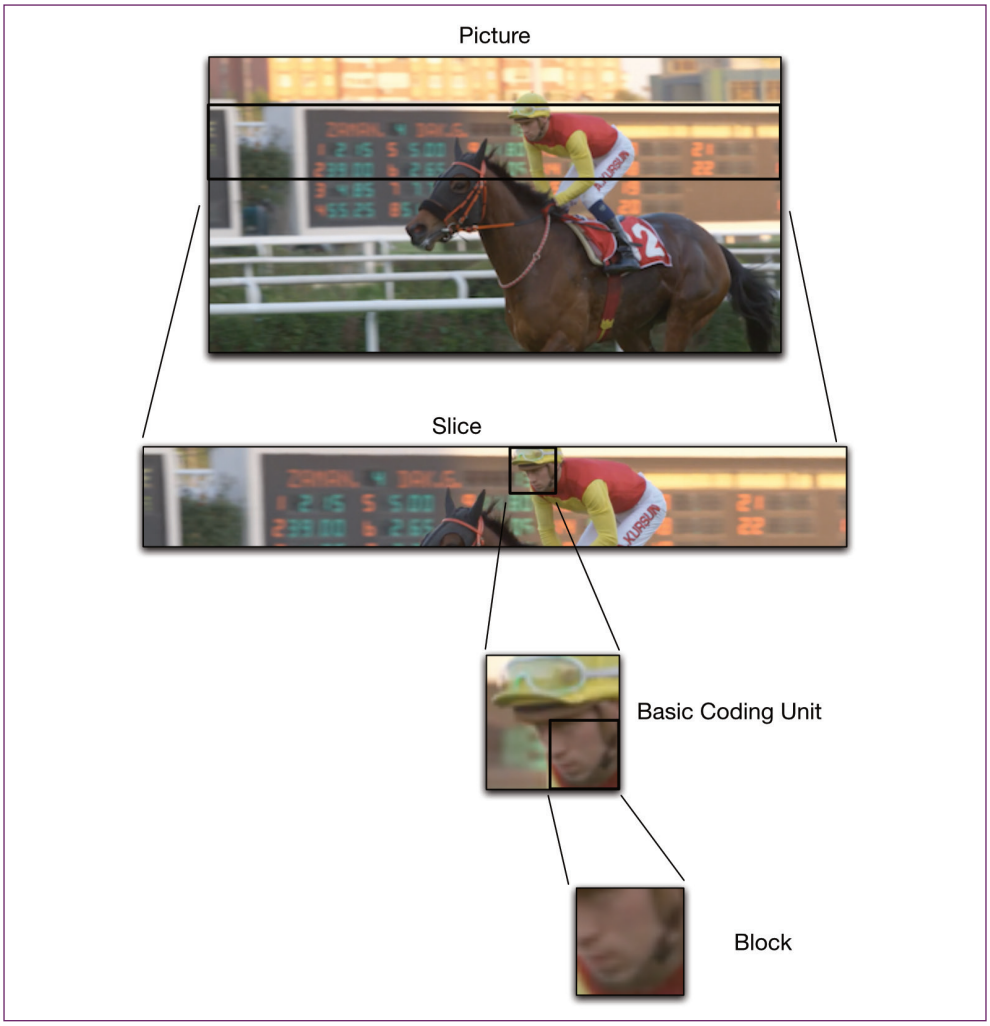

Figure 2 Partitions

Many of the partitions within a frame are square or rectangular, with dimensions that are powers of two (16, 32, 64 etc). These dimensions are (a) easy for electronic devices to process efficiently using digital logic and processors and (b) easy to indicate or signal in the encoded file.

2. Prediction: Each basic unit or block is predicted from previously-coded data such as neighbouring pixels in the same frame (intra prediction) or pixels in previously coded frames (inter prediction). A prediction block is created that is as close a match as possible to the original block. The prediction is *subtracted* from the actual block to create a difference or residual block.

3. Transform and quantize: Each residual block is transformed into a spatial frequency domain using a two-dimensional transform such as a Discrete Cosine Transform (DCT) or a Discrete Wavelet Transform. Instead of storing each sample or pixel in the block, the block is converted into a set of coefficients which correspond to low, medium and high frequencies in the block. For a typical block, most of the medium and high frequency coefficients are small or insignificant. Quantization removes all of the insignificant, small-valued coefficients in each block. The *quantization parameter* (QP) controls the amount of quantization, i.e. how much data is discarded.

4. Entropy encoding: The video sequence is now represented by a collection of values including quantized coefficients, prediction information, partitioning information and 'side' or header information. All of these values and parameters are entropy encoded, i.e. they are converted into a compressed binary bitstream. An entropy encoder such as a Huffman or Arithmetic encoder represents frequently-occurring values and parameters with very short binary codes and less-frequent values and parameters with longer codes.

The output of all these steps is a compressed bitstream - a series of binary digits (bits) that takes up much less space than the original video frames and is suitable for transmission or storage.

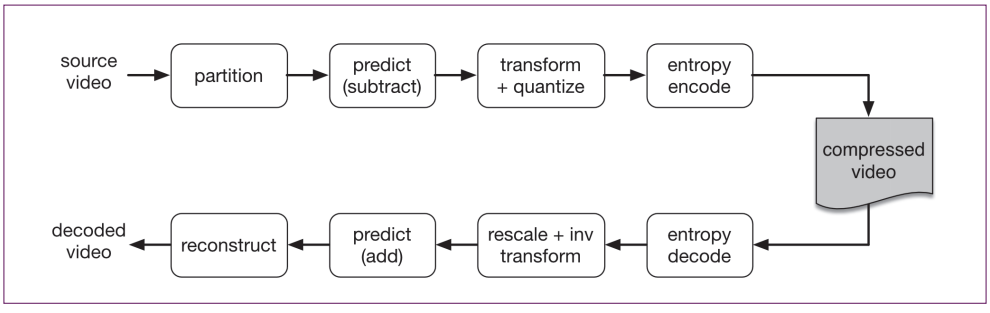

Figure 3 Encoding and decoding steps

Most video encoders in current use carry out the steps described above. However, there is considerable variation within each of the steps, depending on the codec standard and on the particular software or hardware implementation.

2.5 What's inside a video decoder?

A video decoder reverses the steps carried out by the encoder, converting a compressed bitstream into a displayable series of video frames. To decode a bitstream created as described in section 2.4 above, the decoder carries out the following steps:

1. Entropy decoding: The decoder processes the compressed bitstream and extracts all the values and parameters required to re-create the video clip.

2. Re-scaling and inverse transform: Quantized coefficients are scaled up to their original range and each block is transformed back into a set of image samples or pixel differences. It is important to note that in a lossy codec, the information that was removed by the quantizer cannot be restored, i.e. the output of this stage is not identical to the original difference block.

3. Prediction: The decoder creates the same prediction as the encoder, based on spatial or temporal values that have previously been decoded, and *adds* it to the decoded residual block to create an output block.

4. Reconstruction: Each video frame is processed block by block to reconstruct the video clip.

3. Video codec formats and standards

A codec standard makes it possible for encoders and decoders to communicate with each other successfully. Conisider the example of a video that is recorded on a smartphone, encoded (compressed) and emailed to a PC where it is decoded and played back. The smartphone and the PC may be designed and manufactured by different companies. If the encoder and decoder conform to the same codec standard, we can ensure that the decoder will be able to successfully extract and play back the video clip, regardless of how the source and destination devices were designed.

3.1 What's in a standard?

A standard is a specification document created by a committee of technical experts. A video coding standard defines at least the following –

1. The format of a compressed video stream or file, i.e. exactly how each part of the coded file is represented.
2. A method of decoding the compressed file.

Typically, a video coding standard does *not* define an encoder (Figure 4). It is up to each manufacturer to decide how to design an encoder. The only requirement is that the bitstream produced by the encoder must be compliant with the standard, i.e. it has to conform to the format described by the standard and it must be decodeable by the method defined in the standard.

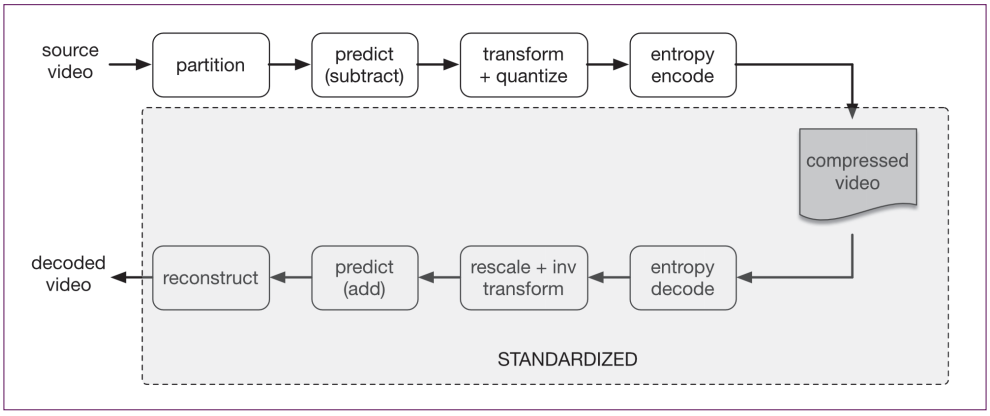

Figure 4 What a video coding standard covers

3.2 Why are there so many standards?

Since the first digital video coding standards were developed in the late 1980s/early 1990s, there have been a surprising number of standards released. Figure 5 shows some (but not all) of the key standards released over the last 25 years. Many were developed by working groups of the ISO/IEC and ITU-T international standards organisations. ISO/IEC standards include MPEG-2 (ISO/IEC 13818-2 and ITU-T Recommendation H.262, 1995), the standard used for the first digital TV services and for DVD Video. Some standards have been co-published by ISO/IEC and ITU-T, which is why H.264 (ITU-T Recommendation H.264, 2003) (for example) is also known as MPEG-4 Part 10. The most recent publication of the ISO/IEC and ITU-T is H.265 / HEVC, High Efficiency Video Coding, first released in 2013 (ITU-T Recommendation H.265, 2013).

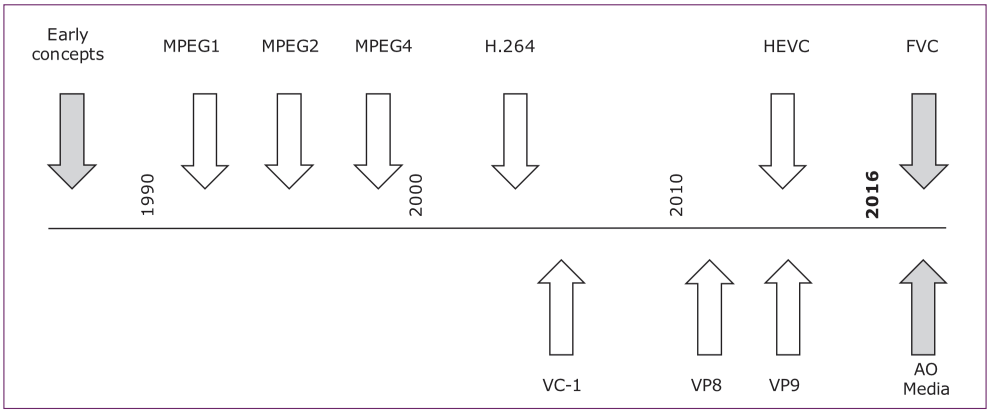

Figure 5 Timeline of selected video coding standards

The VP8 (IETF Request for Comments 6386, 2011) and VP9 formats were published by Google as part of the open source WebM initiative. At the time of writing (late 2016), new codec formats continue to be developed. The Joint Video Exploration Team (JVET) of ITU-T and ISO/IEC is considering new technologies as part of its Future Video Coding (FVC) exploration. The Alliance for Open Media (AOM), a consortium of companies including Google, Cisco, Microsoft, Mozilla, Netflix and others, is developing the AV1 codec format.

There are at least three factors behind the continued development and publication of new video codec formats and standards.

1. The demand for storing and transmitting increasingly high-resolution video content continues to rise. In the early days of broadcast and internet digital video, resolutions tended to be limited to Standard Definition or lower, and the volume of content was significantly lower.
2. This increase in high-resolution video content puts significant pressure on network and storage capacity, despite continuing increases in bandwidth. According to Cisco (Cisco Visual Networking Index, 2015), video data is increasingly dominating internet use and will make up over 80% of all consumer internet traffic by 2020.
3. Processing power continues to increase, so that it becomes feasible to carry out more complex processing of video, even on a mass-market device such as a smartphone.

Furthermore, new formats and usage scenarios are continuing to emerge. For example, 360 degree video involves an array of cameras that simultaneously capture video in all directions from a single central point. Playback on a conventional screen allows the viewer to move their viewpoint around to any angle, from within the scene. Free Viewpoint Video gives the viewer the freedom to observe a scene from the outside, selecting to view the scene from angle or

viewpoint. These new modes may have particular advantages for capturing events where a single, conventional viewpoint only records a small part of what is happening. These and other scenarios such as stereoscopic video, animation and screen sharing, may require new or modified standards.

Putting these factors together, there is a continued demand for better compression of video to support the increase in created, stored and transmitted video. Increasing processing power on consumer devices makes it possible to use new, more sophisticated video coding standards to meet this demand.

As new standards are released, manufacturers build support for new formats into devices such as tablets and smartphones. Typically, older standards such as MPEG-2 and H.264 continue to be supported, so that a newly-manufactured device may be capable of decoding video in multiple formats including MPEG-2, H.264, HEVC and VP9. In a similar way, software players such as VLC and web browsers increasingly support a range of codec standards.

4. Practical concerns

4.1 Quality, compression and computation

Coding video involves a trade-off between many different factors, including:

- Quality and fidelity. What is the resolution of the video image? How good is the quality, compared with the original captured image?
- Compression. How much space does the compressed file occupy? how many bits per second does it take to stream or transmit the coded file?
- Computation. How quickly can we compress video? Can it be processed in real time, or faster than real time? How expensive is the hardware for compressing video?

The *fidelity* of a video image depends on factors such as spatial resolution, frame rate and colour depth. Higher spatial resolutions such as 1080p and UHD can give the appearance of a sharper, more detailed video image. However, there is some debate as to whether a human observer can actually tell the difference between 1080p and UHD video at longer viewing distances (Le Callet and Barkowsky, 2014). As humans, our sensitivity to fine detail is limited and at a certain viewing distance from a screen, it is no longer possible to observe the extra details added by a UHD display. Increased frame rates (e.g. 50 or 60 frames per second) can represent fast and complex motion with better fidelity. Higher colour depths, in which each colour component of a pixel is represented using 10 or more bits instead of the widely-used 8 bits per colour component, may give a more vivid impression of colours and ranges of brightness, depending on the capability of the display.

The *quality* of a decoded video image depends on how it was compressed. Lossless coding involves retaining all of the visual information present in the original video sequence. However, the amount of compression is likely to be limited to 2-3 times. Lossy coding offers the potential for much higher compression ratios, often 100 times or more, at a cost of a reduction in visual quality. So-called 'visually lossless' compression may be a suitable compromise for some archival scenarios, in which the compression ratio of a lossy codec is kept deliberately low, perhaps reducing the file size by a factor of 20 times or more, whilst maintaining visual quality at a level that is indistinguishable to a human observer.

Compression determines the size of the encoded video file and the bitrate (number of bits per second) required to stream or transmit the file. Many factors affect the amount of compression achieved by a particular codec for a particular video clip. The encoder *quantization parameter* (QP) is often used to control the amount of compression and the quality of the decoded video clip. A higher QP tends to produce more compression but also lower video quality. A lower QP gives less compression but maintains a higher video quality.

The amount of *computation* required to compress a video file determines how long it will take to process the file. In general, more compression can be achieved at the expense of increased computation. Encoding a video sequence involves many choices and repeated computation steps, such as finding the best prediction for each block of a video frame. Video compression software often has different options such as 'fast', 'slow' or 'very slow' encoding presets. This makes it possible to choose whether to encode slowly and achieve better compression, or to compress a file more quickly at the expense of a lower compression ratio. Newer standards such as HEVC or VP9 typically require more computation than older standards such as MPEG-2 or H.264.

4.2 Files and containers

A coded video clip is typically stored in a *container file*, together with associated audio track(s) and side information such as metadata. Just as there are many video coding standards, there are a number of file format standards including:

- MPEG-2 Systems : Part of the MPEG-2 family of standards, file extensions include .MP2, .TS and .VOB
- MPEG-4 File Format : Part of the MPEG-4 family of standards, file extensions include .MP4, .M4V and .MOV
- Flash file format : A proprietary format with file extensions including .FLV, .SWF
- Matroska file format: An open-source format with file extension .MKV
- WebM file format: An open-source format with file extension .webm

In general, a container file will include:

- A header indicating the type of container, the type of coded video and audio within it, the number of tracks, etc
- Metadata
- One or more coded video streams
- One or more coded audio streams.

The audio and video streams are often interleaved, i.e. chunks of coded video and associated audio are interspersed within the file (Figure 6).

There is considerable flexibility in the choice of container format, video format and audio format. For example, an MP4 file can contain video formats such as MPEG-2, MPEG-4, H.264 or H.265 and audio formats including MP3, AAC and others.

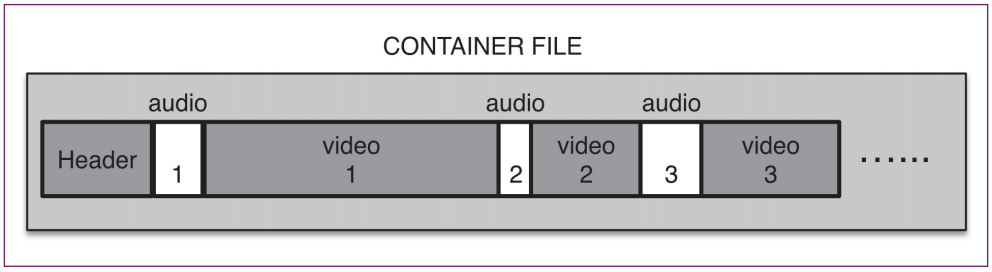

Figure 6 Container file

4.3 Transcoding

In a simple scenario (Figure 7), a video source is encoded into a compressed file (Format 1) and decoded in order to play back the video. However, often it may be necessary to convert from one compressed format into another (Figure 8). Here, the compressed file (Format 1) is converted into a new format, Format 2. Video and perhaps audio is decoded then re-encoded into the new format. This conversion process is known as *transcoding*. Transcoding may be necessary for a number of reasons, for example:

- To convert between resolutions and bitrates
- To convert video from multiple sources and formats into a common format for storage in an archive
- To convert from a high-quality archive source (e.g. visually lossless, high definition) into one or more lower-bitrate versions for streaming or delivery to end-users
- To upgrade from an older, legacy format such as MPEG-2 into a newer format such as H.265/HEVC.

It is important to be aware that each transcoding step - more specifically, each encoding step - can introduce quality loss into the video and/or audio content. If the encoding step is lossy, then degradation is introduced every time the content is re-coded. This may lead to generation loss (Figure 9), such that the visual quality of the material progressively degrades with each conversion.

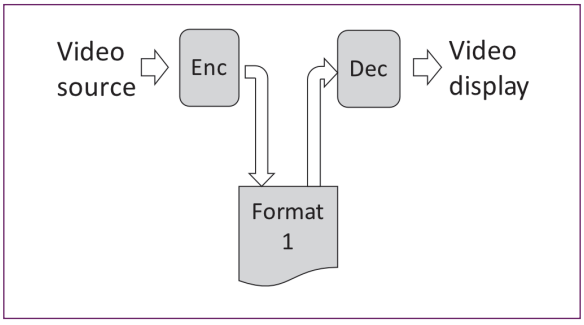

Figure 7 Single encode and decode

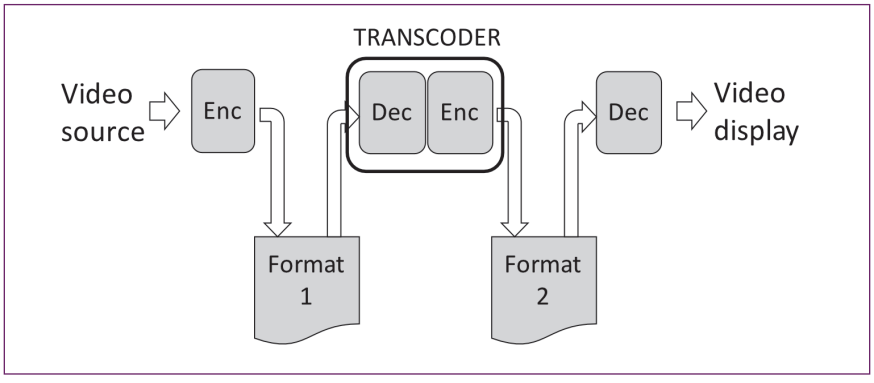

Figure 8 Transcoding

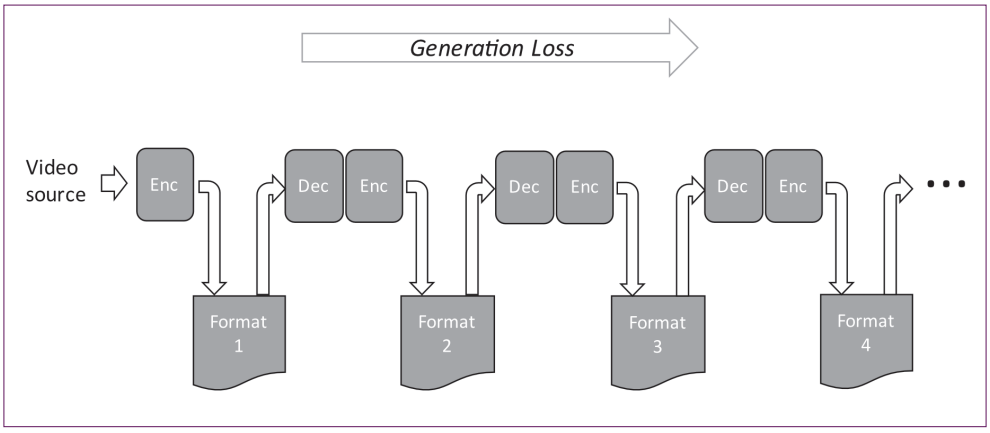

Figure 9 Generation loss

4.4 Storage requirements

How much space is required to store an hour of compressed video? The answer depends on many factors, including:

- Resolution and frame rate: Higher resolutions (HD, UHD) and higher frame rates (50 or 60 frames per second) will require more storage space than lower resolutions and frame rates.
- Choice of codec standard: In general, video compressed using newer standards and formats such as HEVC and VP9 takes up less space than video coded with older standards such as MPEG-2 or H.264. However, this depends on the next factor…
- Codec implementation: Not all codecs are created equal. For example, a recent study found significant variation between different implementations of the same coding standards (MSU Graphics and Media Lab, 2016). In some tests, a highly optimised software version of the older H.264 standard out-performed some implementations of the newer HEVC standard.
- Quantization / bit rate control: In a video encoder, the quantizer parameter QP acts as a control dial. A higher QP results in more compression and reduced quality; a lower QP gives less compression but higher quality. Setting the QP, or setting a target compressed size or target bitrate for the encoder, affects the size and also the quality of the compressed file.
- Video content: Some types of video sequence are harder to compress than others. For example, a clip with predictable motion such as a slowly panning camera is relatively easy to predict and therefore will tend to take up less space once it is compressed. A clip with complex motion, such as explosions or steam clouds, is much harder for the encoder to predict and will tend to take up more space after compression. Similarly, scenes with simple, smooth textures are easier to compress than scenes with complex detail.

With the correct choice of bitrate settings and/or quantization settings, it is generally possible to produce compressed files with either (a) a predictable file size or (b) a predictable visual quality, but not necessarily both at the same time.

4.5 Delivery

Acquiring, encoding and perhaps transcoding video material is one side of the story. The other side is providing access to the video content once it is stored. It may be sufficient to simply provide the encoded file to the intended viewer, for example by copying the file onto portable media or delivering it via file transfer. However, if the stored file is maintained at a high fidelity and therefore has a large size, it may be necessary to derive a version that is more suitable for transfer or streaming.

Proxy versions : The archived file may be transcoded to a lower-resolution and/or lower-quality proxy version for delivery to an end user. Reducing resolution and/or quality will make the compressed file smaller and can be a simple way of controlling or limiting access to full resolution versions.

Streaming : Container formats such as MP4 can be constructed to be 'streaming ready', such that the audio and video samples are interleaved (Figure 6). The file is streamed by transferring it in a sequence of packets, each containing one or more chunks of audio and/or video data. The receiver stores incoming packets in a buffer and once enough data is available (say, a few seconds of video), playback can commence. The well-known phenomenon of buffering occurs when the stream of packets does not arrive quickly enough to maintain constant decoding and playback.

Adaptive streaming : The buffering problem can be mitigated or avoided by using an adaptive streaming protocol such as DASH (Dynamic Adaptive Streaming over HTTP) (ISO/IEC 23009-1, 2014). A DASH server maintains multiple copies or representations of the video scene, each at a different bitrate (Figure 10). For example, the lowest-bitrate version might have a low spatial resolution (e.g. SD or lower) and may be encoded with a high QP so that the bitrate and the quality is low. Higher bitrate versions may have higher resolutions and/or lower QP settings. In a typical scenario, the receiver requests the lowest bitrate version first, so that playback can start quickly after a relatively small number of packets have been received. If packets are arriving quickly enough, the receiver requests a higher bitrate version and switches seamlessly to this version at certain switching points, e.g. every few seconds.

Example: The receiver of the stream shown in Figure 10 starts decoding and playback of the Medium Quality representation (Section 1). The first section is received before playback is completed and so the receiver switches to the High Quality representation (Section 2). The channel bitrate drops significantly and so the receiver requests to switch to the Low Quality representation (Section 3). The viewer experiences continuous video delivery, albeit with a reduction in quality if the network rate drops.

DASH and other adaptive streaming technologies require multiple transcoded versions of the video clip to be created, with each section stored in a container file so that the required switchover points are available.

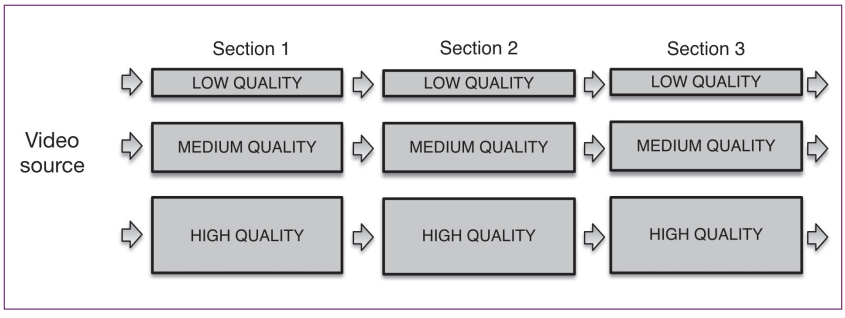

Figure 10 Adaptive streaming

5. Conclusions

Designing and specifying systems and protocols for archiving and retrieving coded video is a challenging task, as standards, electronic devices and user behaviours continue to change. Video resolution is increasing with each new generation of devices. For example, UHD resolution video recording is now supported by smartphones such as the iPhone 7 and Xperia Z5, and by an increasing range of consumer and professional cameras. As well as the challenges of higher resolutions and new codec formats, the way in which video is captured and disseminated continues to evolve.

Video footage of significant events is increasingly captured on a smartphone. With the rapid rise in user-generated video content, it is no longer possible to assume that content will be professionally captured in a well-lit environment. Content created on consumer devices such as smartphones and low-cost cameras is 'born' in an already compressed form.

Most video footage is still shot in the familiar format of a rectangular window. However, new ways of capturing video are beginning to emerge, such as 360 degree, stereoscopic and Free Viewpoint video, as discussed in Section 3.2. These and other departures from the traditional rectangular video scene offer particular challenges for coding, storing and delivering video.

Is it possible to future proof video archiving and delivery? The answer is probably not, since codec formats and usage patterns continue to evolve. However, the challenge of future proofing can be met at least partially by taking practical measures. During acquisition, it may be desirable specify an up-to-date codec that is likely to be supported for some time to come and a resolution such as 1080p that preserves visual information without taking up excessive storage space. Visually lossless rather than fully lossless compression may be an acceptable compromise between retaining important visual information and achieving reasonable compression. It is important to be aware that each transcoding or conversion process can introduce progressive degradation into audio-visual material. Finally, delivery or access to end users may be provided by deriving a reduced-quality, streamable version of stored content.

The rapid evolution of video capabilities, usage and formats in the last two decades implies that digital video technology will continue to change and develop for the foreseeable future. The only certainty is that further change is inevitable. However, by developing an understanding of the underlying principles and practical considerations of video compression coding, it is possible to specify and implement systems for the acquisition, storage and delivery of audio-visual media that can provide a good quality of service today and can adapt to the constantly changing landscape of digital video technology.

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THE SOUND OF AN ARTICLE: PRESERVING AUDIO AND VIDEO SUPPLEMENTAL MATERIALS FROM PRINT JOURNALS

Jonathan Ponder, ITHAKA-JSTOR, Content Management, USA

1. Introduction

This paper addresses issues around the conversion and digital preservation of audio and video content issued as supplemental material to print journal issues, and specifically audio and video originally issued on physical media such as CDs, as opposed to born-digital media files. I am not going to address the processes and technical details of actually doing this conversion and digital preservation work, mostly because, at JSTOR,[1] we have not actually done much work with this material yet. Instead, I'm going to deal with 1) a precise description of the particular subset of content that I am concerned with, 2) the story of it at JSTOR and how it has come to my attention in my work, 3) a little bit about the larger context of journal supplementary material and digital preservation, and 4) some of the challenges and questions this audio-visual content on physical media raises. I am thinking about this presentation and paper as a way to simply alert the reader to this content, discuss some of the issues surrounding it, and check in to see if this sounds like an area of concern to others like it does to me. Along the way, I will share what we have done (but again, mostly not done) at JSTOR to convert, preserve, and provide access to this kind of supplementary journal content, and I will hopefully also communicate the value, benefit, and interest of this kind of material and why we should care about preserving it in the context of its related journal articles.

2. What is JSTOR?

JSTOR, ITHAKA S+R, Portico, and Artstor are all products and services of ITHAKA.[2] ITHAKA is a non-profit organization whose stated mission is to "work[] with the global higher education community to advance and preserve knowledge and to improve teaching and learning through the use of digital technologies." JSTOR helps fulfill part of this overall mission. JSTOR started in 1995 with scanning and providing electronic access to the full back runs of academic journals, as well as committing to the long term preservation of the journals that it signs agreements with. JSTOR currently provides access to thousands of journals, books, and primary sources from over 1,000 different publishers, and it serves 9,000 universities, schools, and institutions and 6 million unique monthly users. JSTOR has been an important player from the beginning in the movement toward digitization and digital preservation of academic journals.[3]

3. Journal audio-visual media collection

After I had been at JSTOR for a little while as a Metadata Librarian, I became aware of "the box of random stuff". This box was filled with a various assortment of material that had come to JSTOR over the years along with print journals (either with donation issues or subscription issues). The large majority of the items were CDs, DVDs, and CD-ROMs, but there was also microfiche, cassette tapes, obsolete computer diskettes, a few vinyl records, and a pair of 3-D glasses, among other things.

1 JSTOR is pronounced JAY-stor. A shortened form of "journal storage", "JSTOR" was a nickname used during its initial conception and founding and then became the actual name. More about what JSTOR is in a moment.

2 The name ITHAKA looks like an acronym but is not; it is the name of the organization. ITHAKA S+R is ITHAKA Surveys and Research, a service that "provides intelligence about emerging technologies to guide the transformation of higher education." Portico is "a community-supported digital archive [that] preserves over 350,000 e-books and e-journals for future scholars." Artstor derived the spelling of its name from JSTOR and is a digital repository for art that "provides 2+ million high-quality images and digital asset management software to enhance scholarship and teaching." Details and quoted descriptions in this note come from "ITHAKA: Our Work," ***ITHAKA.org***, accessed December 8, 2016, http://www.ithaka.org/our_work.

3 Details and quoted descriptions of ITHAKA and its services in this paragraph come from the ITHAKA website: "ITHAKA: Our Mission," ***ITHAKA.org***, accessed December 8, 2016, http://www.ithaka.org/content/our-mission; "ITHAKA: Our Work," ***ITHAKA.org***, accessed December 8, 2016, http://www.ithaka.org/our_work.

The inventory and acquisitions staff were responsible for this material, but there was no written inventory or control over what all was actually there. I was only aware of the "box of stuff" when, in my work, I would sometimes encounter a piece of media and ask inventory what to do with it. They would point me to the "box of stuff," the contents of which we all hoped would someday be able to be made accessible on the JSTOR website. Before I started working at JSTOR, there was a time when the production staff inserted explanatory pages into articles with associated media, and even scans of the media in certain cases, to alert users to its existence, even though we did not have the actual content accessible online. This was not happening any more by the time I started at JSTOR. We were just continuing to collect the material with the hope of using it at some point. I became interested in this material and volunteered to take responsibility for it. I went through and made a spreadsheet inventory of all of it, connecting each piece of media to the articles or issues that they are associated with.

4. Overview of content in collection

So what did I find in this random collection of "stuff?"

- **Sound recordings.** There are sound recordings that contain music for the most part but also poetry and other types of sound recordings, such as field recordings and experimental recordings. One example is a collection of poets reading their work that was compiled and released by *The Hudson Review* with their 55th Anniversary Issue.[4] Another example is *Computer Music Journal*,[5] which puts out a CD or DVD with every volume that is a curated and theme-based compilation of recordings around some topic related to the volume and its articles. Some *Computer Music Journal* anthologies contain both sound and video where both the audio and video are the focus. There is, for example, a video for Vol. 30 that shows videos of a robot flutist and videos of other types of robots playing music. Videos such as these demonstrate the workings of these machines that are created by researchers as well as the music that the machines are able to create.
- **Videos.** Videos in the collection include stand-alone works of film, video illustrations of work discussed in articles (like the robot flutist), samples of videos that are raw data from research studies, or videos of papers/presentations from a conference. In a few cases there are videos called "Video Papers" where the video constitutes the substance of a journal article and there is not a textual counterpart. We have several examples of this in JSTOR, for example, one where the online table of contents for the issue lists the video papers but there is not actually any content because the video is not yet accessible on the website and there is no text version of the "paper".[6]
- **Multimedia Presentations.** Some examples of multimedia presentations in our collection include:
  - Videos of conference presentations that also include the text of the paper and/or presentation slides, all embedded on a DVD or other software program.
  - A CD-ROM that supplemented an issue of *Memoir (Society of Vertebrate Paleontology)*[7] and contains an interactive interface that navigates a 3-D digital atlas of an alligator skull ("Alligator: Digital Atlas of the Skull").
- **Records and cassettes.** These again contain sound recordings but are on media that present an additional layer to digital conversion and preservation work.
- **Computer discs.** There are a few different formats of old computer discs where I have not been able to find out what is on them.

4 *The Hudson Review* 56, no. 1 (Spring 2003), accessed December 8, 2016, http://hudsonreview.com/issue/spring-2003/.
5 *Computer Music Journal*, accessed December 8, 2016, http://www.mitpressjournals.org/cmj.
6 An example: Ferdinando Arzarello and Ornella Robutti, "Approaching Functions Through Motions Experiments," *Educational Studies in Mathematics* 57, no. 3 (2004), accessed December 8, 2016, http://www.jstor.org/stable/4150294
7 Rowe, et al., 1999

- Other collection details
  - Appendix-like data that supports research in articles, either in digital form or on microfiche. When this kind of data is in some kind of reproducible page-like form, we have added it as page images to articles, but when it is data either embedded in database software or in some kind of program, we have not done anything with it.
  - Image files corresponding to articles that were either not included in the print version of the article or were present in black and white while often the digital file is in color and/or in high resolution.
  - Digital surrogates of print articles or issues in PDF form on a CD. These are not of much interest unless they contain color or higher resolution images than the original print version.
  - There is a total of 236 separate items to date, but we continue to get more.
  - There are lots of different file types, both standard and proprietary.
  - Most of the time, material relates to specific articles, but it may relate to the issue as a whole or to the theme of a theme issue.
  - These materials may or may not be referenced in some way in the print version of articles or issues.

5. The larger context

In discussing this topic, I want to make a clear differentiation between *born-digital* audio-visual content in the networked environment and audio-visual content on *physical media*, whether digital or analog. Supplementary journal content issued on physical media is a particular subset of content that is related to but not exactly the same as supplementary content in the born-digital networked environment. It is a clear difference that people understand, but I have also found that, as I bring up this topic with different people, they sometimes do not understand the distinction clearly enough. Someone may think they know what I'm talking about and may say, "Oh yes, this has been addressed or is being addressed by this or that project." The issue of supplementary journal article content has been addressed and worked on to a certain extent in the born-digital environment with various projects and initiatives:

- NISO Recommended Practices for Online Supplemental Journal Article Materials[8]
- The RMap Project, which is an initiative by the Data Conservancy, Portico, and IEEE "to make it possible to preserve the many-to-many complex relationships among scholarly publications and their underlying data…."[9]
- A LOCKSS paper in *Information Standards Quarterly* titled "Archiving Supplemental Materials"[10]

Projects and reports like these have dealt with the digital preservation of supplemental content, but these projects assume electronic formats that are in the networked environment. I am concerned with the transition from the print and physical media environment to the digital networked environment: audio, video, and multimedia content that was issued originally on physical media but now needs to be *converted* and *preserved* in the networked environment. This particular subset is not considered in other projects or initiatives as far as I can determine.

Supplementary journal content on physical media is not a new problem; it has been one for a long time. In the world of print periodicals in libraries, extra pieces of media that came along with issues of print journals did not fit the library model of shelving and binding journals. Libraries often have not known what to do with this material and have found places apart from the journal issues and articles to hold the media, or they have left the media stuffed into the journals on the shelves where their existence is largely unknown and uncontrolled.

8 "NISO/NFAIS Supplemental Journal Article Materials Project," ***NISO.org***, accessed December 8, 2016, http://www.niso.org/workrooms/supplemental

9 "RMap Project," ***rmap-project.info***, accessed December 8, 2016, http://rmap-project.info/rmap/

10 Rosenthal and Reich, 2010

There is now an opportunity in the digital world to bring articles and related audio-visual content together in a way that wasn't possible before, and I would say that these materials are valuable, beneficial, and worth being preserved for what they can bring to research and learning. But preserving them and bringing them together with their articles is not automatic. As academic journals move increasingly to born-digital publication and as back issues of print journals are increasingly converted to digital versions and libraries de-accession print copies, there is a risk of these supplemental materials on physical media being lost and separated for good from their journal issues and articles. There are a number of challenges that I have faced in trying to work with this kind of material, and I will discuss these in the next part of this paper.

6. Challenges and issues

6.1 Organizational priority and resource issues

The allocation of organizational priorities and resources is probably the key challenge that relates to all of the others because, if JSTOR were to make this content a priority and to decide to put resources toward it, then we would be better able to deal with the other challenges, such as digitization, more effectively. These challenges would still raise questions and issues to work through, but they would be less daunting because there would be people and time to work on them. There is really a small amount of this audio-visual content in comparison to the rest of JSTOR's content and other work. Everyone agrees that it is interesting material and that it would be ideal to have it converted, preserved, and accessible to users, but on the other hand, users are not asking for it or complaining that it is missing. Probably almost nobody—including publishers, users, and most JSTOR staff—is aware that it exists and is missing from the publicly available content, so getting the time and resources to do something with it might be difficult.

I decided to start working on a small scale to try to push this work forward. I talked to our Content Development Unit about the possibility of beginning to approach publishers and explore rights issues for just one or two journals at a time and, in this way, take on a manageable amount of work. In this way, I might also begin to learn what kind of questions will come up and how much work will be required. I sent my colleague on JSTOR's Content Development team a list of some of the journals that have sound recordings for her to choose a few publishers who may be responsive and easy to work with on this. The one response so far ended up being very positive and it looks like this content for this publisher will be easy to deal with, at least as far as rights issues. The publisher for two journals that have yearly collections of sound recordings and videos informed us that they have the rights to permit the work on those discs to be included in any database in which the journals are held.

6.2 Unclear rights issues

Now, more about rights issues. This is often the first question that comes up when we start talking about working on this content. Do we have the rights to convert, preserve, and make it accessible? Does the publisher whom we deal with own the rights? This media content often has stated copyright holders that are different than the journal publisher or current journal rights holder that JSTOR has negotiated with, therefore it is not clear and cannot be assumed that the journal that issued the content has rights to it beyond its original issue. In compilations, there are usually multiple individual rights holders for the different works.

- Examples:
  - Annual recording compilations put out by *Computer Music Journal* and *Leonardo Music Journal*,[11] for example, have a copyright statement for the compilations as a whole but also a different copyright statement for each of the individual creators/contributors of each track.
  - It is a similar situation with the recordings of poets reading their work for the *Hudson Review* that was mentioned earlier. The compilation is copyrighted by the journal, but the individual authors still hold the copyright to their poems.

This looked like a real problem to me: the possibility of having to seek out numerous individual rights holders for every individual work on each different disc and the amount of time, work, and resources that would require. I was happily surprised that our first attempt looks to be simple and straightforward. Hopefully this will be the case for the others, but there may be more complicated cases to address.

In JSTOR's case, for a long time, the rights for these supplemental materials were not discussed or even considered in negotiations for digitizing the print issues of journals, simply because nobody thought about them or was aware that they would be published with the print journals. As I understand it, JSTOR's Content Development team now addresses this topic in negotiations, but for the first 15 years or so of JSTOR it was not addressed. So for this earlier content, JSTOR will need to go to the publisher or rights holder and ask specifically about the rights for the audio-visual supplemental content.

These rights issues have, unfortunately, caused a dynamic between different departments in a way that relates to organizational priorities and resources. Production and development don't want to put work into converting the material and developing systems and platform code to handle it until we know that the rights issues are cleared. On the other hand, Content Development, who deals with the publishers, is hesitant to approach publishers and create expectations about this material on the public site until they know it's actually going to happen according to some kind of timeline. This dilemma is one reason that I started trying the approach of just beginning to explore a little bit at a time.

6.3 Assessing the nature and importance of the material

Another question that needs to be addressed in this undertaking is assessing the nature and importance of this material, not the intrinsic value and importance of the content itself but rather of this particular copy that we have in this context. Is its issue with the journal that is in JSTOR unique? Is the journal the only place where this content was ever issued, and maybe the only place where it exists, so that it needs to be preserved with the journal, or is it also available and archived elsewhere? Examples of these contrasting situations might include, for example, recordings issued with *The Quarterly Journal of the Library of Congress*,[12] which are likely preserved by the Library of Congress vs. the recordings gathered and issued by the *Hudson Review* of poets reading their work, which probably only exists in this particular CD issue. The *Hudson Review* recording liner notes describe how they requested these readings and recordings from the poets and that they were recorded in different ways in many locations. Then the recordings were sent to the journal especially to be placed on this CD.

A further question is, if a particular work *is* archived elsewhere, is it necessary to preserve it in the context of the journal? Is it integral to understanding the article, or is it truly supplemental to an article or issue? This is a distinction that is addressed by the NISO Recommended Practices for Online Supplemental Materials, cited earlier. This document makes a distinction between content that is supplemental to an article but not needed to understand the article vs. content that is truly integral to understanding an article and

11 *Leonardo Music Journal*, accessed December 8, 2016, http://www.leonardo.info/lmj/about.html.
12 Shirley, 1981

therefore must be present with the textual article. Of course, my bias is that, regardless of whether it is supplemental or integral or whether it is preserved elsewhere or not, if it was issued with the journal, having it preserved and accessible in that context will enrich the experience or the arguments of the article and is worthwhile to preserve within that context. But in the context of organizational priorities and resources, I may need to address some of these questions and be able to defend the value of using time and resources to preserve and provide access to this material. Do we *need* to preserve it in JSTOR? If we don't, will it still be preserved and accessible somewhere else?

6.4 Assessing how much we don't have

Another challenge or question that arises is knowing how much is out in the world that we don't have or don't know about, and given that, what should our collection policy be for this content? Our collection of this material has always been and still remains passive. The original model for JSTOR didn't expect this kind of content. We just started getting it sometimes, either with donated, loaned, or subscription issues. Especially for donated or loaned back issues, there is probably no way to know how much of this type of content might have been issued originally but didn't make it to us for one reason or another when we acquired and scanned the journals.

As an example, when I looked further into the Vol. 30 DVD for *Computer Music Journal* (mentioned earlier), I discovered that this particular DVD disc includes material relating to Vol. 30, but it is also a reissue of all of the recordings issued from Vol. 4 (1980) to Vol. 14 (1990). These earlier recordings were originally issued on thin vinyl "soundsheets" bound as inserts into the pages of the journal, and we do not have these vinyl soundsheets for this journal. We apparently did have at least some of them because one of them was scanned and placed as a page within the relevant article, but we no longer had them by the time I started working with the collection. I also discovered looking into the Vol. 30 disc that there were CDs issued from Vol. 19-Vol. 21 that we do not have. Based on this example from just one journal, it is clear that there might be much out there that we don't have and don't know about.

So then the question comes up, what is our policy going to be? And what is our responsibility? If we begin to preserve *some* of this content for *some* journals, are we then going to begin to search for it? The answer to that from those making decisions about budgets and resources is likely, "No, probably not." But it does raise the question and concern that, if we preserve this content for some journals, will there be an expectation, and maybe some responsibility, for us to preserve and provide access whenever it exists with JSTOR journals and to consider it missing journal content if we don't have it? We do know that some libraries make the decision to de-accession their print copies of a journal based on JSTOR acquiring that journal. When they do that, are they aware of this audio-visual content and are they de-accessioning that too? If they are aware of it, are they assuming that JSTOR has it as well as the articles? Regardless of what libraries may or may not be aware of, when de-accessioning happens there will be fewer and fewer copies of the audio and video content saved and accessible for a given journal. Given this, maybe JSTOR should assume some responsibility to make sure that this kind of content is preserved for the journals it commits to preserve.

6.5 Conversion and obsolescence issues

One last issue is that of conversion and obsolescence of the media containing this content. There are costs involved in converting this material, and the processes get more complicated and the costs increase as the media or file types get older and become obsolete. The physical media such as records, cassette tapes, and old computer disks require an extra layer of work to be converted to digital files. Multimedia presentations are another difficult type; they are usually on some kind of proprietary software that in some cases works and opens up easily but in other cases does not and will require further work and exploration to determine what is on the media. Once the actual content is determined, there is the question and difficulty of converting, preserving, and maintaining these kinds of complicated digital files in a sustainable way. With costs and more complicated processes, we face the problem of being able to allocate

resources, but then, at the same time, if we wait too long, we may not always be able to recover some content from physical media or file types if they degrade or get so old that there is not hardware or software upon which to run them. I am well aware that this tension between the costs of converting and the risk of not converting needs to be managed and dealt with.

7. Conclusion

I will conclude with one final thought about organizational priorities and resources and about the importance (or not) of preserving this content with its associated journals. I mentioned before that nobody is asking for this content or complaining that it is missing. If it is, in fact, important for JSTOR to preserve this material, it would be good for us to hear from you or from other users of JSTOR. I would be interested to hear from anyone about this, and it would also be good for JSTOR to hear directly from users who are looking for content like this that is missing. There are arguments to be made about preserving it because it's the "right" thing to do, however, it would be more effective for JSTOR to hear directly from the users that they are missing this material and that they want it to be accessible. JSTOR could then set priorities and aim resources toward the problem. Please let me and let JSTOR know what you think about this. I believe that these materials are interesting and important, and that they can enrich learning and research when present. My plan is to keep pushing forward and hopefully to be able to navigate the challenges and get this audio-visual content preserved for and accessible to students and researchers.

8. Postscript

I received feedback from a few people who attended my presentation at the 2016 IASA Conference. In general, there seemed to be agreement both that this is a topic of interest to the IASA community and also one that is difficult to address. Gene DeAnna, Head of the Recorded Sound Section of the Library of Congress, introduced the papers at my session, and he commented to me at the time and in a subsequent email exchange that this kind of material does present challenges at the Library of Congress. Currently, it is separated from the print content that it originally accompanied, and although its existence is noted in cataloging records and the media is being conserved in good storage for the Library, the separation into entirely different buildings and locations creates an impediment to access. He concurred that some of the biggest challenges are 1) finding the resources to digitize and preserve this content and 2) assessing which of the content is unique and more critical to preserve and which is preserved elsewhere and so not as critical to preserve. I have subsequently learned in additional email exchanges with another librarian at the Library of Congress that there is a digital preservation program for this kind of physical or tangible media and its content at the Library, but I have not been able to determine yet how far back this preservation plan goes and whether it covers journal supplementary material going back many years or only to when the preservation plan started and going forward (DeAnna and Leigh, 2016).

A different attendee from the Library of Congress expressed to me his opinion that this kind of audio-visual supplementary content is indeed crucial and that it should definitely be part of the mission of an organization such as JSTOR to preserve it along with the journals it commits to preserve. Another attendee suggested to me that I look at the work that has been done with scientific datasets for ideas and help on how to deal with the content I am concerned with. Acknowledging the distinction between born-digital supplementary content and supplementary content on physical media, he said that there still is likely some good information in what others have started to do with supplementary content to guide me in my work on this collection.

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THE EVOLUTION AND ISSUES ENCOUNTERED IN PROVIDING MEANINGFUL AND USEFUL ONLINE ACCESS TO ORAL HISTORY RECORDINGS

Leslie McCartney, University of Alaska Fairbanks, USA

1. Introduction

For the past 70 years, or since easy, affordable portable tape recorders could be purchased by almost anyone, there was the push to record the memories of ordinary folk and particularly older people before they passed away and with them, their first-hand knowledge, stories of their life and experiences. If not recorded, when they passed away, these stories and memories would be lost forever. Many of these recordings have become the genre of oral history, that is, the recording of historical information drawn from the narrator's personal knowledge and then the use or interpretation of this recording is used as an academic subject (Thompson, 2000: xi); or as Grele states 'the interviewing of eye-witness participants in the events of the past for the purposes of historical reconstruction (Grele, 1996: 61). The focus was to record, record and then record more. Individuals recorded narrators, organizations and local history societies undertook oral history projects and more commonly than not, many of these recordings remained in boxes in an organization's offices until they were finally donated to a local archives when the organization realized they could do little with them. While recording and collecting, little thought was given as to how these recordings could be used in future for researchers or anyone interested in the narrator or subject. Thus, we are left with the situation today, how can archivists who now have these recordings in their collections provide meaningful and useful access to these recorded collections (both audio and audiovisual or mixture thereof) for researchers of all kinds and in all locations?

This question is not new. There have been new and creative solutions come to the fore and then disappear as technology has provided more and more tools that provide access to collections. Reflecting back on how access to recordings was achieved prior to the Internet shows us just how far we have come. For example, in Alaska, prior to 1981 there was no oral history or centralized audio collection in the state. Collections instead were scattered about in personal homes and in the offices of many local organizations. After a study revealed these results, William (Bill) Schneider founded the Oral History Program in 1981 at the University of Alaska Fairbanks as part of the of the Alaska and Polar Regions Collections in the Elmer E. Rasmuson Library.[1] The mission of the Oral History program was, and continues to be, to collect, preserve, and provide access to audio and video recordings that provide insight into Alaska's history and the people who have contributed to its heritage.[2]

This however did not really solve the meaningful access to researchers of all kinds in all locations issue. Firstly, researchers had to know that there even was an oral history collection in Alaska. Secondly, they had to know it was at the University, in Fairbanks, and thirdly located in the library on the University campus. Then they physically had to visit the library, navigate through the corridors, descend to the 2nd floor underground and try to navigate the halls to find the office that housed the recordings. Once there, they were rewarded with having to listen to the reel-to-reel or cassette recording in the office while someone, and there were no dedicated oral history staff at this point, searched the multitude of filing cabinets to see if there was a summary, log or transcript. Most likely, the researcher needed to make their own notes of the contents of the recording. The notion of a Gift and Release Agreement or Consent Statement had not been put into practice yet.

1 In email correspondence with the author on December 14, 2016, Schneider recalled that the library had received a grant from the Alaska Historical Commission for him to conduct a survey of existing collections in the state. He does not have, nor can he recall, if a formal report was penned after the study. No published version of this study has been found by the author.

2 Oral History, ***Elmer E. Rasmuson Library***. Last accessed December 13, 2016, http://www.library.uaf.edu/oral-history.

That of course was for people who could visit the library. For other researchers in other locations, they would have had to use the library catalog to locate recordings. Early library cataloging was done via the National Union Catalog.[3] Patrons would then put in a request for a copy to be sent to them from the home library housing the collection. Delivery could take weeks.

Organizing materials held by a library, for example books, maps, audio recordings, needs to be done in a systematic and coherent way so they can efficiently retrieved when requested by a user. The system by which this– is done is known as bibliographic control and bibliographic records of collections are organized into catalogues. (Lazarinis, 2015). The Ohio College Library Center or as it became known, OCLC began in 1967 when the Ohio College Library Center wanted to create a cooperative, computerized network for Ohio Libraries and in 1971 the first online library occurred. Today, OCLC and its member libraries produce and maintain WorldCat, the largest online public access catalog in the world.[4] By cataloguing oral history recordings into WorldCat, researchers could find oral history recordings in any library. It was much easier than using the National Union Catalog. With WorldCat, the use of the recordings in a collection started to become more frequent but they still needed to be physically accessed using Inter-Library Loan System.

2. Project Jukebox is founded[5, 6]

In 1986 Alaska faced a financial crisis, much as it is facing today with shrinking oil revenues leaving the state finances depleted. The Oral History Program at UAF was threatened with elimination. William Schneider, the founder of the Oral History Program, as noted above, acted on a suggestion made by a student who had expressed an interest in investigating the digitization of audio recordings for his master's thesis (Schneider, 2013: 299-306). He suggested to Schneider that instead of upgrading and copying old recordings, why not digitizing them; this would save time and money. An Apple Library of Tomorrow grant gave them new equipment to create a digitizing station and the digitizing of recordings began. As an added bonus, text and image digitization could also be done with the same equipment.

Schneider then met Steve Ulvi of the National Park Service and he proposed doing a series of interviews in the Yukon-Charley Rivers National Park and Preserve in Alaska. The goal was to collect oral histories of people involved with, or impacted by the creation of Yukon-Charley Rivers National Preserve in east-central Alaska. The narrators include men, women, trappers, miners, educators, historians, archeologists, biologists and government bureaucrats. Some narrators had been associated with the upper Yukon for their entire life while others were relative newcomers to the region. Ulvi and Schneider wanted to make these interviews available to a broad audience. This resulted in the first big launch of a 'Jukebox' concept and the National Park Service had the funds to support the endeavor. Thus the first Project Jukebox project was the Yukon-Charley Rivers National Preserve Project Jukebox.[7]

So using HyperCard, the first 'Jukebox' was created in 1988. Project Jukebox was one of the first oral history programs in the United States to provide digital access to oral history recordings.[8]

This was before the Internet so in order to use Project Jukebox, individual cards had to be loaded onto a standalone computer thus the name 'Project Jukebox'. Additionally these stan-

3 These were large printed books that were sent out to libraries and they contained pages and pages of catalog records of books of materials catalogued by the Library of Congress and other American and Canadian libraries.
4 World Cat. Last accessed November 29, 2016, www.worldcat.org .
5 Project Jukebox, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, www.jukebox.uaf.edu.
6 For a more in-depth review of the history and philosophy behind Project Jukebox, see William Schneider, "A Jukebox Full of Stories." ***Oral Tradition*** 28, no. 2 (2013):299-306.
7 'Yukon-Charley Rivers National Preserve Project Jukebox, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, http://jukebox.uaf.edu/YUCH/index.htm.
8 Technology at Jukebox, University of Alaska Fairbanks. Last accessed December 13, 2016, http://jukebox.uaf.edu/site7/tech.

dalone computers needed to be lugged around from location to location. Schneider recalls them becoming frozen in vehicles in the winter if left overnight. It was a chore to move the equipment from place to place; certainly not easy or convenient but it was the state of the art way to integrate oral history recordings with transcripts or key word summaries, archival photos and maps, making the material accessible to visitors of parks and researchers.

3. Project Jukebox as access to recordings today

As the Internet came into being, the Project Jukebox delivery system evolved with the technology. It went from stand-alone Hypercard programs, to web-based HTML programs, to using Testimony Software and then to using Drupal 7.[9], [10], [11] Project Jukebox continues to be a grant funded venture with support from the University of Alaska Fairbanks in the form of supporting the IT component of the website and managing the Drupal platform. The technological advances in delivery may have changed but the purpose of Project Jukebox remains the same: to integrate oral history recordings with associated transcripts, photographs, maps, and text while at the same time creating a historical and social context around the subject/topic of the recordings and making this all available to world-wide researchers via internet. Highlights of our current delivery Drupal 7 format of Project Jukebox include:[12]

- An interactive, easy to use and user friendly interface,
- Multiple ways to access the recordings in Project Jukebox - either browse by project, people, interviews or slideshows,
- Listening to the recording in full, jump ahead or back to a particular section, or jump to a particular spot in the transcript to immediately focus on a particular section,
- Access to the entire transcript, or text for the audio appearing under the play bar as a speaker talks,
- More metadata, or information about the actual recording, which can be found under the Digital Assets Information box on an interview page,
- Slideshows associated with an interview, and
- Themes associated with every interview which connect researchers to other recordings that also contain the particular theme terms.

Today, hundreds of the recordings held in the UAF Oral History collection are available online through Project Jukebox and associated with each project are associated transcripts, films, radio programs and photographs and in some projects, research portals and maps.

The following are examples of three projects which include several of the above noted features plus special features to a specific project.

4. Exxon Valdez oil spill Project Jukebox[13]

With March 2014 marking the 25th anniversary of the 1989 Exxon Valdez Oil Spill, the then Digital Librarian for the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC), Alicia Zorzetto, wanted to do something to mark this milestone in Alaska and the nation's his-

9 Testimony Software was created by Turtle Lane Studios Pty ltd. This software delivers synchronized-streamed media. See The Australian Centre for Oral History. Last accessed December 13, 2016, http://www.acoh.com.au/. The Testimony software has been used by a number of organizations, most notably the Cultural Conversations. Last accessed December 13, 2016, http://www.cultconv.com/.

10 For more about the development of Project Jukebox using the Testimony Software, see William Schneider, "A Jukebox Full of Stories." ***Oral Tradition*** 28, no. 2 (2013):299-306.

11 Drupal is a content and management platform for creating websites. ***Drupal***. Last accessed December 13, 2016, https://www.drupal.org/drupal-7.0.

12 Technology at Jukebox, University of Alaska Fairbanks. Last accessed December 13, 2016, http://jukebox.uaf.edu/site7/tech.

13 Exxon Valdez Oil Spill Project Jukebox, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, www.jukebox.uaf.edu/exxonvaldez.

tory. The focus was on the human aspects of this tragedy, to hear the stories of those involved with, and impacted by, the spill and its aftermath. Partnering with UAF and with funded from PWSRCAC, The Alaska State Library through the Institute of Museum Services and support from Alaska Resources Library and Information Services, the goal was to compile, disseminate and preserve a record of the causes and effects of the oil spill disaster for people around the world to learn from so nothing like this would happen again. Project Jukebox was the perfect platform to achieve these goals.

A total of 35 recordings by 21 people composed of older recordings made by Stan Jones and Sharon Bushell and new recordings made by Zorzetto and Amanda Johnson are featured on the Project Jukebox along with the associated transcripts.[14] Available from the homepage of the project are also five archival films,[15], a detailed list of other resources, portions of radio recordings including the first call made by Captain Hazelwood that the ship had run aground and was leaking some oil, to the many hours of public meetings with the oil company, politicians and public where the increasing frustration can be heard escalating day to day. Also available on the project website is a PDF version of Captain Stan Stephens' journal that he kept where he documented his contemporaneous thoughts and feelings about the oil spill as it unfolded. Slideshows made up of some of the narrator's private photos are also featured.

5. Gates of the Arctic National Park Project Jukebox[16] | Gates of the Arctic Research Portal[17]

As in all Project Jukebox projects, the Gates of the Arctic National Park Project Jukebox contains a large number of recordings, transcripts and associated slideshows created from narrators' and archival photographs. The unique feature of this site however is the Research Portal. This portal brings information about a particular village located near the Gates of the Arctic National Park from several databases in several organizations together on one page. If for instance if you want to know what archival films exist about Anaktuvuk Pass, with one click you can find what films there are and where they can be accessed. Nine communities are listed and all contain links to books, images, oral histories, archival films, archival materials, language materials, objects (currently only in PDF but we are hoping in the near future to add the Museum database to our portal), journals, maps, government documents and other collections. Researchers or community members need not look to several databases to find this information, instead the portal collects and updates the information nightly and brings it easily to the user.

6. Exit Glacier Project Jukebox/Kenai Fjords National Park[18]

In addition to the online interviews, transcripts, slideshows and links to related materials, this Project jukebox features two interactive maps.[19] These maps are critical in understanding the interviews as many of the narrators refer to geographic places on the land. These maps highlight the features mentioned in two ways, either by clicking on the name of the narrator in the 'voices' tab or by topic by clicking on the 'Land Use' tab. From the 'voices' tab, users looking

14 The earlier recordings made by Bushell and Jones were used for the basis of their book, ***The Spill, Personal Stories from the Exxon Valdez Disaster***.

15 Films were made available courtesy of the Alaska Film Archive, Alaska Resources Library & Information Service and the Seldovia Public Library.

16 Gates of the Arctic National Park Project Jukebox, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, www.jukebox.uaf.edu/gates.

17 Gates of the Arctic Research Portal, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, http://jukebox.uaf.edu/gatesportal7/.

18 Exit Glacier Project Jukebox Kenai Fjords National Park, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, www.jukebox.uaf.edu/exitglacier

19 Exit Glacier Project Jukebox Kenai Fjords National Park, Map of Traditional Uses of the Exit Glacier Area, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, http://jukebox.uaf.edu/site7/sites/default/files/kenaifjords/voices.html

for particular features discussed by a particular narrator and easily locate these on the map. For instance the areas in which Ralph and Anne Hatch talk about goat hunting, moose hunting and ptarmigan hunting are easily viewed on the map. Using the 'Land Use' tab, you can easily find trapping or fishing spots discussed in several of the interviews.

7. URLs to recordings in the Library Catalog[20]

Project Jukebox is a fantastic delivery method which easily makes recordings and associated archival materials such as film, maps, text and photos available online to researchers but it is completely grant funded and it is not feasible to believe that we can make every recording in our collection available online this way. Increasingly patrons from around the world want access to recordings that are not available through a Project Jukebox.

In 2013 we were able to link audio recordings with associated transcripts or documents directly into the library catalog. Patrons no longer had to wait for materials from the Inter Library Loan System or come into the actual UAF library building to use the materials. Instead, anyone with an internet connection can access for instance a recording made in July 1964 of Bobby Sheldon talking about the first car he brought to Alaska (it was a build it your own kit) in 1904. So here we are, in November 2016, 53 years after the recording made and 113 years after the event, through the online library catalog, we can hear Bobby Sheldon telling us this story (see Figure 1).

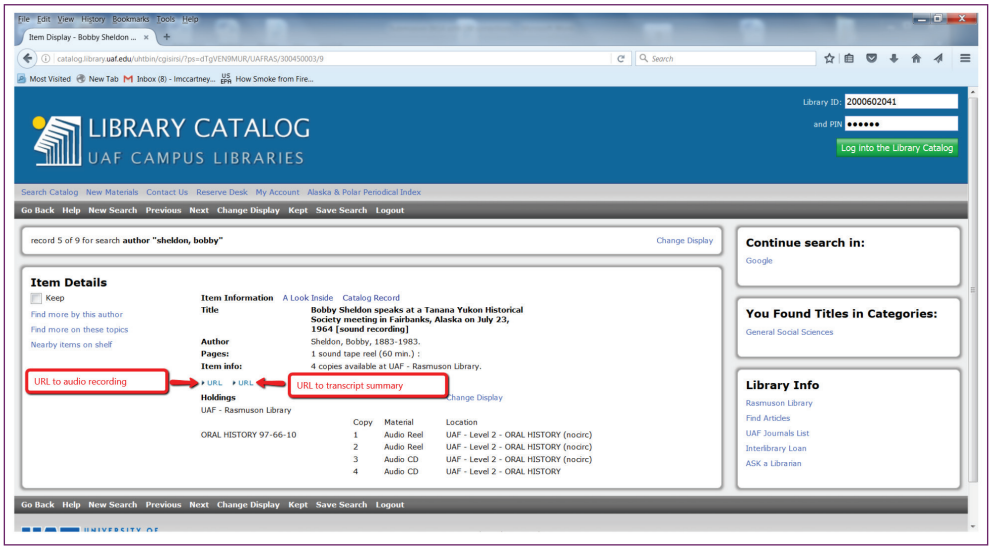
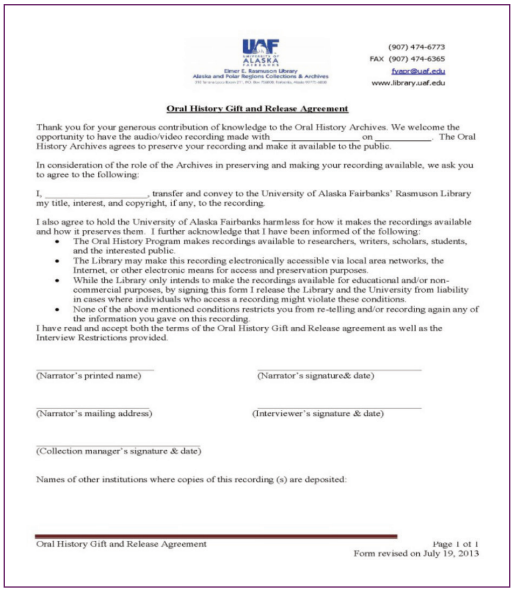


Figure 1: UAF Library Catalog record for Bobby Sheldon recording with URL links to recording and transcript summary.

20 Elmer E. Rasmuson Library, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, http://www.library.uaf.edu/.

8. Gift and release agreements

Before making any recordings accessible to researchers or online, we endeavor to secure an up-to-date Gift and Release Agreement that explicitly states "The Library may make this recording electronically accessible via local area networks, the Internet, or other electronic means for access and preservation purposes." An example of the standard UAF Gift and Release Agreement is shown in Figure 2.



UAF ALASKA FAIRBANKS
Elmer E. Rasmuson Library
Alaska and Polar Regions Collections & Archives

(907) 474-6773
FAX (907) 474-6365
fyner@uaf.edu
www.library.uaf.edu

Oral History Gift and Release Agreement

Thank you for your generous contribution of knowledge to the Oral History Archives. We welcome the opportunity to have the audio/video recording made with _____ on _____. The Oral History Archives agrees to preserve your recording and make it available to the public.

In consideration of the role of the Archives in preserving and making your recording available, we ask you to agree to the following:

I, _____, transfer and convey to the University of Alaska Fairbanks' Rasmuson Library my title, interest, and copyright, if any, to the recording.

I also agree to hold the University of Alaska Fairbanks harmless for how it makes the recordings available and how it preserves them. I further acknowledge that I have been informed of the following:

- The Oral History Program makes recordings available to researchers, writers, scholars, students, and the interested public.
- The Library may make this recording electronically accessible via local area networks, the Internet, or other electronic means for access and preservation purposes.
- While the Library only intends to make the recordings available for educational and/or non-commercial purposes, by signing this form I release the Library and the University from liability in cases where individuals who access a recording might violate these conditions.
- None of the above mentioned conditions restricts you from re-telling and/or recording again any of the information you gave on this recording.

I have read and accept both the terms of the Oral History Gift and Release agreement as well as the Interview Restrictions provided.

_____ (Narrator's printed name)

_____ (Narrator's signature& date)

_____ (Narrator's mailing address)

_____ (Interviewer's signature & date)

_____ (Collection manager's signature & date)

Names of other institutions where copies of this recording (s) are deposited:

Oral History Gift and Release Agreement

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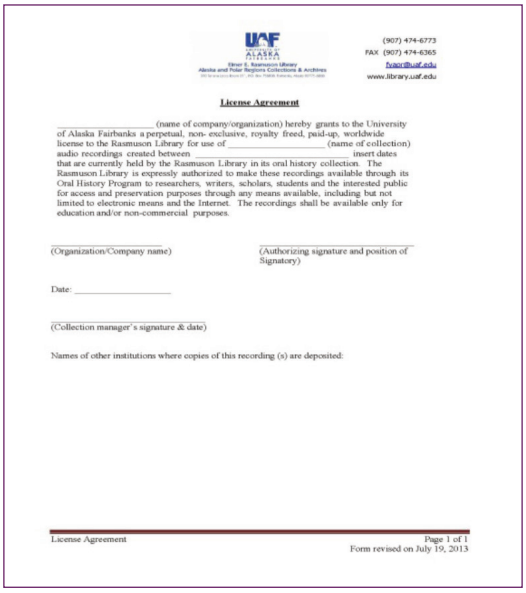
Form revised on July 19, 2013

Figure 2: UAF Oral History Gift and Release Agreement.

This can be a very major undertaking given that many of our recordings do not have any sort of Gift and Release Agreement or Consent Statement or if they do, they are very basic and do not include electronic access. This issue came to the fore for the Oral History Collection shortly after the author accepted the position of Curator of Oral History at UAF and learned that a series of 100th year University anniversaries would be happening over the next couple of years. The author realized that there were hundreds of recordings in the UAF Oral History collection that the university had made over the years featuring past university Presidents and Chancellors, distinguished scholars, the opening of various campus buildings and other historic university events. These recordings had been created by the university for the university yet there was no paperwork associated with most of these recordings and therefore legally and ethically they could not be used.

Realizing that the UAF Oral History Collection could make a significant contribution to and celebration events, the author contacted the UAF legal team. Their solution was to create a License Agreement which states:

"The University of Alaska and the University of Alaska Fairbanks hereby grant a perpetual, non-exclusive, royalty free, paid-up, worldwide license to the Rasmuson Library for use of the University of Alaska oral history audio recordings created between January 1, 1940 and December 31, 1999 that are currently held by the Rasmuson Library in its oral history collection. The Rasmuson Library is expressly authorized to make these recordings available through its Oral History Program to researchers, writers, scholars, students, and the interested public for access and preservation purposes through any means available, including but not limited to electronic mean and the internet. The recordings shall be available only for educational and/or non-commercial purposes". A copy of our standard License Agreement is illustrated in Figure 3.



UAF ALASKA FAIRBANKS
Elmer E. Rasmuson Library
Alaska and Polar Regions Collections & Archives

(907) 474-6773
FAX (907) 474-6365
fyapr@uaf.edu
www.library.uaf.edu

License Agreement

_____ (name of company/organization) hereby grants to the University of Alaska Fairbanks a perpetual, non- exclusive, royalty freed, paid-up, worldwide license to the Rasmuson Library for use of _____ (name of collection) audio recordings created between _____ insert dates that are currently held by the Rasmuson Library in its oral history collection. The Rasmuson Library is expressly authorized to make these recordings available through its Oral History Program to researchers, writers, scholars, students and the interested public for access and preservation purposes through any means available, including but not limited to electronic means and the Internet. The recordings shall be available only for education and/or non-commercial purposes.

_____ (Organization/Company name)

_____ (Authorizing signature and position of Signatory)

Date: _____

_____ (Collection manager's signature & date)

Names of other institutions where copies of this recording (s) are deposited:

License Agreement Page 1 of 1
Form revised on July 19, 2013

Figure 3: UAF License Agreement.

This effectively freed up all of the UAF recordings to now be used for the anniversary celebrations and any other research into the history of the University.[21]

The author has since implemented this solution with many of our other collections that have been donated to us by organizations over the years. For example, recordings collected in the 1960-80s by the Pioneers of Alaska and the Tanana Yukon Historical Society. Most of the people interviewed have long passed away; the organizations donated the recordings to us long before Gift and Release Agreements were the norm. On many of the recordings they say that the recording will be archived at UAF for future generations to learn from. The author has also asked organizations such as school districts that donated recordings to us to sign similar agreements along with Arts Councils and other local history groups. To date, not one organization has declined. These recordings were created and archived with UAF to be used by researchers and the general public. By signing these UAF License Agreements, it allows us to freely use thousands of recordings that were previously not available to the public as there was no permission to do so. As shown in figure 3 and as noted above, these License Agreements give the Rasmuson Library authority to make these recordings available through the Oral History Program to researchers, writers, scholars, students and the interested public and it also allows us to make them also electronically available through internet. It explicitly states that the recordings are for education and/or non-commercial purposes only. The author realizes that this is not the only solution for making large collections available; Creative Commons is also an option.[22] The UAF legal department directed us toward using the UAF License Agreement they had prepared and as shown above in Figure 3.

21 In personal correspondence to the author on April 2, 2013, UAF Legal Council decided on using a License Agreement over a transfer or assignment as the university already owned the rights to the recordings themselves.

22 Creative Commons. Last accessed December 14, 2015, https://creativecommons.org/.

The largest achievement using this method to date came in 2014 when we discovered we had 163 recordings related to the Exxon Valdez oil spill that occurred in Prince William Sound, Alaska in 1989. As noted above, from the first recording by Captain Hazelwood reporting that the ship had run aground and was leaking oil to the first radio news broadcasts, to the public meetings that continued for months and months thereafter. The recordings contain public radio news coverage of the spill from March 24 to December 31, 1989.

We discovered that the collection had been given to us by either a radio station and/or the Alaska State Archives in 1990. Copies were also given to five other institutions/repositories and four radio stations all within Alaska. The letter accompanying the recordings in 1990 clearly set out that the original intent was not to circulate the recordings outside the library and although not stated, this was for reasons of the several legal suits filed after the spill. The author contacted each of the five institutions and four radio stations explaining the Exxon Valdez Oil Spill Project Jukebox and her wish to add a selection of the various radio broadcasts from our collection to the online Jukebox. This would give users a real sense of the growing frustration of the citizens affected by the spill as the days went on and the response of the oil companies at the time. Time had now passed; the court cases had been settled. Every radio station and repository agreed that these recordings should be made public. 2014 was after all the year of the 25th anniversary of what at the time was the worst oil spill in the world and we were creating a Project Jukebox with several recordings and wanted to include Hazelwood's first call and various days of meetings. Every organization and radio station agreed to sign a License Agreement. Today you can listen to portions of these recordings online.[23] All of the recordings are now open to the public and will be made available to researchers on request.

But what of recordings that were not made by or donated by organizations that we wanted to include in a Project Jukebox or link via a URL to the recording in the Library Catalog? Retired United States Judge and oral historian John A. Neuenschwander refers to these types of recordings as 'the orphan interview problem' which he defines as 'work that contains enough originality to be copyrightable but whose owner or creator cannot be found (Neuenschwander, 2014: 83). Such a work could be a film, musical recording or photograph. It could also be an oral history interview for which there is no signed release. Many of the recordings in the category contain invaluable information and to make them not available because they might have been recorded in the 1940s and 1950s and it is unlikely that the people are still alive seems a poor practice for making these primarily resources available to researchers. After attending a workshop by Neuenschwander entitled Oral History and the Law at the Oral History Association Annual Meeting in Cleveland, Ohio in October 2012, the author decided we would implement his due diligence and fair use doctrine to our collection. Our guidelines became as follows:

- An orphan work is identified in our collection, that is, a recording that has either no Gift and Release agreement was ever signed or if on was, it does not meet today's standards of allowing us to make it electronically available
- On a purposely set up spreadsheet we log in the recording number and metadata (interviewer/interviewee name, date, collection, series etc.); all of the next steps detailed are logged in with the date of the search
- We do an internet and database search for an obituary looking for any clues to next of kin and their location
- If any clues are found, follow up steps are next (search for telephone numbers or addresses and write or call the next-of-kin for example)
- Alaska may be geographically big but it population small; depending on the interview details, contact someone in the village that may know of the narrator or next-of-kin

23 Exxon Valdez Oil Spill Radio Recordings, ***University of Alaska Fairbanks***. Last accessed November 28, 2016, http://jukebox.uaf.edu/site7/exxon-valdez-oil-spill-radio-recordings.

- Search to see if there any further archival collections in our institution and if so, search files for contact or next-of-kin details
- If any of these searches are successful, ask for an updated Gift and Release Agreement to be signed, give copies of the recording/transcript to the family and release to public
- After a minimum of three solid efforts to find any information and the narrator and next-of-kin, and if this search is unsuccessful, make the recording and associated transcript (if there is one) available yet note on the series catalog record that a new Release is needed

We have been very successful with this practice. The following is just one example:

In October 2014 we were contacted by a researcher who was writing a memoir of her uncle who had been a practicing doctor in Alaska many years ago. She found on WorldCat reference to a recording in our collection by a Dr. Arthur Wilson who had been interviewed in 1982. Although this was not her uncle, Dr. Wilson had practiced medicine in Alaska about the same time as her uncle and she wanted to look at the transcript for some historical context for her writing. The author checked our Gift and Release Agreements and they were indeed the old ones where electronic distribution of the material had not been consented to. UAF Oral History staff knew that the interviewer had passed away. This was our first test of Neuenschwander's due diligence and fair use doctrine. A quick Internet search revealed that Dr. Wilson was no longer practicing but his son was also a physician in Alaska. The author contacted the information on the website about his address and telephone number. The phone had been disconnected, the practice closed. The author contacted the Director of the hospital in the town where Dr. Wilson had practiced along with a few other doctor offices in the same town. Everyone remembered Dr. Wilson and his son but they had both long retired, moved away and no one knew their whereabouts or if they were indeed still alive. Other internet searches did not reveal Dr. Wilson or his son. This amounted to five serious attempts to locate Dr. Wilson. We released the transcript electronically to the patron and put a URL to the .mp3 into the library catalog record so she could listen to the recording. In April 2015 Dr. Wilson's great-granddaughter found the recording through WorldCat when conducting family genealogy research. She contacted us, thrilled to find this recording, her family never knew of its existence and she thanked us, on behalf of her family, and expressed how much find this recording meant to her family. Her father was still alive and was more than happy to sign a new Gift and Release Agreement. They were equally pleased to have learned the recording had assisted a researcher.

We have implemented this procedure many times and in many cases, family members have found the recordings WorldCat when conducting family research searches and are only too pleased to sign a new Gift and Release Agreement.

9. Conclusion

Using the University of Alaska Fairbanks Project Jukebox and online cataloging as an example, we have seen how technological delivery audio and audiovisual recordings, along with associated transcripts maps and related texts has evolved. Making recordings available online however requires a due diligence and fair use attempt to obtain legal consent from the narrator or their descendants to do so. Alternatively, License Agreements may be a solution for large collections recorded by institutions as in the case of the UAF recordings. In an email from the UAF Legal Counsel to the author dated March 29, 2013, it was noted that one must keep in mind however that other copyright issues could arise, for example speakers may have copyright interest in their recorded speeches but an improvised speech is not a fixed work and there is no copyright attached. Given that there may be some risk that works put online under these agreements might be subject to copyright, the risk is fairly minimal and dealt with if an objection arises at a later date. To date this has not been the experience of UAF. Decisions to put materials online with proper permissions has led the UAF Oral History Program today to a way to provide meaningful and useful access to these recorded collections for researchers in any location worldwide as long as they can be connected to the internet. As technological delivery systems change in future, we can only imagine what meaningful delivery systems to our collections will look like in future.

Acknowledgements

The author would like to thank the following people who assisted with providing or clarifying information and background context for conference presentations of which this paper is based on: John Byrne, Karen Brewster, Joann Henszey, Robyn Russell and William Schneider.

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BUILDING A DIGITAL PRESERVATION COMMUNITY IN PUBLIC BROADCASTING: A CASE STUDY OF THE AMERICAN ARCHIVE OF PUBLIC BROADCASTING'S NATIONAL DIGITAL STEWARDSHIP RESIDENCIES

Andrew Weaver, Eddy Colloton, Kate McManus, Selena Chau, Lorena Ramirez-Lopez, Adam Lott and Tressa Graves, National Digital Stewardship Residents, USA

1. Introduction

The National Digital Stewardship Residency (NDSR) is a competitive program which aims to foster a growing community of professionals who are proficient in the tenets of digital preservation and possess the necessary knowledge to advance efforts for the safeguarding of our shared digital heritage. It is built around a cohort model, and to date has had contingents based in Boston, New York City, and Washington D.C. For 2016-2017, the American Archive of Public Broadcasting (AAPB) received grant funding from the Institute of Museum and Library Services (IMLS) to create an NDSR cohort of audiovisual archivists placed in geographically diverse public broadcasting stations not limited to just the Northeast region of the United States. These consist of both television and radio stations and represent a wide range of sizes as well as current capacities for digital preservation.

This range allows insight into models of best practices at different scales for different regions. Residents assess broadcast and production workflows, which are often complex and not well documented. These residents work collaboratively with staff to incorporate preservation standards that lead to increasing access to digital content, maintaining effective workflows, and reducing digital preservation threats while improving authenticity, understandability, persistence, and renderability of digital content. The work done in these residencies may offer similar local broadcast environments ideas to consider for safeguarding their history while simultaneously creating it.

Digital stewardship for audiovisual collections is knowledge that may not easily disseminate to all groups with audiovisual collections. To that end while each resident's project varies from processes and goals, the overall mission to preserve their organizations' content strongly resonates in each of their proposals.

Information on each host site's project is available at http://ndsr.americanarchive.org.

2. City University of New York Television, Andrew Weaver

The library and archives at City University of New York Television (CUNY TV) exist in a uniquely central position within the station. All content that is produced goes through the library, and the library itself is involved with broadcast scheduling. Archival materials are stored on LTO tapes, with a migration from LTO 5 to LTO 7 currently underway. Consequently, CUNY TV already has in place a robust digital workflow built on a system of shell scripts (or microservices) that enable the efficient creation of archival packages containing a vast spectrum of preservation metadata.[1] This makes my NDSR project somewhat unique amongst this cohort, as I am dealing more with refining relatively advanced systems as opposed to implementing more basic tenets of digital preservation.

To date, I have been focused on raising CUNY TV's compliance with the recommendations put forth in the NDSA levels of digital preservation (Phillips, et al., 2013). As such, I am working extensively with this metadata to make it more centralized and easy to use, while also assessing possible enhancements to the types of metadata gathered. When archival packages are generated by CUNY's microservices a broad spectrum of fixity and technical information is created and stored as sidecar files. There currently is a system for adding some of this information

1 These scripts are publicly available on Github at https://github.com/mediamicroservices/mm.

into an existing FileMaker database, but this has been found to be prohibitively time consuming, with the reports from a single LTO tape taking several hours to upload. As a result of my preliminary NDSA levels assessment I have concluded that this data needs to be more accessible for queries as well as more explicitly integrated with metadata pertaining to PREMIS events.

In order to accomplish this I have been working on developing a MySQL database to store fixity and PREMIS metadata, as well as modifying existing microservices to intelligently communicate with this database. In the current prototype, this is accomplished in two ways. CUNY TV has several microservices that generate fixity metadata on the package level as well as on the collection level (such as for an entire LTO tape). These scripts have been modified so that after execution, the generated manifest will be cycled through in an iterative manner to report all checksums and file paths to the database. This is used in conjunction with a database table for PREMIS information that records event types and event outcomes both for fixity generation as well as for all other microservices involved in package creation. I have found the PREMIS Data Dictionary (PREMIS Editorial Committee, 2008) a useful document for providing guidance on developing a standardized vocabulary for events, as well as for what type of information to prioritize.

Another component of my project that I have been investigating beyond standard preservation metadata is the implementation of perceptual hashing within our workflows. Perceptual hashing is similar to normal fixity metadata in that it uses algorithms to analyze content, but while fixity is seeking to identify identical data, perceptual hashing seeks to create "fingerprints" that can be used to establish connections between similar data. If this data were to be collected, it could potentially aid in the identification of derivative materials as well as help automate some elements of cataloging. Due to the wider availability of tools for creating these hashes for audio materials[2], so far I have been testing the efficacy of creating fingerprints from the audio component of video programs. These tests have been relatively successful at establishing links between content, and the next stages of my project will involve establishing both how to efficiently store and effectively use this information.

3. Louisiana Public Broadcasting, Eddy Colloton

The archiving initiative at Louisiana Public Broadcasting (LPB), as it exists now, began just under a decade ago, in 2009. Through the American Archive of Public Broadcasting (AAPB) project and an IMLS funded project, LPB embarked on the difficult task of preserving and providing public access to the station's thousands of video assets. The station's archive contains a wealth of culturally and politically significant content, from governor's debates to interviews with Louisiana artists, musicians and writers. Not to mention, the archive has tremendous value to the station and its producers. Archival footage is now often employed in LPB's weekly news magazine program, *Louisiana: The State We're In*, illustrating the relevance of the state's history through the lens of today's issues.

LPB works in partnership with the Louisiana State Archives to provide public access to moving images in these two institutions' collections through the Louisiana Digital Media Archive (LDMA), located at ladigitalmedia.org. The public facing website of the LDMA is built on top of a custom designed Microsoft SQL database that both institutions use to catalog and track their materials. The database is used contemporaneously to describe content that has recently been produced by LPB, as well as the analog video materials from the stations 40+ year history. LPB's analog video legacy is being migrated to digital formats in-house. As an established TV station, LPB is in the fortunate position to have access to analog video equipment and expertise in using, maintaining, and repairing this equipment. As digital video files are created, whether they be recently produced programs or documentaries from the 1980s, an access video file encoded for web streaming is automatically created and sent to the station's web server via open source scripting designed and maintained by the station's IT department. These access files are then

2 Most of my experimentation has used the Chromaprint library. https://acoustid.org/chromaprint

linked to their corresponding record in the database, and, copyright permitting, are published to the LDMA website.

Needless to say, developing and managing this workflow has taken significant time and effort from station employees' whose primary occupation is facilitating and creating local broadcasting. Given this situation, policies, procedures, and responsibilities have developed as a matter of course, and were not fully documented. One of the goals of LPB's AAPB National Digital Stewardship Residency (NDSR), which began in July of 2016, has been to create workflow documentation.

As the resident at LPB, I began developing this documentation by interviewing LPB staff. My goal was essentially to follow the "life-cycle" of a particular program, from creation, to broadcast, and finally to deposit in the archive. Not surprisingly, I often found that an individual involved in a particular part of the workflow would be very familiar with their own tasks and responsibilities, but have little knowledge about the other aspects of the program's journey to deposit. Untangling some of the complexities of this system was time consuming and at points confusing, but has been very valuable as we move toward the second phase of the project, which will focus on making improvements to the workflow to promote digital preservation.

Given that the workflow created for archiving LPB's audiovisual legacy has been successful in describing and providing access to both contemporary and historic material, coupled with the challenge of making large-scale shifts in institutional practices, my recommendations for improving the workflow will involve more "tweaks" than sweeping change. Much of this work will involve drafting and implementing policy documents that re-iterate many of the responsibilities that engineers, IT staff, and producers already perform, simply providing a template to perform those responsibilities in a more uniform manner. Similarly, digital preservation practices like fixity checks and metadata extraction can be added to these ongoing responsibilities, hopefully, without disruption. Clearly articulated policies can also provide a mechanism for further development of the archival workflow.

As this effort looks to the future of material created and archived by LPB, I have also been spending time with the content already in the archive and available on the LDMA website. I have been working with the IT manager to extract technical metadata from all of digital videos files in the archive and import that information into the database. I'm also regularly brainstorming with the station's full-time archivist, Leslie Bourgeois, looking for ways to promote and improve the LDMA website.

While digital preservation practices and audiovisual materials often appear to be frustratingly complex, I'm comforted by the fact that much of my work as a National Digital Stewardship Resident has been rooted in traditional archival practice. I am regularly thinking about technology-agnostic concepts like accession policy, documentation of provenance, and public access. Moreover, many of these concepts are prevalent in my cohort's projects too, which has given me a sounding board and support group for working through challenges in my first position as a professional archivist. I feel that, as a cohort, we are all motivated by the commonalities in our projects and our experiences in preserving public media, and that working together in this effort has improved the project for everyone involved.

4. Minnesota Public Radio, Kate McManus

Minnesota Public Radio (MPR) began as a small college radio in Collegeville, Minnesota as a classical music station in 1967 that grew to a giant entity much respected in Minnesota. MPR pushes out an impressive amount of content through its three corner stone radio stations, and more recently through its podcast networks. While the content is managed pretty well in our internally built DAMS, Eddy, it is sometimes messy and certainly not easy to make stories public through the current archive portal.

My project has several discrete goals, with the overall aim being to clean up the internal metadata, normalize fields, and make it easier for digital content to be pushed to the web. In the next few months, I'll be exploring metadata cleanup. Producers all use fields very differently here, and because of the nature of breaking news; we can't make any fields mandatory on the production side.

I'm really lucky that I have an archivist to work with. We also have awesome inhouse IT folks who are constantly building the databases that feed the websites. Right now, we have an internal content management site, Eddy. Eddy was the third attempt at an internal database after two proprietary digital asset management systems were burned down and raided to build what we have today. Eddy is useful for in-house content management, but there's no way right now to make Eddy accessible to outside users. Right now, the workflow to getting content from our play-to-air system (Dalet) is somewhat automated, ingested in batches. The metadata that is created on the production side stays with the audio when it lands is Eddy, which is good for the archives purposes, even if we get that metadata with typos, misspellings, or even raw notations that would not be appropriate to push out to the public.

We've been using a separate archive portal that is not fed by Eddy, but we're hoping in the new year to build a new skin over Eddy that can become a new Archive portal site. Right now I'm completing the documentation of Eddy use, and in the next few weeks, I should have a robust metadata field map, linking what's currently on the Archive portal to what we hope will become the new portal.

There are two major concerns:

1. Which fields can we hide, is there a way to push quality information to the "new portal" without having to touch every record?
2. Of the stuff that's pushed to the current archive website, can we cross that back to Eddy without losing the public facing information, populate the "public" or safe fields, and push it forward?

Today the answer is "I don't know yet," but I'm really excited to explore solutions in the coming months. While my project is very different from most of the other AAPB NDSR projects, the camaraderie and the shared resources are absolutely vital to my work. I need the feedback that I get from my fellow residents, and often the questions they bring to the cohort help me to think more deeply about my own project.

5. KBOO Community Radio, Selena Chau

KBOO Community Radio in Portland, Oregon (http://kboo.fm) went on the air in June of 1968 as an independent, member-supported, non-commercial, and volunteer-powered ration station. Volunteers do everything--create, host, engineer, board op, edit, produce, and broadcast their own shows and run membership drives. While KBOO is unique, it faces many of the same challenges at other public broadcast archives for preserving and providing public access to the station's audiovisual assets. KBOO's time-crunched staff support the urgency of news stories that affect the community, constantly fundraise through membership drives, and are challenged to recruit regular volunteers for work central to its mission. KBOO is further challenged by not having an archivist in the organizational structure. When moving towards the goal of providing access to audio, the foundational work of digital preservation is often not taken into consideration.

KBOO's goal is obtaining a system for making archived programs accessible to KBOO programmers, researchers, and the public. Additionally, KBOO needs help thinking about integrating the born-digital records and digitized analog items into a single search. Digital preservation frameworks, audio asset metadata management, and defining prerequisites of digitization are being scaled down to fit the staff's time, understanding, and commitment level. Working at a community radio station, I find it imperative to advocate for archives as an ongoing responsibility and incorporate values of archives and digital stewardship in the workplace.

In order to prevent issues of unknown and unorganized assets in the future, I'm encouraging change "downstream" by sharing information on filenaming conventions with radio program hosts and contributing embedded metadata guidelines for audio program files for future volunteer trainings. I'm developing a modular preservation plan so that KBOO can approach a part of the plan when they know time and money is going to be available, and then execute it as determined by the overall strategy. This ensures that actions still follow the best practices defined in the digital preservation plan. Workflows and solutions underway include development of a data model that overlaps PBCore and local needs and an internal content management system that encourages group participation with the ability to export data to an integrated analog/born-digital search system.

6. Howard University Television (WHUT), Lorena Ramirez-Lopez

Howard University Television (WHUT) went on the air November 17, 1980 as WHMM (Washington Howard Multi-Media). The station's debut received considerable local and national attention as it was the first and only Public Broadcasting Station (PBS) member station licensed to and operated by a historically black university, Howard University (www.howard.edu), in Washington, DC.

The station's signal reaches over 2 million households in the greater Washington metro area. In fall 2007, WHUT also began a digital simulcast to this viewing area, making it the ninth largest media market in the United States. WHUT airs more than 3,500 hours each year of its own in-house productions of original content and reflection of the DC community as well as educational programming, national and local issues in the United States such as #BlackLivesMatter-Protect and Serve!, a multi-media campaign to raise awareness of the #BlackLivesMatter movement and highlight the importance of mutual respect and understanding among ALL individuals (WHUT, 2016).

WHUT does not have a dedicated archivist to manage their content. Instead that responsibility falls onto each staff member: editors, producers, and broadcast technicians - all are aware of the importance of backups, discoverability, and access. WHUT does have a streamlined workflow where final products and raw footage are stored and backed-up onto LTO6 tapes. We are trying to adapt the current workflow and see where more metadata (technical, descriptive, administrative, as well as archival metadata) can be inserted in order to develop a more efficient broadcast/production workflow.

The bigger task at hand is the organization of WHUT's video archive. Recall that WHUT went on air in the 1980s, and by 1990, the station was producing a live weeknight edition of its flagship series, "Evening Exchange", that has been airing for over 25 years. "Evening Exchange", "@ Howard" and "Let's Talk Education" were all series that depicted the turbulence, progressiveness, and reflection of the community during the eighties and nineties. All this history is stored away in video tapes that haven't been accessed in years. Beginning in 2011, WHUT participated in the American Archive of Public Broadcasting's project where: 5,672 assets were inventoried and uploaded to an archival management system (AMS); 1,727 additional records were delivered to WGBH; 3,945 new records were created. However, WHUT doesn't have control over the AMS, and the inventory done back in 2011 lacks the tapes' locations making it difficult to reference the title listed to where the tape is in the archive. Furthermore, while over 200 hours of footage was digitized - 150 tapes in phase one and 113 tapes in phase two - the 263 tapes do not match the number listed on the inventory spreadsheet. We are trying to cross-reference the spreadsheets while re-organizing the video archive in order to have a more centralized inventory that we can place in a database that WHUT staff will be able to use to find and share their content.

Presently, WHUT generates the same dynamic content as it did back in the eighties and nineties with current series like "The Rock Newman Show", "The Mimi Geerges Show", and "ARTICO". These series continue conversations about our society and demonstrate community outreach and education with science, technology, engineering, and mathematics (STEM)

camps for preschoolers, digital media arts club (DMACS) for middle and high schoolers, and "American Graduate." While this born-digital workflow does have everything backed-up, establishing naming conventions and organization are key steps towards making sure that episodes are findable, accessed, and archived in order to also include them in WHUT's database.

WHUT houses and creates a rich and diverse television production of African-American experience, which we hope to preserve and access for the community and future.

7. Wisconsin Public Television, Adam Lott

WPT lies in the heart of the UW campus and has been broadcasting to the greater Wisconsin area since the early 1950's. From the beginning, WPT has been dedicated to the creation of content which not only educates, but entertains the public. In 2004, Ann Wilkens was hired as the station's first media archivist in an effort to preserve their 60+ years worth of content. Her efforts have greatly informed the ongoing digitization of legacy assets, laid the architecture for longterm storage of digital content, and produced metadata for thousands of assets. She continues to be WPT's sole archivist to this day.

As a resident, I feel lucky to be placed in an institution with active preservation practices. Our station has the luxury of owning a full suite of VTRs for capturing our diverse collection of tapes, a fully staffed engineering department which maintains the upkeep of these tools, and a knowledgeable IT department that has developed numerous micro-services which support our preservation practices. However, despite our good fortune, the archive is still working to map itself onto a production heavy environment.

Currently, our largest bottleneck concerns the creation and management of metadata. Our assets are described across several databases and spreadsheets which must be cross-referenced throughout our workflow. Microprocesses which push our content onto LTO have become a double-edged sword, as we are given a time limit to accurately describe assets, lest we want to restore them from backup. Luckily, plans are in place to adopt the Archival Management System, a metadata management tool jointly created by AVPreserve and WGBH. The system streamlines the creation of PBCore compliant XML documents, assists in the planning of digitization projects, and provides a clean interface for inputting data. The "big crunch" has already begun as we prep our metadata for large-scale ingest.

My eventual hope is that the production and archival workflows follow the same preservation streams. All content at WPT eventually finds its way onto LTO tape, so it would be ideal to treat all content as archival content right from the get-go. We've had success in the past pushing archival content onto social media, and I would love to continue this practice. We are well on our way to revamping our archive, which will hopefully lead to great changes within are station at large.

8. WYSO, Tressa Graves

WYSO started as a college radio station for Antioch College in 1958. Currently, the college still holds the license to the station but WYSO has expanded to becoming the public radio voice for southwest Ohio. With a small staff like KBOO, WYSO relies heavily on its volunteers for membership drives, community events, programming, and other station related tasks. IT services are provided by the college.

The WYSO Archive was created in 2009 and consists of analog audio recordings, digital audio recordings, and other WYSO related materials. The station does not currently have an archivist but hopes to hire someone in the future. All current and past archival work has been done through volunteering, internships, and through my current residency.

The bulk of my residency responsibilities are making more WYSO audio accessible to the public. This consists of a born digital civil rights oral history project and audiotape digitized

through previous AAPB grants. WYSO has a partnership with the Greene County Public Library (the station's local county library) allowing the station to put materials online (http://www.greenecountyroom.info/cdm/landingpage/collection/WYSOProgram). Currently there is approximately 35 hours of local civil rights oral histories and 77 hours of digitized material that require metadata to be completed before they can go online. The oral histories also require transcripts to be created.

Currently the station does not have a digital asset management system but rather has hard drives of material duplicated and located around the station and in staffs' homes. While it would be wonderful for WYSO to upgrade to a digital asset management system so the staff could easily access previously aired broadcasts, the implementation of such software is not part of my residency goals (though suggestions of possible software is). The station first needs institution wide file naming conventions that can be used on all future created materials. Current workflows and digital preservation standards also need to be examined so they can improved. These are two important tasks that I also plan to complete during my residency at WYSO.

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PROVIDING ACCESS TO MUSIC-THEATRE WORKS WITH ELECTRONIC SOUND ON TAPE: THE CASE OF CONSTANÇA CAPDEVILLE

Filipa Magalhães and Isabel Pires, Centre of Music Sociology and Aesthetics Studies, Universidade NOVA de Lisboa, Portugal

1. Introduction

Constança Capdeville was a composer and one of the most prominent figures in Portuguese contemporary music. She also stands out as the most representative example of the music-theatre genre, which saw its most intense period of activity in Portugal peak between the 1970's and the 1980's. This genre was explored by Capdeville through her close contact with the Grupo de Música Contemporânea de Lisboa (GMCL), conducted by Jorge Peixinho, also a renowned Portuguese composer. They were collectively responsible for bringing to Portugal some of the trends in the contemporary music of their time, for example through attending the *Internationale Ferienkurse für Neue Musik* in Darmstadt.

Regarding the music-theatre genre, Capdeville not only assimilated some of the conceptions of Mauricio Kagel but also developed her own language through exploring the "new sonorities" concept to the limit, creating, rehearsing, and conducting her own compositions. Capdeville additionally founded the ColecViva theatre group with the core purpose of performing her own music-theatre compositions. We would furthermore note that in Capdeville's music-theatre works, every facet of the composition plays a relevant role, even the simplest of objects. She thus explores the concept of "new sonorities" to the maximum. Some of Capdeville's works have also been composed within a context of combining electroacoustic music on magnetic tape and instrumental music. These different dimensions of her compositions mean incorporating a new electronic component, which requires new approaches not only as regards the appropriate analytical processes but also the preservation strategies necessary to retaining the media[1]. Daniel Teruggi argues that magnetic tape brought about new scope for manipulation and higher quality recordings, less degradation through usage and an improved recording duration as compared to other historical mechanical recording formats, such as cylinders, coarse groove discs, and micro groove discs. However, despite being less fragile and more resistant to stress, depending on their chemical composition and format, magnetic tapes recorded a long time ago tend to deteriorate, thus endangering their viability (Teruggi, 2004). Taking into account the previous statements, this article aims to put forward a general reflection on a methodology appropriate to understanding how we can, or cannot, re-perform Capdeville's music works in the future by preserving not only the magnetic tape media but also their performance as well as analysing some of these works within a musicological context.

2. State of the art in Portugal: preservation problems

In Portugal, the preservation and the musicological study of this kind of music, mixing acoustic instruments and electronic dimensions, in particular those including recordings on magnetic tape, constitutes a research field still in its earliest stages, an area hitherto virtually non-existent. Should no action be taken, we shall lose such cultural heritage.

The magnetic tape remained the technical reference benchmark for audio signal storage for around fifty years in Portugal and, as an unstable medium, requires specific concerns regarding its preservation. The short life span of audio carriers, the obsolescence of the data reading systems, and the musical instruments, requires swift intervention in order to avoid the loss of content (Canazza & Vidolin, 2001). This preservation inherently involves a multidisciplinary approach conducted by institutions and experts from different fields of musicology, cultural

1 Henceforth, I will myself refer to the term "music works" since Capdeville´s compositions involve many other components that extend beyond the concept of "electroacoustic music", therefore, further studies are needed in order to properly classify such kinds of works.

heritage, computer engineering, information and communication technology (ICT), and signal processing (Canazza et al., 2010). Electroacoustic music preservation strives to keep alive the musical thought and outputs by preserving masterpieces and instruments, allowing performances and functionality both for musicological research and philological interpretation (Canazza & Vidolin, 2001). The preservation of the performance praxis requires broad knowledge about traditional and electronic instruments. In the presence of these new electronic instruments, the study of a new language and new performance techniques thus becomes necessary. Even though the recording technique represents a testimony to the creative process, which does enable us to properly document the information, this work has yet to be carried out in Portugal where there is currently no structure to undertake this kind of multidisciplinary work and what does exist, what very little has been done stems from individual efforts and the study set out here represents something new within the musicological field.

3. Issues around the analysis of Capdeville's music works

This article also seeks to discuss the pertinence of analysing Constança Capdeville's music works correspondingly raising questions including: What is the relevance of analysing works that include technology? Is a composer creating a work with the purpose of it being re-performed? How can we re-perform a work when some features are missing?

There are indeed several issues that may be decoded from technology. For example, spectral analysis allows us to study the spectrum, with its content containing the timbre, thus analysing frequencies, amplitudes, and understanding whether the composer is actually making recourse to a spectrum as an aesthetical choice or if this spectrum for instance stems just from a noise made by the recording itself. We may however also make comparisons between interpretations and watching sound results regardless of the sound sources. Indeed, there are several tools dedicated to sound analysis, for example, the sonogram, which displays a waveform representing frequencies, amplitudes, and the duration of a sound sample, providing a new understanding of sound and music visualization. Despite both software serving their purposes, consisting of different approaches to sound analysis, some limitations remain as they are not able to distinguish between layers, still only possible by hearing. Thus it would be desirable to propose new methodologies to document music works including recordings in a descriptive sense in order to recreate the sound alongside how such a documentation task requires adapting to the software existing.

With regard to the electroacoustic parts of Capdeville's music, the spatial disposition of the loudspeakers constitutes one relevant aspect of her compositions. However, besides exploring new sonorities, intensities, densities, textures, another of Capdeville's aims was to compensate for the reduced number of performers regularly participating in her representations. Nevertheless, in this, she was only following the trends of other composers of the time, such as Karlheinz Stockhausen, Luigi Nono and Emmanuel Nunes. At a compositional level, alongside the traditional acoustic instruments, Capdeville added other objects as sound sources, which in turn divide into three categories. Firstly, sounds created through instruments but not conventionally, playing strings with other objects, in sound boxes or by piano pedals. Secondly, applying objects to create dry sounds as marbles, cellophane, water, and among others. Thirdly, and the core of this work, electronic objects, deployed by Capdeville to overcome the common sound universe. As Laura Zattra argues, "electroacoustic music analysis is a complex and heterogeneous discipline depending on one musical genre which includes a large typology of subgenres: from tape music to computer music, from concrete music, to mixed music, live electronic music, laptop music […]"[2] (Zattra, 2005). The music, through incorporating an electronic component, completely changes the way of making music and, thus, different approaches to analysing such kinds of music have correspondingly emerged. The composer and researcher François Delalande, in his article "La musique électroacoustique, coupure et continuité", while referring

2 Zattra, L. (2005). "Analysis and Analyses Of Electroacoustic Music. In Proceedings of the Sound and Music Computer Conference (SMC05), Salerno, Italy. Page 1.

himself to the expression "electroacoustic music", points out that "[l]e plus souvent, pas de partition, ou bien, dans le cas d'une électroacoustique instrumentale, une notation prescriptive qui permet difficilement de se faire une idée de la réalisation sonore."3 (Delalande, 1996), and here reinforcing the idea that new analytical methodologies not only should arise but that these also require systematisation. Capdeville applied new symbols in her graphic scores, creating her own particular language in order to conduct performers, even with regard to interactions between the performer and the electronic component, particularly in her recourse to magnetic tape. She also left handwritten parts with several annotations, explanatory scripts about movements, lights and interpretation. All such facets need gathering in conjunction with the sound content included in tape recordings in order to build any new performance. Those aiming to re-perform the works of Constança Capdeville therefore need to understand the meaning of these metadata she herself created.

3.1 Case studies

The work *Mise-en-Requiem* serves here as our case study and was composed by Constança Capdeville for an ensemble (flute, horn, trumpet, violin, viola, cello, harp and guitar), magnetic tape and three spotlights, and falls within the scope of the music-theatre genre. The work was commissioned by the Calouste Gulbenkian Foundation (FCG) and premiered in 1979, following the 3rd edition of Encontros Gulbenkian de Música Contemporânea (EGMC). These encounters, which promoted the contemporary music in Portugal, spanned an almost three decade long period of activity and generated a strong impact on the dissemination of contemporary music in this country.

Mise-en-Requiem presents a structure divided into seven movements, respecting the liturgical order of a traditional "Requiem", which are autonomous in terms of musical framing, material and duration.

The following sequence of images[4] below shows the beginning of the second movement "RÉ, QUIEM". This session starts with only acoustic instruments (live music). A huge unison is played by the strings on the D note (Ré, in the Portuguese language, and the choice of the note RÉ means a sort of pun with the first syllable of the name of the movement "RÉ, QUIEM"). Here, performers need to seek out different effects and sonorities, and at the end of the score there is a warning about a recorded sequence that is coming (as shown in the image on the left below).

In turn, on the right, there is a sequence of pre-recorded sounds of a gong, low and deep, with the pedals functioning. The magnetic tape also contains pre-recorded voices emitting mismatched phonemes about inspiration and expiration: "EHHHHHH, HEEEEEE, UHHHHHH, HUUUUUU, AHHHHHH, HAAAAAA". Both images are representative of typical Constança Capdeville graphic notations, totally different from the traditional version. This example draws attention to the fact that a distinct and particular analytical approach, unique to Capdeville's compositions, is required in addition to how the electronic part also calls for new analytical methodologies.

3 "Most of the time, there is no score, or, in the case of an instrumental electroacoustic, there is a prescriptive notation that makes difficult to have an idea of the resulting sound." Delalande, F. "La musique électroacoustique, coupure et continuité." In ***Musurgia*** 3, No. 3 (1996): pp. 36. (Our translation).

4 All images representing original hand written documents scanned were kindly provided by CESEM - Centre of Music Sociology and Aesthetics Studies, FCSH/NOVA.

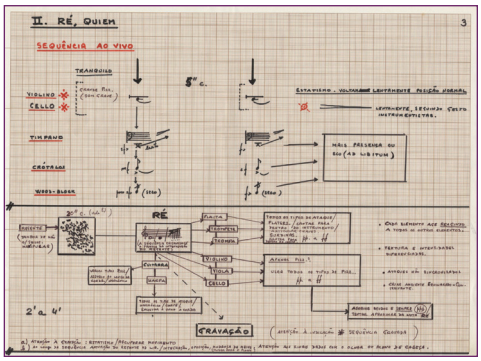

Figure 1. *Mise-en-Requiem*: original hand written document scanned. In the first of the second movements of this work, the live stream is indicated in red.

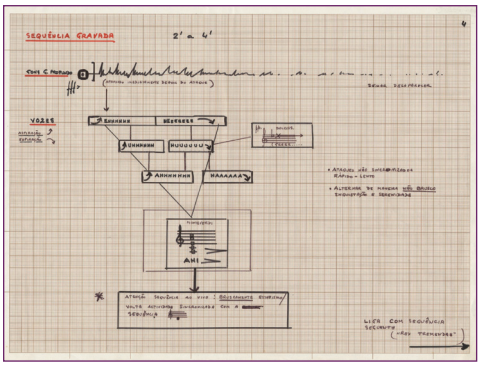

Figure 2. Second page of the same movement, with the recorded sequence also represented in red.

These musical works, combining an acoustic performance and an electroacoustic dimension, may have a traditionally notated part for the acoustic performer, but the electronic component, whether live or pre-recorded, cannot usually be fully notated in traditional ways.

Zattra states that although there are personal approaches, which render musical analysis a delicate and subjective field, some main trends may also be outlined: some analysts skip the technological dimension and base their work on the perceptual dimension; others deepen a genetic approach. Furthermore, any approach proves worthy of consideration given the potential for advances in the interdisciplinary research on electroacoustic music analysis (Zattra, 2005).

This study aims to adopt the musicological perspective with the purpose of outlining a general survey of different musicological and computational approaches made whether by musicologists, computer scientists, composers, sound engineers, with all their respective diverse skills gathered in order to create a multidisciplinary workflow to foster the analytical methodologies appropriate to these particular musical works.

Watching Capdeville's music works, especially those including recordings on tape, performed as an acoustic instrument, another case study *Don't Juan* also proves significant. This complex work is paradigmatic of the theatrical genre and written for voice, piano, double bass, percussion, magnetic tape, mime, dancer and lights. The composer applies fragments of texts, quotations from other composers in several languages, vocal and instrumental music live and spread, theatrical games, mimicry, movement, lights, props, instruments used as characters or scenic elements. Additionally, Capdeville, in close cooperation with a sound technician, recorded an orchestra being tuned, adding noises presented throughout the performance, duplicating instruments, among other means of sound manipulation. The image below displays a prescriptive notation of such tuning up with the following sample from the beginning of the first overture:

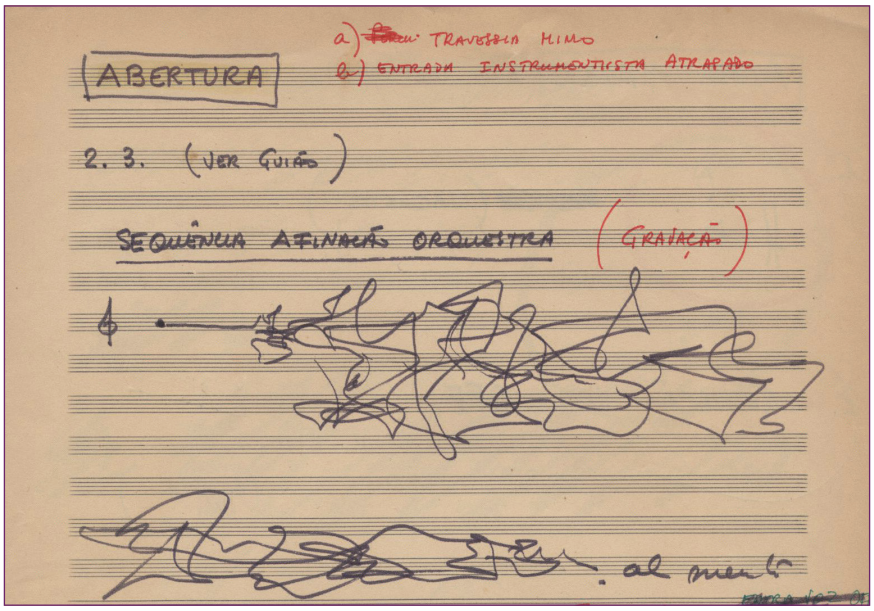

Figure 3. *Don't Juan*: original hand written document scanned, which represents the "Overture" of the work *Don't Juan*, also composed by Constança Capdeville.

The next image depicts a scheme for the entrance of a recording, and the composer indicates the sound of stamps in the first square while in the second, besides stamps, there are indications for water sounds, another example of Capdeville's characteristic notation.

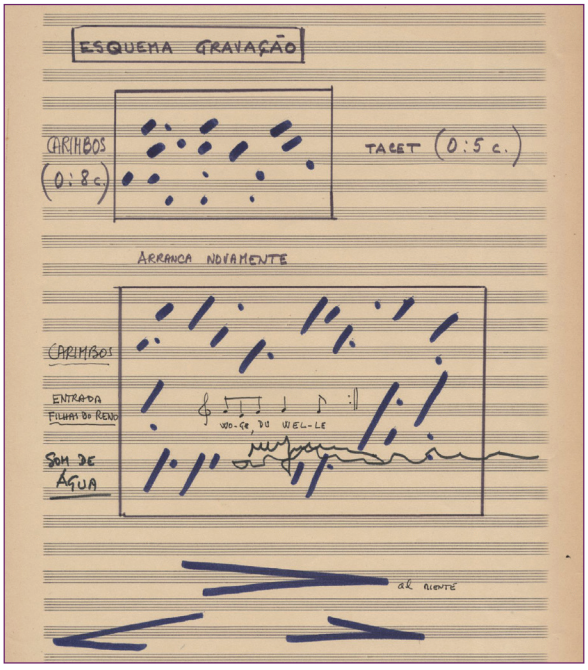

Figure 4. Recording scheme presented for the work *Don't Juan*, representing sounds of stamps and water.

The recording input is described in the score but we cannot ensure that the original magnetic tape for this performance still actually exists as there is, thus far, no documented reference to it. All of the existing Capdeville tape collection is currently stored at the Portuguese National Library, and we have not hitherto been able to playback the recordings mainly because of the lack of a proper workflow. Furthermore, any listening to such recordings should consider the sound migration from the original medium onto a new medium, because for the full perception of this kind of musical work the score alone proves insufficient as the work is not complete and hence it really is strictly necessary to hear the medium. Daniel Teruggi defends how "Digitisation is the gateway to a completely new way of accessing, studying and diffusing music"[5] (Teruggi, 2004), therefore sound content should be included within a digitisation[6] strategic plan, preferably in accordance with IASA[7] standards and recommendations[8], and alongside producing a documentation plan about this entire process. Nevertheless, an appropriate workflow regarding audio preservation remains a non-existent priority within most Portuguese institutions with some actions in this sense clearly necessary. The goal is not just listening to the magnetic media but also the preservation of the media and its sonic content. However, another issue arises at this point: just why do we need to preserve such works?

According to Teruggi, first of all, for historical purposes since such constitutes an example of human artistic production and worthy of preservation for future generations. The author states that electroacoustic music amounts to one of the major human technological revolutions deemed as important as the appearance of musical writing due to it changing the way music gets conceived and composed. The electroacoustic domain was a pioneer in the usage of magnetic tape technology for artistic creation by means of tape manipulation, and has correspondingly opened doors to all kinds of composers, academics and self-taught musicians and furthermore endowed musical creativity with a new perspective, new goals and new publics. From the point of view of preservation, musical works including tape recordings should gain priority because the first tapes produced are now almost at the end of their life spans and thus tending to fade and disappear.

There is a clearly identified need to explore and study this domain; musical analysis has sought out some options, nevertheless these still require improvements and adaptation to the needs of each case, whence new experiments and new theories are required. Due to both different dimensions of this kind of music and the "ambiguity" of their material outcomes, the study of the process of composition must be applied to the tape, score, composer notes, testimonies and so on. As the last resort, these different and particular sources, converging around the work, serve as a support for the understanding of musical intention, and their analysis is essential to reproducing musical thought. Obsolescence and preservation are crucial problems in the study of tape-recorded music (Zattra, 2007). Therefore, additional information about composers, technicians, and so forth, holds importance to the preservation and analysis of musical works. Below, we delve deeper into the magnetic tape collection of Capdeville while also proposing some methods for the preservation of her music works.

5 Teruggi, D. "Electroacoustic preservation projects: how to move forward." In ***Organised Sound*** 9, no. 1 (2004): pp. 62
6 We refer to digitisation as when the sound is transferred from an analogue source to a digital format.
7 International Association of Sound and Audiovisual Archives (<http://www.iasa-web.org>)
8 Mostly presented in the IASA-TC 04 publication, whose reference is: Bradley, Kevin ed., ***IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects (Standards, Recommended Practices and Strategies)***, International Association of Sound and Audiovisual Archives, IASA Technical Committee, Second edition, 2009.

4. Capdeville's magnetic tape collection: preservation of the media

This section presents an overview about the magnetic tape collection[9] of Constança Capdeville, currently deposited at the Portuguese National Library.

The picture below exhibits most of the collection although some tapes still require locating despite their listing as part of the donation with some musicological work about the composer and her role within the Portuguese contemporary music from the second half of the twentieth century also still lacking.

Maria João Serrão[10], a researcher who managed a digitisation plan of Capdeville's scores and screenplays, has listed a great amount of Capdeville's works, although the work is not complete with a huge part of the inventory still to be concluded. As regards the magnetic tapes, these are not yet catalogued as nobody has listened to their recordings, in addition to some of the tapes identified within scores being missing. We believe that some of these are lost or were possibly given to actors in the performances or perhaps friends but there has thus far been no chance to check or explore such eventualities.

Figure 5. The complete magnetic tape collection of Constança Capdeville currently stored at the Portuguese National Library.

Capdeville wrote about thirteen works within music-theatre context that include electroacoustic parts on tape, however most recordings in the overall tape collection are very relevant to Capdeville's compositions as they often served as the basis for leading musicians. Capdeville composed the majority of her music-theatre works between the 1970's and the 1980's, listed in a chronological order as follows: *Ritual One* (1973), *Mise-en-Requiem* (1979), *Libera Me* (1979), *Dmitriana* (1979), *Memoriae, Quasi Una Fantasia I* (1980), *Double* (1982), *Avec Picasso, ce Matin...*

9 All following images with regard to Capdeville's tape collection were kindly provided by the National Library of Portugal.

10 Serrão, Maria João. Constança Capdeville Entre o Teatro e a Música. Lisboa: Edições Colibri / Centro de Estudos de Sociologia e Estética Musical, 2006.

(1984), *Ainda Bem* (1984), *Don't Juan, Uccello* (1985), with the latter the final part of *Don't Juan, Memoriae, Quasi Una Fantasia II* (1986), *Amen Para Uma Ausência* (1987) and *Stabat Mater* (1988). Besides these, Capdeville also composed works for chamber music, music for dance, choir and orchestra/ensemble, among others. Following the compositional trends of the time, especially from the mid-twentieth century onwards, Capdeville was at the forefront of the search for new sounds through recourse to technology, deploying an electronic element that often involved simultaneously electronic sounds (pre-recorded on magnetic tape) with acoustic instruments. In such cases, the absence of the tape, even when the score exists, hinders the performability of the work, which effectively means that when such tapes do not exist, the work are unlikely ever to be reproduced as the tape constitutes another source of the compositional process. As Bernardini and Vidolin state: "Live electroacoustic music is different in that we seek to preserve not only a single, memorable performance but rather the ability to perform, study and re-interpret the same work over and over again, with different performances proposing different interpretations"11 (Bernardini & Vidolin, 2005), and therefore fundamental to the performance.

Firstly, for over twenty years the collection was stored in the house of Capdeville's close friend, Janine Moura. During this time, the tapes were kept at room temperature, which is quite harmful given they are subjected to changes temperature and relative humidity, enabling appearance of fungi, mould, among other types of flagging. Such variations are also undesirable for this type of media, because they cause a decrease in magnetic properties leading consequently to loss of beep.

The Portuguese National Library holds 65 tapes from Capdeville's collection, which are generally not in good condition. Currently, analysis of Capdeville's magnetic tape collection allows us to state that this is still not properly documented, listed, digitised or otherwise under preservation plans.

This collection, stored at the National Library, includes original recordings of her compositions, but also some recordings of concerts. However, the information details are unclear and thus listening to these recordings is an urgent demand. We hope that hearing them is still possible in the future because some look very fragile considering the physical facets of the medium material (acetate or PET), condition (state of degradation of the tape, etc.), state of preservation, number of segments of the tape, etcetera, and it is necessary to determine what kinds of decay they present. Within this collection, there are several kinds of usages, such as: tapes identified as editing materials, such as tapes number 32 and 33, assigned to the work *Molly Bloom*, a music-theatre work based on texts from James Joyce. Here, once more, Capdeville opts to record citations of songs from other composers, using a studio technique, which consists in the "cutting" and "collage" of the tape, mixing different sound sources during the assemblage, creating an expressive sequence that earned its own meaning. The assembly would be presented throughout the performance. Another significant example is tape number 19 entitled *FE ... DE ... RI ... CO*, it is also a music-theatre piece inspired on the poems, songs and illustrations by Federico García Lorca, a homage to the Spanish poet and dramatist, one of the victims of the Spanish Civil War. The National Library also contains an example of cinema soundtrack, a recording in Capdeville's collection indicated as an original of the movie *Cerromaior* by Luis Filipe Rocha, made in 1979. Additionally, in this collection, magnetic tape represents original recordings with transformations of pre-recorded materials for performative purposes such as tape number 7, which consists of the electronic part used in real time during the performance of *Mise-en-Requiem*. In the box of the tape, there are indications on the recording speed, track number, work duration, tape brand (eg.: Agfa-Gevaert), these are also useful indications for the technicians responsible for the content's migration. Nevertheless, hearing is an ability required to check the tape recording speed.

11 Bernardini, N., and Vidolin, A. (2005). "Sustainable live electro-acoustic music." In Proceedings of Sound and Music Computing, Salerno, Italy: pp. 1.

The image on the right is representative of the majority of Capdeville's tape collection in it exhibiting visible signs of degradation, such as mould, dust and dirt, and break down of the back coat. Currently these tapes are kept in an appropriate storage environment but they cannot be replayed, since there is no suitable workflow. We would take this opportunity to emphasise that no single magnetic tape collection, in the care of Portuguese institutions, receives the appropriate protection of a preservation strategy. Such interventions are crucial to retaining this facet of our cultural heritage.

Figure 6. Original magnetic tape used during the performances of *Mise-en-Requiem*, includes general technical information about the recording.

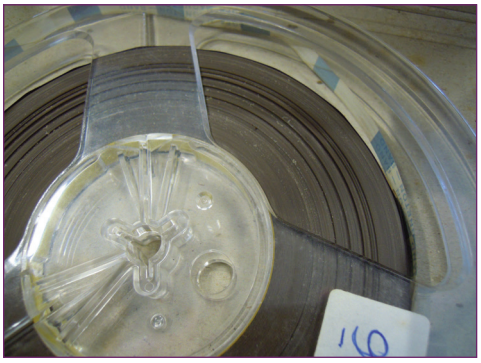

Figure 7. Original magnetic tape belonging to the work *Libera Me*.

For all of the above reasons, there is an urgent need to submit this collection to a preservation plan including its treatment, digitisation, and archiving. Despite the increasing development of new restoration techniques and technological progress, we do not know whether it is still possible to retrieve the sound content of these recordings. Notwithstanding the importance of these procedures and their recurring application, Portuguese institutions are not yet prepared to deal with this; and it is crucial to pay attention to this problem in order to take the first steps in preserving this kind of asset. Unfortunately, the advanced state of deterioration of Capdeville's tape collection only hinders researchers from accomplishing the operation as time is running out. Not only are the tapes at risk but also the possibility of holding future performances of this composer's music. The re-performance of the types of works that contain audio recordings on magnetic tape, which are not accessible, depends on a multidisciplinary effort that should include the work of archivists, musicologists, technical / audio engineers, and must constitute an overall concern of all institutions dealing with sound collections. The development of methodological guidelines for the musicological study of this kind of work contributes as a facilitator system to the public access of such collections, ensuring the availability of recordings or documents that are now partially or totally unavailable and of relevance to all users whether researchers, archivists, or educational institutions.

5. Possible solutions to preserving Capdeville's music works

The magnetic tape collection belonging to the composer Constança Capdeville encapsulates various failures in the way preservation should be undertaken. Most of her works involve traditional instruments and recorded sounds in which musical information and musical sound are closely interlinked with one unable to exist without the other. In this situation, the traditional model has to be applied (score and instruments) while recorded sounds have to be preserved onto new media.

In most cases, Capdeville's music is made up of various components such as a score, recorded music, suggestions for interpretation, and other materials often of importance to understanding the making of the piece itself (Canazza & Vidolin, 2001). Referring specifically to Capdeville's

music, including tape recordings, besides the conservation of the magnetic media, we seek to keep alive the performance; therefore all sources of information must be encompassed. Finally, this requires preserving both graphic and textual materials (score, schemes, directions), and audio materials (musical parts or the whole piece) (Canazza & Vidolin, 2001).

5.1 Methodology

Preserving contemporary music nowadays is really challenging. After the second half of the twentieth century, composers often incorporated new technologies into their works. By that reason, the conservation of music works is actually a great stimulus to institutions in charge of their longevity or even for artists / researchers that intend to re-perform a work from the past. The conservation paradigm is changing and, instead preserving testimonies of works, it is more relevant to preserve a coherent description, or new strategies of documentation, in order to facilitate the access to future transmissions and performances of works involving technology. Several initiatives and institutions are working to develop clearer models to allow this sort of preservation. An example is a methodology developed by Federica Bressan and Sergio Canazza, from Padova University, involving the preservation of audio documents. In conjunction, they have created an operational protocol, which acts as the methodology, and an original open source system that supports and automates several tasks along the process. Their approach reflects two main aspects. Firstly, "the design of a database, which works as a reconciliation of different approaches to preservation or information modelling; and secondly, the formalization of a workflow as an accordance between the theory of preservation and the laboratory practice [...]"[12] (Bressan & Canazza, 2013).

Although, the methodology presented here is based on some considerations from Daniel Teruggi, through unpublished information sent by the author himself, since he is particularly concerned with the preservation of contemporary music, specifically within the electroacoustic music context, and perceived as susceptible to adaption to Capdeville's music works. The main goal is to keep the performability of a musical work in such a way that it can be performed again at any time, and with any future technology. To ensure the preservation of performances of such kinds of music, a certain number of elements hold importance to appropriately understanding the work and its components. These elements consist in scores, instruments, sound producing or processing devices, sound enhancing description, and other complementary information. It may also include information about size, power, speed, location, and so forth. This process can be achieved through a proper identification and description work, as follows:

1) A precise list of the aforementioned elements. It is necessary to identify the active elements within a work: what is really required to perform the work. It will naturally include the score and the instruments if they exist, but also the machines or systems that will transform or produce sound, the number of loudspeakers, microphones or any technical device that contributes to the result.

2) For each intervening element, a description of its function and components as regards to the final result. It consists in a precise description about the role of each element within the work. This is an essential task since it provides information as schemas and standards needed for the work to be performed.

3) A description of the relationships among elements and the ways they correlate. It is a general plan of the work explaining the essential connections between elements and how they are functionally linked. It identifies dependencies amongst elements and difficulty points in the structure that need particular attention. It also helps to identify missing descriptions within the structure.

12 Bressan, F. & Canazza, S. "A Systemic Approach to the Preservation of Audio Documents: Methodology and Software Tools". In ***Journal of Electrical and Computer Engineering***. Hindawi Publishing Corporation, Vol. 2013, Article ID 489515 (2013): pp. 19.

4) Whenever possible; a recording of the work that serves as a result testimony. A description of how the work really sounded or looked like.

5) Additional documentation that helps in building up the process. Any element that describes, shows, explains or comments on the work (by collecting notes or composer's instructions, the testimony of musicians, actors, photos, reviews by critics, video or audio performances, and so on).

Once these are all brought together, a preservation strategy for each component needs establishing in order to minimize the preservation risks.

5.1.1. Organizing the preservation

The last five procedures involve an essential part of the task of gathering the preservation information, however, in order to complete the preservation work other actions need taking:

- Location of the constitutive elements: where are they, who is keeping them, how they can be used, who owns the rights.
- The digitisation of all materials: with regard to their long-term preservation, this represents an effective means of keeping the information together in a structured approach. Hence, it is important to digitise every possible contribution (especially paper and media) in order to convert them into coherent information sets, within which links can be established and efficient metadata gathered.
- A preservation and migration plan for each kind of media. Once the components are identified, located and digitised, a preservation plan requires establishing for each medium and for the ensemble. Migration plans have to be established from the outset in accordance with each media and their average duration time within an information system.

However, Teruggi states that satisfactory preservation work on performances, which includes electronic dimensions, should be perceived as a matter under continuous development.

6. Final reflections and conclusion

One cannot deny that the absence of tape recordings represents a huge problem able to compromise all future performances of *Mise-en-Requiem*, *Don't Juan* and other similar works. The whole magnetic tape collection of Constança Capdeville has not yet been subject to proper documentation and conservation strategies. As in the case of Capdeville's collection, there are many others scattered around, in need of study, preservation, digitisation and documentation. Such collections include the electroacoustic parts of these music works, which are also composed of instrumental performances, and thus the imperative of conserving the magnetic media coupled with the preservation of the musical performance through its documentation.

Concerning analysis of Capdeville's music, the development of a universally applicable analytical methodology constitutes a difficult task yet one nevertheless still needs to opt for the proper process based on some of the aforementioned useful tools while adapting them to each particular situation.

The study of Capdeville's music works including recordings on tape is part of an ongoing PhD research project, which aims, through the score and its analysis, in conjunction with the recordings, their preservation and their documentation, and other complementary information, to make the reproduction of Capdeville's works possible despite their very particular characteristics stemming from her embracing of the music-theatre genre. Future goals involve preserving these works through a simplified description and structuring process but, in order to achieve this, several issues first need reviewing and appropriately establishing. This work may also serve as a basis for future work; and the preliminary methodology aforesaid might contribute to establishing uniform tools that counteract the dispersion of the work done thus far.

The case of Constança Capdeville demonstrates the need to explore methodologies for incorporating the involvement of those recordings used in real time during the performances in order to allow the replay of these works, moreover these recordings are crucial inputs to Portuguese Music History. This should therefore represent a core concern of institutions in charge of collections containing such recordings as the formats and equipment are swiftly becoming obsolete and interventions are crucial. Otherwise, we shall certainly lose this cultural heritage.

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MANAGING BORN-DIGITAL AUDIOVISUAL MEDIA: A CASE STUDY OF SCIENTIFIC VIDEO COLLECTION STEWARDSHIP

Margret Plank, German National Library of Science and Technology, Germany

1. Introduction

The German National Library of Science and Technology (TIB) is one of the world's largest specialized libraries in the fields of engineering as well as architecture, chemistry, computer science, mathematics and physics. TIB has established a competence centre for non-textual materials in order to improve the access and the use of audiovisual media, 3D Objects, research data and software.

Audiovisual scientific media are often shared via web portals like YouTube[1] or Vimeo[2], where videos are provided with little or no metadata. Further it is unclear how long content will be archived and how it can be cited consistently. This makes the search for and the re-use of audiovisual media difficult and valuable scientific information remains hidden or gets lost. In order to improve the accessibility, citability and the sustainable use of scientific videos, the German National Library of Science and Technology (TIB) in cooperation with the Hasso Plattner Institute (HPI)[3] has developed the TIB AV-Portal. This paper addresses the workflow TIB has established in order to manage born-digital audiovisual content across its lifecycle. The TIB AV-Portal shows how to overcome the appearing challenges regarding scientific videos.

2. Acquisition

Sharing scientific results via audiovisual media has become an important part of scientific communication. "A video forum has the potential to make the knowledge gained from scientific communication richer and more useful, by providing a deeper understanding of the experiential aspects of the published contributions (Löwgren, 2011)".

The explosive growth in scientific video content was the trigger for us to develop a video portal which was aimed to become a reliable infrastructure for scientific videos.

Because there are so many online video plattforms and channels, for ours to stand out, it is important that we have a unique profile and offer a reliable infrastructure. This not only sets our content apart from other channels, it also ensures that we can make better decisions about what videos we acquire and curate.

The source of inspiration for the content of our AV-Portal comes mainly directly from national and international Universities and Scientific Institutions, which provide e.g.

- Recordings of scientific conferences, lectures, colloquia, panel discussions and other scientific lectures, talks and discussions.
- Recordings of experiments from the area of research and development, presentation of technologies and practices of outstanding scientific importance
- Microscopic images, images taken using special cameras (such as thermal cameras) and other imaging techniques
- Documentation and presentation of research work and results
- Modelling, simulations and presentations of specialised software for certain scientific purposes

1 https://www.youtube.com/ Date Accessed: 2016-12-28.
2 https://vimeo.com/ Date Accessed: 2016-12-28.
3 https://hpi.de/ Date Accessed: 2016-12-28.

- Presentations of scientific organisations, self-portrayals (film clips and slide shows) of research facilities and companies, mainly with a scientific content
- Documentaries, reports and portraits on video (for example, of architects and their buildings)

These videos span the breadth of topics across Technology, Engineering, Architecture, Chemistry, Information Technology, Mathematics and Physics and wherever possible they are published on an open-access basis, the users being free to watch, embed and download.

We also feature a historical film collection, from the former IWF Wissen und Medien gGmbH, which TIB was entrusted with in 2012[4]. The collection comprises around 11,500 analogue and digital scientific films related mainly to technical and scientific subjects, as well as biology and ethnology. Although most of the research films, university teaching films and documentaries were created between the 1950s and 1980s, the collection also contains a number of earlier cinematographic works, some of which date back to the 1910s. The videos are made available step by step to the public via our portal as soon as the rights could be cleared.

A complete new genre in science communication is videoabstracts. A videoabstract is the motion picture equivalent of a written abstract[5]. Typically 3-5 minutes long, this kind of video helps the reader to get a quick overview of a scholarly paper or research article. Authors have the opportunity to provide background information about their research, and to present their research activities to a wider audience. A videoabstract is often directly associated with a scientific paper that has been accepted and published by a journal. Among the journals which already accept videoabstracts are Elsevier[6], Wiley[7], IOP Science[8], IEEE Xplore[9] and the American Chemical Society[10].

TIB cooperates e.g. with the Open Access publishing company Copernicus Publications[11] regarding videoabstracts. Scientists can simply use the TIB AV-Portal to publish video abstracts or supplementary videos to the specialist articles they publish in one of Copernicus' Open Access journals. The cooperation offers the authors the possibility of using videos in a scientifically sound way to reach out to other scientists and beyond, boosting the impact of their work.

Another interesting genre, which fits our profile is conference recordings. Traditionally, the results presented at scientific conferences are published in proceedings. Today, in many cases those talks are also recorded and published after the conference. For us, this means that we harvest videos from conference websites, in many cases even complete series of recordings such as FOSS4G 2016[12], EuroPython [13] 2014 or Free and open Source Software Conference (FrOSCon)[14] (Drees 2016).

4 https://www.tib.eu/en/search-discover/special-collections/iwf-media-collections/ Date Accessed: 2016-12-28.
5 https://en.wikipedia.org/wiki/Video_abstract Date Accessed: 2016-12-28.
6 https://www.elsevier.com/ Date Accessed: 2016-12-28.
7 http://eu.wiley.com/ Date Accessed: 2016-12-28.
8 http://iopscience.iop.org/ Date Accessed: 2016-12-28.
9 http://ieeexplore.ieee.org/Xplore/home.jsp Date Accessed: 2016-12-28.
10 https://www.acs.org/ Date Accessed: 2016-12-28.
11 http://publications.copernicus.org/ Date Accessed: 2016-12-28.
12 https://av.tib.eu/series/253/foss4g+2016+bonn?0 Date Accessed: 2016-12-28.
13 https://av.tib.eu/series/248/europython+2014?53 Date Accessed: 2016-12-28.
14 https://av.tib.eu/series/231/froscon+2015?106 Date Accessed: 2016-12-28.

3. Indexing and digital preservation

Our media asset management system (MAM) professionally indexes the videos. The system has its own transcoders that handle all established codecs and creates statistics. The system's underlying metadata schema on standardised registration of non-textual materials is based on the current DataCite Metadata Schema[15] and has been expanded by a few elements required for the detailed description of an AV medium. The metadata schema is made available to media providers online[16] Metadata is supplied by the content providers via an XML file and describes formal, technical and content-related features of the video. Formal metadata of the video includes, for example, title, author, publisher and licence. Technical metadata are, for example, file size and duration. Content-related metadata are subject area, abstract and keywords.

In light of the rapidly increasing number of digital AV media and the necessity to index them at the segment level, solutions for automatic indexing are needed, because this is not manageable manually (Neumann and Plank, 2013). Therfore, in addition to reliable authoritative metadata (Dublin Core[17]), time-based metadata is generated by automated media analysis. A combination of state-of-the-art multimedia retrieval techniques (Snoek et al, 2007) with semantic analysis allows us to provide content-based access to videos at the segment level and the ability to link data to new knowledge: the spoken language, text overlays and image information contained in the video (Blümel et al, 2012) are automatically analysed and semantically indexed by using subject specific parts of the Integrated Authority File (GND)[18]. This context information enables searches that make use of synonyms, broader and narrower terms. The portal also allows for cross-lingual retrieval (German/English) (Strobel and Plank, 2014). The English identifiers were obtained by mapping GND entities onto data from other standards. These standards include DBpedia[19], Library of Congress Subject Headings (LCSH)[20], mappings from the Multilingual Access to Subjects (MACS) project[21] and the WTI "Technology and Management" thesaurus[22].

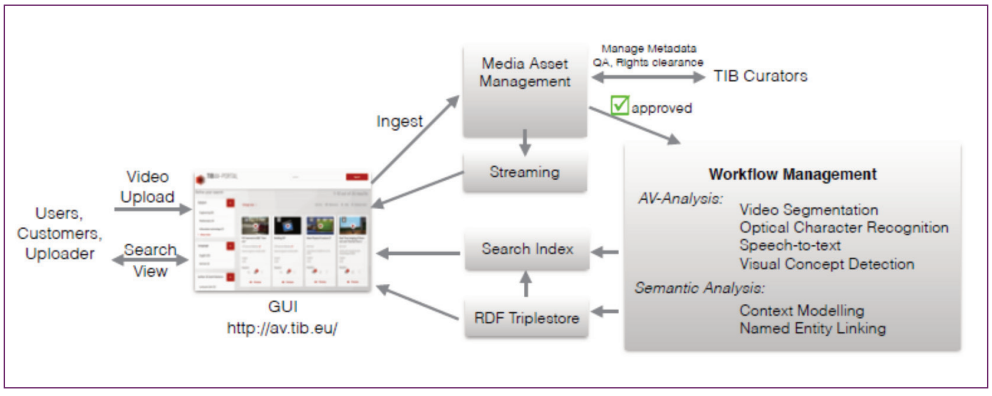

Figure 1. The overall architecture of the TIB AV-Portal (Waitelonis, Plank, Sack 2016).

15 https://www.datacite.org/ Date Accessed: 2016-12-28.
16 https://av.tib.eu/about Date Accessed: 2016-12-28.
17 http://dublincore.org/ Date Accessed: 2016-12-28.
18 http://www.dnb.de/EN/Standardisierung/GND/gnd.html Date Accessed: 2016-12-28.
19 http://wiki.dbpedia.org/ Date Accessed: 2016-12-28.
20 http://id.loc.gov/authorities/subjects.html Date Accessed: 2016-12-28.
21 http://www.dnb.de/DE/Wir/Kooperation/MACS/macs_node.html Date Accessed: 2016-12-28.
22 https://www.wti-frankfurt.de/images/themenpakete/english/en-tema.pdf Date Accessed: 2016-12-28.

All videos is allocated a unique citation link (DOI name) in order to make them citable on a permanent basis[23]. DataCite[24] registers the DOI via the API interface. Additionally the AV Portal offers a time-based citation link. Using the open standard Media Fragment Identifier (MFID)[25], a citable DOI is displayed for each video segment.

Non-textual materials are digitally preserved if they are particularly important for science and teaching and of appropriate technical quality. TIB operates a professional digital preservation system called "Rosetta"[26], which is jointly used by the German National Library of Medicine (ZB MED)[27] and the Leibniz Information Centre for Economics (ZBW)[28].

4. Licencing

By concluding a license agreement, the content providers specify the terms and conditions of use, and grant us permission to provide the audiovisual media via our portal.
If the content providers do not own the necessary rights, they are asked to first contact the originators or other rightholders of the films before placing the audiovisual media at TIB's disposal.

If the content providers are the originator of the audiovisual media or if the rights have been transferred to them, they can choose between an open access licence and a declaration of consent, enabling them to decide how they wish to place the material at TIB's disposal.

4.1 Open Access Licence

With an open access licence, the content providers grant users as many rights as possible to the extent provided by law, and permit the diverse use of their film, fostering scientific exchange in the digital environment. We recommend the "CC-Namensnennung – Deutschland 3.0" licence, which ensures that the originator is acknowledged and permits the comprehensive use of audiovisual media in research and teaching.

4.2 Declaration of Consent

TIB is granted a simple right of use of the audiovisual media, which it is permitted to make available via its portals. Users may watch the film online or download it. However – in contrast to all CC licences – users may not forward it to third parties or make it available online themselves.

If the specified types of licensing do not suffice, TIB will endeavour to find an individual licensing solution.

23 https://www.tib.eu/en/publishing-archiving/doi-service/ Date Accessed: 2016-12-28.
24 https://mds.datacite.org/static/apidoc?lang=de Date Accessed: 2016-12-28.
25 https://www.w3.org/TR/media-frags/ Date Accessed: 2016-12-28.
26 https://www.tib.eu/en/publishing-archiving/digital-preservation/ Date Accessed: 2016-12-28.
27 http://www.zbmed.de/ Date Accessed: 2016-12-28.
28 http://www.zbw.eu/de/ Date Accessed: 2016-12-28.

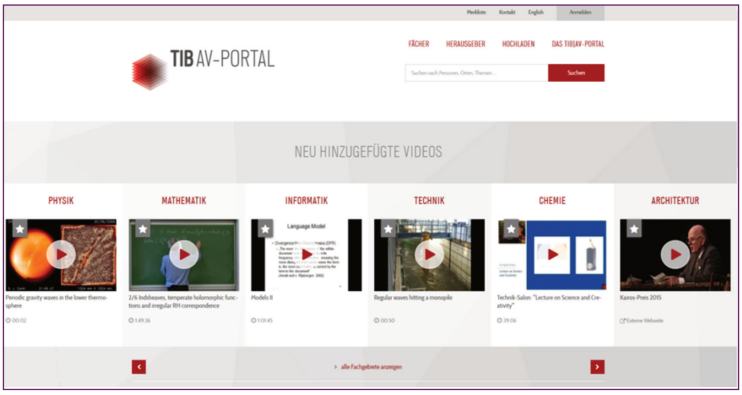

Figure 2: TIB AV-Portal: Landing page (av.tib.eu).

5. Access

The AV-Portal was created in a joint project of TIB together with the Hasso Plattner Institute (HPI). In 2011, a semi-functional prototype of the AV Portal was developed; in 2012-2013, the system was further developed and the beta version was created. Since spring 2014, the system has been fully operational at TIB. Our portal currently contains around 5,000 videos from the field of science and technology, as well as some 2,400 film credits with external links to other websites.

To date, our AV-Portal has had over 150.000 visitors. About 70% of our audience is from Germany, about 20% from other European countries and about 5% from the US. We have a wide geographical range with a total of 300.000 page impressions. Our viewers come from 154 different countries around the world including even Antarctica. Producers of scientific films can simply upload their videos via an online form or FTP (file transfer protocol) to the portal free of charge.

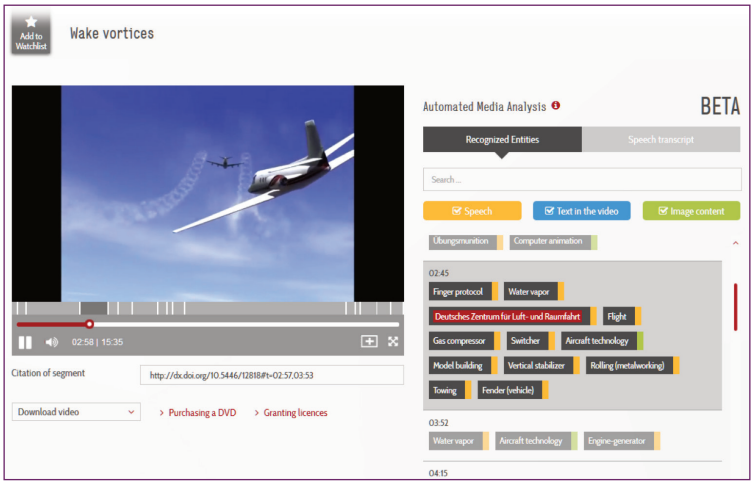

Figure 3: TIB AV Portal: Detail page. http://dx.doi.org/10.5446/12818#t=02:59,03:53.

Thanks to automated, semantic video analysis our portal offers access at the segment level, improving keyword-based search by tagging materials with entities. This leads to better and more precise search results. In addition, the search results of the AV Portal can also be specified thanks to content-based faceted navigation. The AV Portal contains facets for subject area, publisher, year of publication, licence, terms found in the video, images and organisations.

Reaching a wide audience is part of our strategy so we like to put our content where people are and make it available beyond the AV Portal itself. Therefore TIB has made the metadata and preview files it has licensed available to partners such as EUROPEANA[29], the Deutsche Digitale Bibliothek[30] and the Filmarchives Online[31], as well as to many other institutions. Further expansion of cooperative activities is underway.

6. Linked Open Data Service

Recently, TIB has started to publish authoritative as well as time-based, automatically generated metadata and thumbnails of videos, for which a use has been agreed under the CC0 1.0 Universal licence[32], as linked open data for further use in the standard RDF format (Waitelonis, Plank, Sack 2016). In the future, the datasets will be updated quarterly. In addition, users can attend a tutorial on our website[33], providing a brief overview of the structures of the datasets of TIB's AV Portal. The tutorial explains how datasets can be imported into an RDF database and searched via SPARQL (Marin Arraiza and Strobel 2015).

7. Conclusion

Today's researchers move beyond text as their publications are enhanced by a variety of digital assets such as research data, video, graphics, models and even software code. However, only a negligible proportion of those digital assets are accessible at present, whilst scientific texts are, in principle, sufficiently well-documented and available. This can lead to serious problems when it comes to verify, reproduce and reuse the research results.

This paper summarizes the current status from the efforts undertaken by TIB to ensure the longterm provision of scientific videos, video abstracts and video supplements in a legally sound manner. The video hosting arrangement includes indexing according to international standards, semantically enhancement, transcription, digital preservation and finally the allocation of a DOI name. Scientific videos from the TIB core subjects such as Technology, Engineering, Architecture, Chemistry, Information Technology, Mathematics and Physics are constantly acquired. In order to optimise the material's discoverability the TIB AV-Portal - a web-based platform featuring state-of-the-art multimedia retrieval technology and semantic video analysis - was developed.

Thus this library-operated service infrastructure underlines the way that the output of researchers is understood today: a combination of journal article, data sets, and model code, as well as video, a conference recording, animation supplements – all linked to each other through Digital Object Identifiers.

29 http://www.europeana.eu/portal/ Date Accessed: 2016-12-28.
30 https://www.deutsche-digitale-bibliothek.de/ Date Accessed: 2016-12-28.
31 http://www.filmarchives-online.eu/ Date Accessed: 2016-12-28.
32 https://creativecommons.org/publicdomain/zero/1.0/ Date Accessed: 2016-12-28.
33 https://av.tib.eu/opendata Date Accessed: 2016-12-28.

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Waitelonis, J., Plank, M., Sack, H. (2016). TIB AV-Portal: Integrating Automatically Generated Video Annotations into the Web, in Proc. of 20th International Conference on Theory and Practice of Digital Libraries (TPDL 2016), Springer.

CHALLENGES OF TEACHING SOUND STUDIES THAT INCLUDE PRESERVATION ISSUES IN MALAYSIA

Ahmad Faudzi Musib, Universiti Putra Malaysia, Malaysia
Gisa Jähnichen, Shanghai Conservatory of Music, China

1. Introduction

At the Music Department of Universiti Putra Malaysia, that since 2 years offers university-wide the opportunity for audiovisual archiving in ARCPA (Audiovisual Research Collections of Performing Arts), the implementation of a course named 'Sound Studies" is planned.

If we say 'planned', it means that in the light of shaping a better profile of each of the few tertiary music education units within Malaysia, each of these units should find some special focus that enriches the academic landscape and attracts industrial attentiveness. If done in an effective way, students from all over the region can be educated on high level and serve then as multipliers in their local homes or home countries as audiovisual archivists.

Sound Studies as a university subject is not new though relatively new to Malaysia.

Some dedicated composers cum sound engineers tried to get into the field of sound studies in order to provide creative tools to be used for musicians or for stage performances such as Hasnizam Abdul Wahid (UNIMAS, University Malaysia Sarawak) or Mohammad Azam Sulong (UPSI, Universiti Pendidikan Sultan Idris) from various educational institutions in Malaysia. The idea, however, that sound studies may cover human ecology of sound and within this area a science on preservation approaches to sound and audiovisual material is new.

2. Main problem

One of the big problems is that practical aspects of sound are seemingly strictly separated from reflective academia.

A recent paper by Chan claims to be the first on this topic. He seems to separate groups of people affected such as students from non-students: "The objective of this paper is to determine if the present state of noise exposure in the Malaysian living environment can be both a research and practical problem from the perspective of music education, by looking into the quality of the noise and its implications on the growth of a person." (Chan, 2015: 32).

The paper comes later up with some insights on conditions in "indoor rooms" where ceiling fans and air conditions are "heavily" used and compared with the given standards on occupational health that may impose (1) a physical threat to the student's growth and, obviously to his surprise, (2) a threat to the life quality of the student (ibid: 34) using a former stated theoretical framework from another scholar who had some quite different goals.

The method how such studies are produced in the academic world makes wild measurement collections of "soundscapes", school corridors, and even "indoor rooms" a numerical necessity in order to produce written texts on facts that are practically known to everyone. In its concluding remarks, Chan recommends teachers to send students with hearing difficulties to the medical doctor, to draw their attention to "soundscapes", which are of course out there somewhere, and to use identified soundscape elements for creative performances.

3. Other problems

The most interesting of the article (Chan 2015) is, however, that nearly all problems faced in order to get to the point of promoting a truly advanced course on sound studies are concentrated and factually demonstrated within the text:

- The priority of technical equipment that completely replaces any social and historical approach to what sound means in an actual place and among actual people;
- The priority of formal settings given through standard rules for measurements as well as for writings;
- The eclecticism of perspectives and the quasi-scientific choice of data that fit the technical equipment;
- The importance of being Malaysian while researching sound in Malaysia;
- The hiding behind educational matters in the tone of being worried about something that does not affect anyone except the young generation;
- The obvious tendency not to question the cause of a danger but the delivered reports on it, which makes academicians ultra-cautious - Prufockian - in naming social causalities;
- The deeply ingrained unawareness of sound as a social, historical and individual belonging that permeates any type of environment.

In other words: the students get deaf because they weren't aware of the danger. So, it's their fault. And teachers have to guide the students in becoming aware of it, if possible through playing around with 'soundscapes'. That would then make a good teacher as we learn from Chan's article.

4. Change of perspectives

Things are different, if they are looked at from a global or at least regional perspective. ARCPA[1], the small research oriented university audiovisual archive established at the UPM[2] music department was an issue that had to be defended (see earlier reports: Musib, Jähnichen & Meddegoda 2014; Jähnichen 2015).

If the establishment of ARCPA was already a great effort not only from the technical aspect but from the aspect of changing attitudes and mind sets within the academic environment of the largest public Malaysian University, one could wonder what the new course will mean to the involved parties.

While audio engineering and 'digital creativity' is a widely accepted business, it seems to be tremendously important to also attract interest into sound studies that include preservation of sound recordings, since a vast amount of recordings available in the region are shortly before their expiry date.

The cultural situation in Malaysia nurtured over many decades a quite careless dealing with those resources that are stored under difficult conditions. Latest by now, it is time to improve the situation through educating man power and – at the same time – through teaching future users of documents preserved in AV archives.

1 Audiovisual Research Collections of the Performing Arts
2 Universiti Putra Malaysia

Finally, taught preservation efforts in accordance with an increasing awareness of sound as an environmental condition is examined in this paper based on philosophical as well as actual observations made during experiments in Padawan, Sarawak, between 2012 and 2015. The following scheme summarizes the many factors influencing the establishment of 'Sound Studies' as a tertiary educational subject in Malaysia[3]:

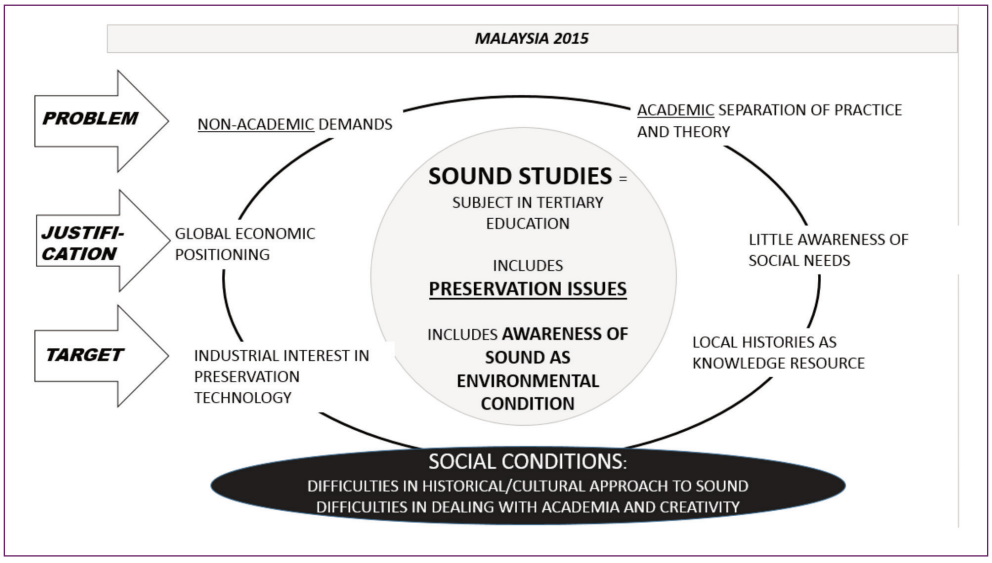

Figure 1: Scheme of influencing factors on the introduction of Sound Studies as subject in tertiary education (Malaysia).

5. Attracting attention

A first attempt is to draw the attention of non-academicians to the possibilities that an audiovisual archive can provide in order to serve the community. This point can't be over-emphasized as this is a crucial moment in justifying audiovisual archiving.

Recently, Ahmad Faudzi Musib developed an effective work flow for contextual sound preservation of selected string instruments in rural and urban areas of Borneo. To be more precise, in Anah Rais, a small longhouse village of Padawan, a subregion of Greater Kuching, Sarawak. He applied new aspects of high resolution recordings and technical highlights set into a spatial framework, which are worth to be shared. In connection with his study that is explained in the second part, I am going to further develop this approach and expand it regarding variously constituted definitions of 'musical life' within a selected space and time.

Musib produced sound analytical findings that help to understand how the concept of a "sounding home" works among people with different cultural conditions. Core questions are whether contextual sound is indicative for a spatial sound memory and if so, which role plays the 'musical life' of a place in a time through amplifying recognition patterns and creative impulses.

The principle is easy to understand and to explain: Humans are used to listen to the entire sound offered. However, attention is mostly paid to those sounds that are considered to be of relevance in the flow of conscious living. They contribute to orientation, decision making and patterns of response within a communication network.

3 Scheme by the authors.

Musical life is part of it. Musical life as embedded in sound events can be seen as contextual sound apart from primary attention.

The problem discussed here is the factual division of foreground or focus and background or contextual environment. Further, the discussion is about how sound may contribute to patterns of human movements, to individual decisions and to spatial memory. It is recommended to eventually use perspectivism as discussed in Heonik Kwon's paper on "Perspectivism in Social Anthropology" (2012). It can help to compensate for some weaknesses that place the rather technical 'quality of recorded sound' into the centre of any preservation efforts.[4]

The experiments done in a village of the Bidayuh situated in Padawan on Borneo show that contextual sound preservation is an important tool in tracing cultural memory and in placing oneself into a local history which includes present and possible future.

Preserving a sound context in order to cater additional information needs for the future is not a new issue. Most of academic writings do so since the very beginning of musicology. But they do it without sound. Places, times and agents are described in a rather static way as words can't indicate the same information compared to sound which is in its nature a dynamic and a moving feature strictly bound to an actual time and a real place.

Listening to recorded sound triggers the re-construction of time and place. If there is no experience for that, people do individually imagine time and place. If they do not imagine, the technical device such as a CD player or the CD rack from where the sound carrier was taken one day becomes the time and place reconstructed.

Here, a model is developed that includes sound environmental perspectives. The main question is 'How do these people [horizontal categories] here those people [vertical categories]'. The answers were collected through observation and informal conversation with the villagers. Most interesting are the individually different sound memory patterns that are introduced following this first scheme.

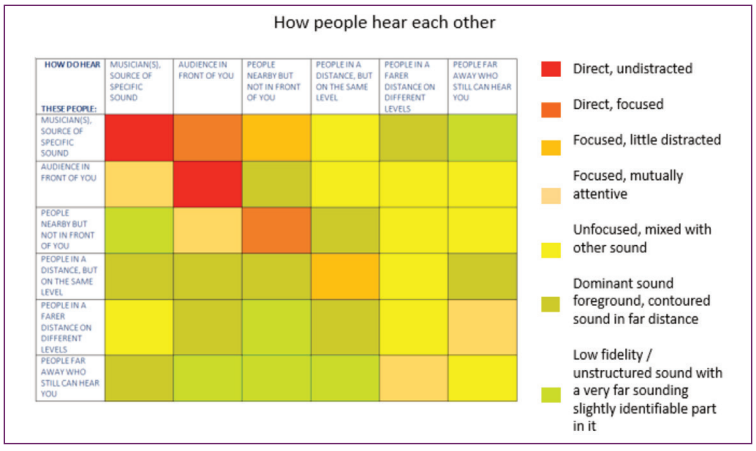

Figure 2: How people hear each other.

The range of focus, distracting sound, contoured sound, dominant sound and identifiable parts in it is large and individually different depending on the personal profile of a community member or a community group. In some cases, memory patterns can follow the focus on the main source and transitional perceptions from tolerance to disturbance.

4 Kwon, Heonik (2012). Perspectivism in Social Anthropology. ***CultureNature*** *1*, 59-68.

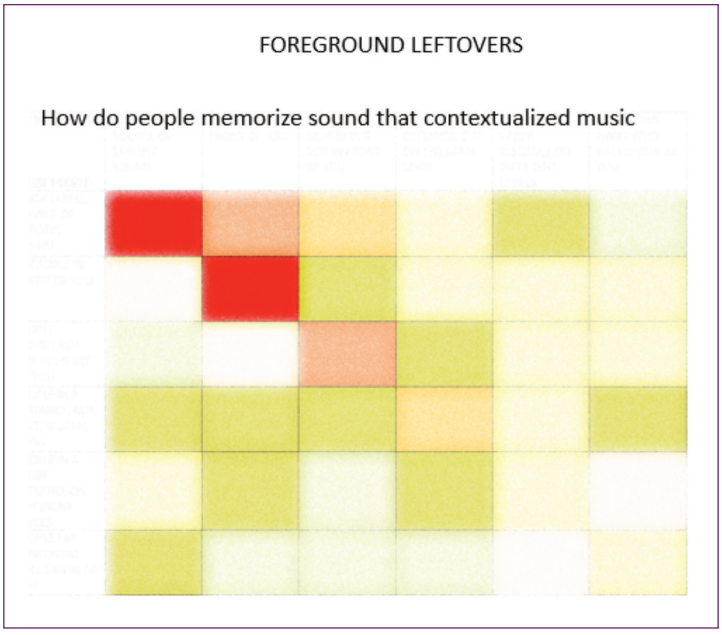

Figure 3: How do people memorize sound that contextualized music (1).

Other individual memory patterns may completely delete stronger transitional perceptions.

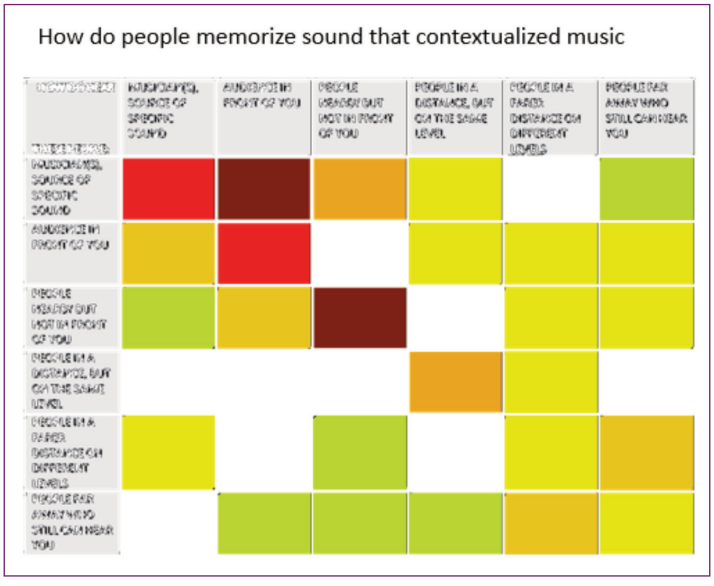

Figure 4: How do people memorize sound that contextualized music (2).

Again other memory patterns show indistinct and overlapping structures that include a number of unequal perceptions as a whole construction.

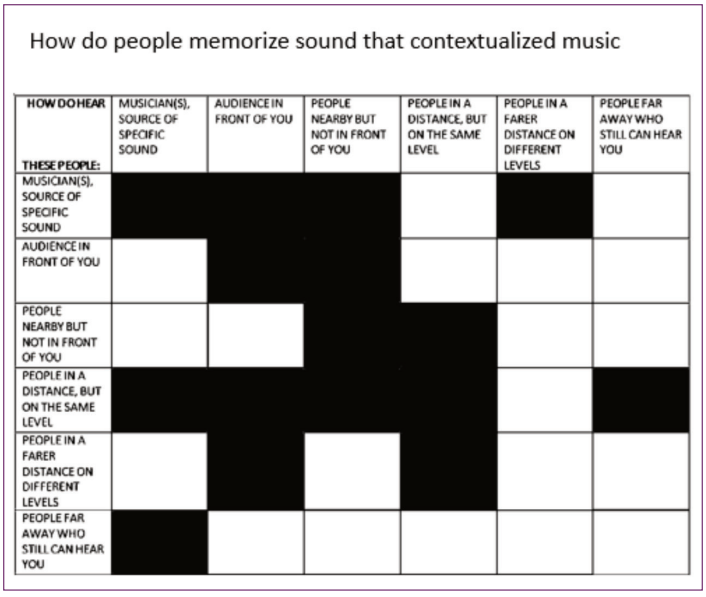

Figure 5: How do people memorize sound that contextualized music (3).

Or the memory draws on so called 'cleaned' recordings that are found on world music cassettes and CDs. By repeatedly listening to these recordings, the entire contextual sound is hidden from being traced as a stimulus.

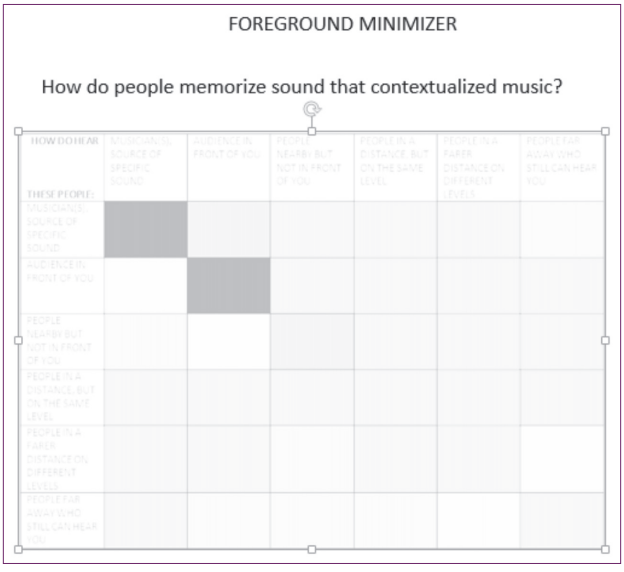

Figure 6: How do people memorize sound that contextualized music (4).

Most people who have a live experience with the sound source will add a blurry context to the cleaned sound.

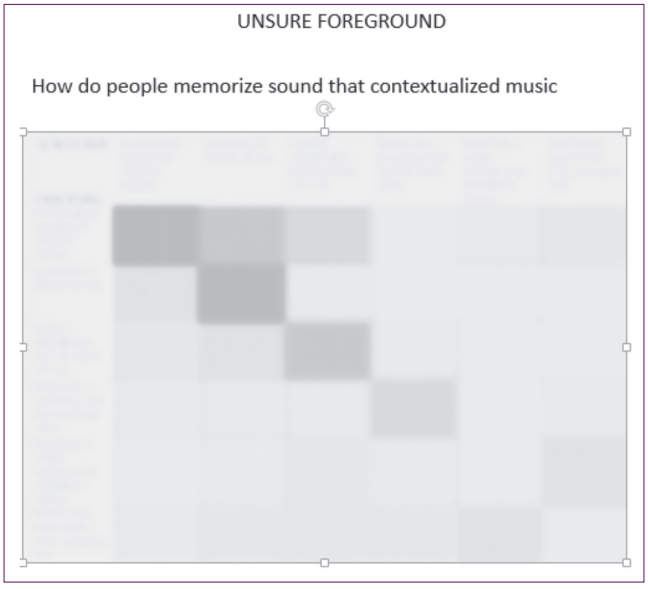

Figure 7: How do people memorize sound that contextualized music (5).

Howsoever those memories work with sound sources, the initial scheme that represents already an abstract summary is increasingly vulnerable through modifying sound re-production. Also, the scheme applies only on people who were or are familiar with the main sound source and had the opportunity to observe different constellations at different places and in different times. And yet, different individual perspectives will emphasize different perspectives:

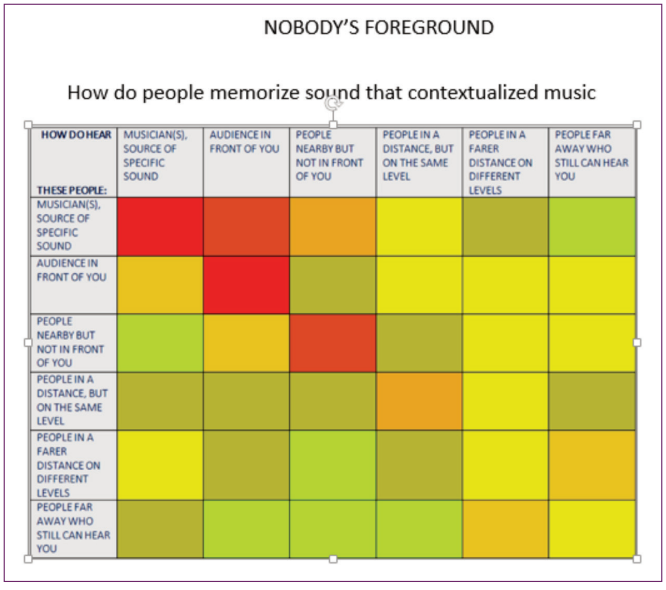

Figure 8: How do people memorize sound that contextualized music (6).

Finally, each actively involved participant has another hearing profile and differentiates sound in various ways. These profiles have definitely an impact on the sound memory within a community or a group of people, not only how they hear, but how they are heard.

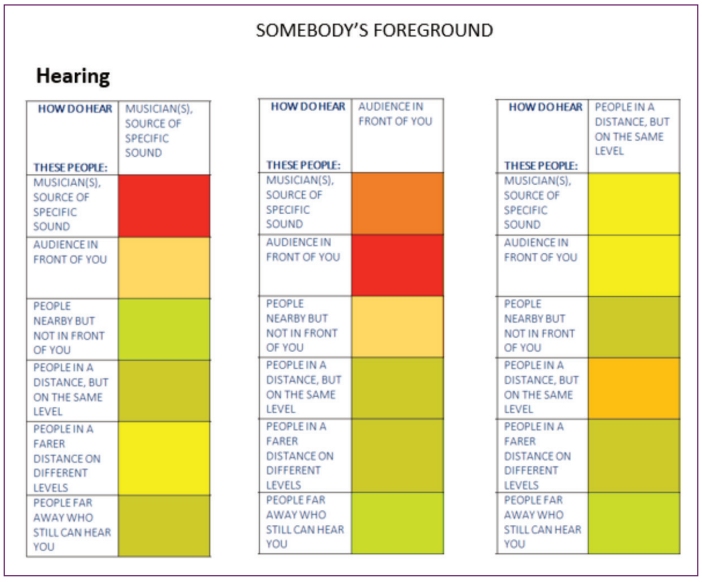

Figure 9: Hearing – somebody's foreground.

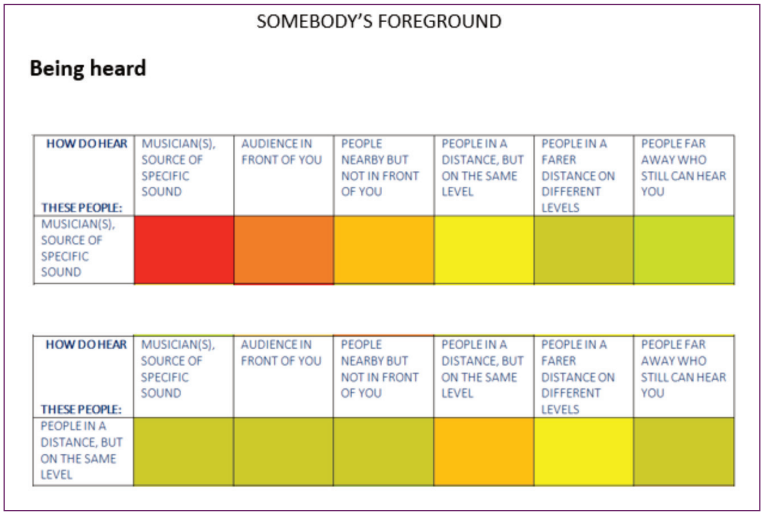

Figure 10: Being heard – somebody's foreground.

Sound memories differ according to the frequency of sound awareness in relation to a spatial order as here between a farmer, a musician and a homeworker.

Putting the outcomes of the study into its historical context and summarizing dynamics of changes in the meaning and practice of specific sound as the sound of the pratuokng[5], obviously many 'sounds' if not all are inter-connective throughout the times. They can be emblematic, surrogating or pragmatic, they can be just habitual, they can be newly added sounds. Whatever they are and under which aspect or using which theory they exist, they are connected to other sounds, even though nobody knows, even without setting an ecological framework.

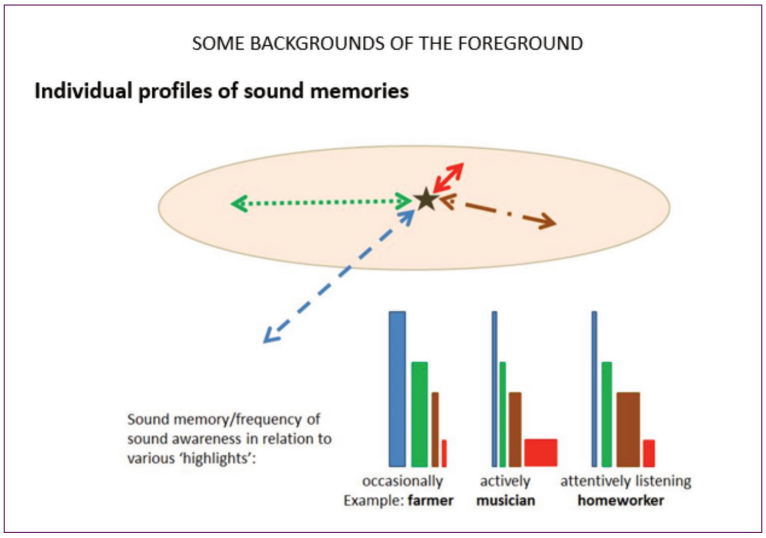

Figure 11: Individual profiles of sound memories.

The fore-/background aspect can be taken as a point of departure to explain this independently existing inter-connectivity between listening habits, main 'profession', and individual spectrum of activities

To give a parallel example: Visual depictions always include background and details of objects that are not in the main focus. Only the visual context makes a drawing or painting informative and enjoyable. Sketches of single details are considered incomplete. What about sound?

Or another example: The dancer is foreground, the musicians are background. That may apply on the visual aspect. What about the sound? Also, the dancer's sound is not arbitrary. There are bangles, steps on the bamboo flooring, and there are expressions of appreciation on the side of those who watch the performance. The idea of an 'ecological framework' becomes obvious, if any of these sounds is cut off.

One of the most striking background-sounds is the sound of walkers on the longhouse flooring. To the people of Annah Rais, this sound is as natural as the wind, the water, the birds and frogs around. Recently, I could observe a very interesting documentary made by Juan Javier Rivera on a recording situation in South America. People were gathered in the darkness of the night and all possibly 'disturbing' sound was tediously avoided. The documentary finishes with not having recorded anything. Looking at these two cases, the absurdity of 'cleaning up' becomes obvious. The outcome is not 'clean', it is incomplete.

5 Pratuokng is a tube zither with 5-11 strings made of skin-stripes of the same bamboo tube (Jähnichen & Musib 2013).

On the map below, the performance area and the usual areas of daily activities are drafted. They mark not only different distances but different experiences of sound.

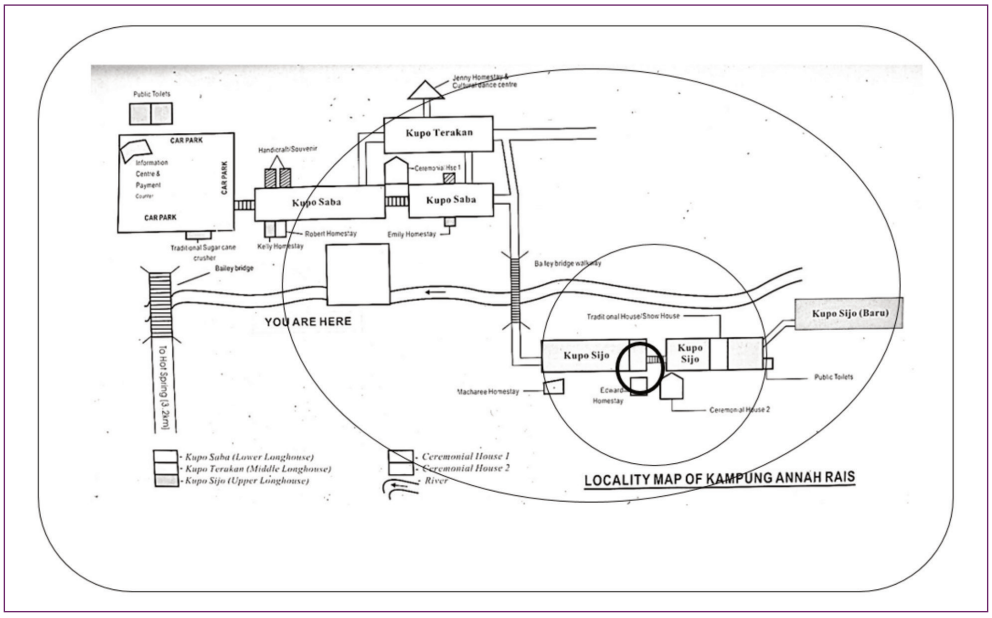

Figure 12: Map with auditory zones.

In the experiment, the author and his friends were simulating space categories that are captured simultaneously to provide a choice of perspectives. That delivers an uncompromised picture of sound experiences.

Following the suggestions implied in this experiment, we could be able to hear, how a place sounded 20 years ago at lunch time or at night, we could hear how it sounds if moving in different directions as if having 3D visuals with real surround sound. What if additionally to the visual invitation to live at a place, to visit a concert, to walk through a shopping mall or through a park, the sound could be provided as it is perceived from various 'highlights'? Technically, these options are possible and attract some attention. It is the understanding of a need for the ecology of sound in life that is certainly missing. In consequence, the understanding of a need for audiovisual archives with qualified staff is partly missing as well.

Sound indicates time and space. Places live with sound. Sound is one important attribute of time and space. It can be a tool for time and space recognition. Music is a distinct sound within this sounding world. Also, the experiment indicates that villages are not quiet. Cities are not noisy. Quietness and noise are relative. It is the meaning one gives them that makes them quiet or noisy. These and many other aspects can play a role in finding auditory shapes, auditory meanings, and auditory changes.

Essentially, it is time to put any type of distinct sound, including all that what is called music, into a wider context of perception. Audiovisual archivists can pioneer in applicative sound ecology.

Summarizing the findings and observations so far:

- The way how recordings of pratuokng and other local instruments are made does not fit any of the given 'contextual sound profiles'.
- While playing an instrument is not confined to the instrument's body, the sound source is mutually changing its actual context.
- The contextual sound defines to a high percentage a spatial arrangement of sound sources with and without focus.
- In order to preserve sound, its sound context has to be preserved as well through spatial, temporal, and individual options.
- Temporality becomes increasingly a factor for contextual sound preservation as time influences all sound in which the main sound source is embedded.
- Memory draws on spatial hearing as well as on recognizing moving sound in a perceptible time period.
- Sound isolation as experienced in high tech performance venues deletes temporal and spatial features.
- This is caused through 'pretending spaceless eternity'.
- The only leftovers from an authentic experience is the audience trying to keep quiet.
- However, most of the memorable context to any musical sound in focus is context indicating and includes temporal and spatial features.
- Today, preserving music could technically and should ethically include its sound context to keep not only individual memories alive. Any preservation efforts will have to include the aspect of 'sound life' around its main target.
- Only then it is possible to explore a 'musical life' apart from time and space.

Another way to attract attention is an interdisciplinary embedding of skills and knowledge into a wider academic and industrial context and to connect them with the communities affected. In result, this approach helps a lot in promoting not only sound studies but awareness about historical sound events and future possibilities of preserving contemporary sound.

6. Some thoughts and an experiment

In the context of earlier sound production, i.e., we may rise the question "How did people hear the real thing?" and try to project a possibility of how one can listen back into the past. An experiment with parallel digital and analogue recordings may try to figure out how the real music behind the recordings on now obsolete carriers might have been. The idea derives from a few simple thoughts: If one can produce a profile of unwanted sound and subtract it in sum from a recording, there should be also the opposite way: One should be able to detect a 'wanted' sound and add in sum to a recording. Today, there might be a possibility to detect in synchronous live recordings the principal differences between widely obsolete and high standard digital recordings. The findings can lead to an applicable algorithm or a model tool that helps to recreate a near to true sound environment which could be heard live in the past when these obsolete carriers were still standard carriers. This aspect plays an important role in a wider concept of preservation applied on postcolonial cultures with remarkable discontinuities in social developments.

The fast market turnover of recording formats in the past ten years makes current material often obsolete (Seeger, 2007: 00:00:00-00:00:30). Carriers used for recordings in the twentieth century might not be played back in the twenty-first century due to systems and format incompatibility of playback and recording devices. On the other hand, current technology can restore sound from whatever carrier more and more reliably. Overall, audiovisual preservation can be generalized into two main necessities. The needs are preservation of the medium that holds the content, and the preservation of the content itself. Most of the medium such as wax cylinder, vinyl's or phonograph, open-reels, cassette tapes, mini discs, compact discs, tapes in the video home system or VHS and all other audiovisual carriers are unstable (Musib, 2015:33-34). Therefore the need for migration of audio and visual materials to more stable media is essential. "The process of signal acquisition in real-time, may lead to some constraint and that is

time. Ethical issues and quality should never be bargained" (Wallaszkovitz, 2012: ARCPA 2053, perf). Monitoring every second of sound may be tedious, but neglecting the process may lead to poor signal extraction (Musib, 2015:33-34).

In addition to physical preservation, conservation efforts towards preserving the content of audio and visual recordings of historical events of the past and future have always a priority. To name a few research articles regarding future thoughts of audio preservations from the perspectives of context were Musib in his thesis regarding contextual sound preservation through collecting sound via 'technical highlights', Umashankar Mantravadi's article "Survival of traditional performance under different acoustic conditions" presented at the 43rd International Association of Sound and Audiovisual Archives (IASA) Conference in New Delhi, India, in which he reported on documenting and archiving acoustic properties of an old temple used as a theatre with the aid of 'impulse response' as a tool. Other articles appeared in the context of city design and architecture (Jones 2005).

7. Methods used in the experiment

The research applies qualitative research methods, especially recording experiments leading to a descriptive analysis through testing audio recordings. In the process, simultaneous audio recordings were made on different carriers such as the normal and chrome bias cassettes tapes, and a digital audio recording of 44kHz sampling rate (minimum) utilizing appropriate audio recording equipment that is also partially examined in this study. The audio analysis focuses descriptively on the aspect of differences in audio quality. The sound captured represents two different perspectives, namely the sound of the musical instruments recorded using cassette tapes, and the digital recording which represents the entire sound setting in a place as it can be heard using the currently most advanced technology.

The test was conducted in two different environments of which one is a practice room, and another is a lecture hall. The purpose of using these two different environments is to have a constant ambience and its noise floor as the backdrop of the overall sound program for both recording experiments. This constant ambience and its noise floor are captured and defined as sound profiles. Two sound profiles were collected via two different formats.

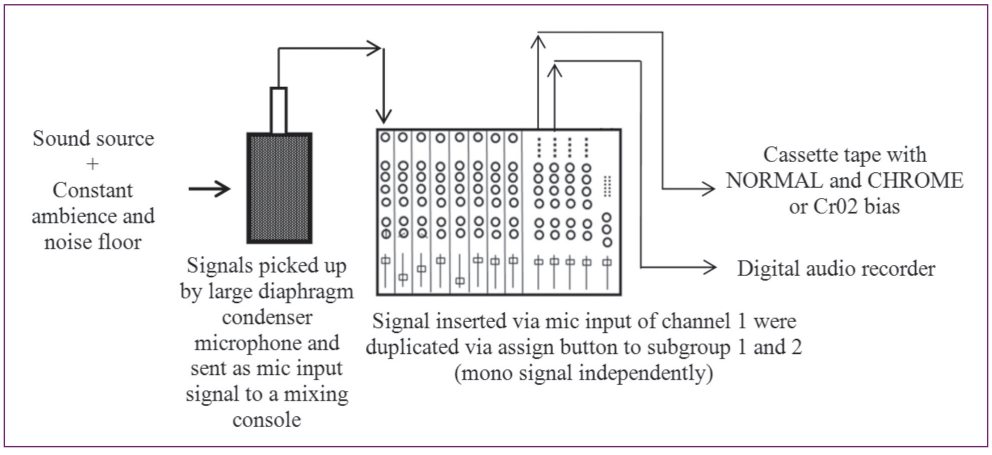

Figure 13: An experiment conducted through parallel recording of a '*bansuri*' on two different formats namely the cassette tapes and the digital audio recorder.

The experiment conducted based on the set-up above is purely a simulation to recreate what is actually being heard and then controlled through the representation of the digital audio recording compared to what was collected during field work from the cassette tapes in the past. The signal had to be captured by a large diaphragm condenser microphone and recorded

separately on two recording devices. This was done through a mixer with all equalizations and effects, send and return, set to by-pass. The outcomes of both recordings were analyzed through amplitude analysis tools.

Descriptions	NORMAL BIAS	CHROME BAIS	DIGITAL AUDIO 24 BIT
Peak Amplitude	-12.11	-13.69	-20.57
Maximum Sample Value	2079675	1734188	784298
Minimum Sample Value	-2051573	-1636108	-785377
Possibly Clipped Samples	0	0	0
Total RMS Amplitude	-21.39	-25.28	-30.45
Maximum RMS Amplitude	-16.39	-19.74	-24.32
Minimum RMS Amplitude	-60.07	-61.19	-71.26
Average RMS Amplitude	-24.28	-28.46	-33.52
DC Offset	0.00 %	0.00 %	0.00 %
Measured Bit Depth	24	24	24
Dynamic Range	43.68	41.45	46.94
Dynamic Range Used	42.45	38.90	41.20
Perceived Loudness	-17.69	-21.44	-25.41
Perceived Eq Loudness	-14.31	-16.65	-22.39

Figure 14: Amplitude analysis of the *bansuri* from the perspective of normal, chrome and DAW (digital audio workstation) recording.

The table shows the general amplitude analysis of the parallel recordings. The differences are audible through these tapes as their bias characteristics were different. The table indicates differences in total RMS amplitude across all formats, showing the total power of the entire selection with normal bias being a higher value at -21.39dB compared to chrome at -2528dB and digital format -30.45 which seems to be much softer in its level of loudness. Similar to the perceived loudness or the average RMS power,all formats seem to decrease from -17.69dB for normal bias, -21.44dB for chrome and -25.41dB for digital audio. There are many factors which contribute to this reading. Tape hiss and noise floor were the two main contributors to the overall loudness containing in the constant ambience.

These audible differences are obvious particularly while working in a recording studio. Signals that were send out to a recording device are very much what one would get back as 'tape return' signals that seem to be the same. Analogue recordings can be, therefore, attractive to a listener from certain aspects that reflect their own sound ideals. To an audio engineer, it might be pleasing to have the assurance of knowing that any signal one put in as 'tape send signal' into a DAW is closed to what you get out of it.

The following is the graphic representation of constant ambience and its noise floor as the back-drop of the bansuri played and recorded on a normal bias tape. Visualization in logarithmic pane enables one to view the frequency spectrum of the constant ambience within the range of 20 Hz to 20 kHz. The frequencies ranging from 200 Hz to 20 kHz were concealed by the threshold.

Figure 15: The frequencies ranging from 200 Hz to 20 kHz were concealed by the threshold.

Figure 3 is the graphic representation of constant ambience and its noise floor as the backdrop of the *bansuri* played and recorded on a normal bias tape with the threshold value set to 50%.

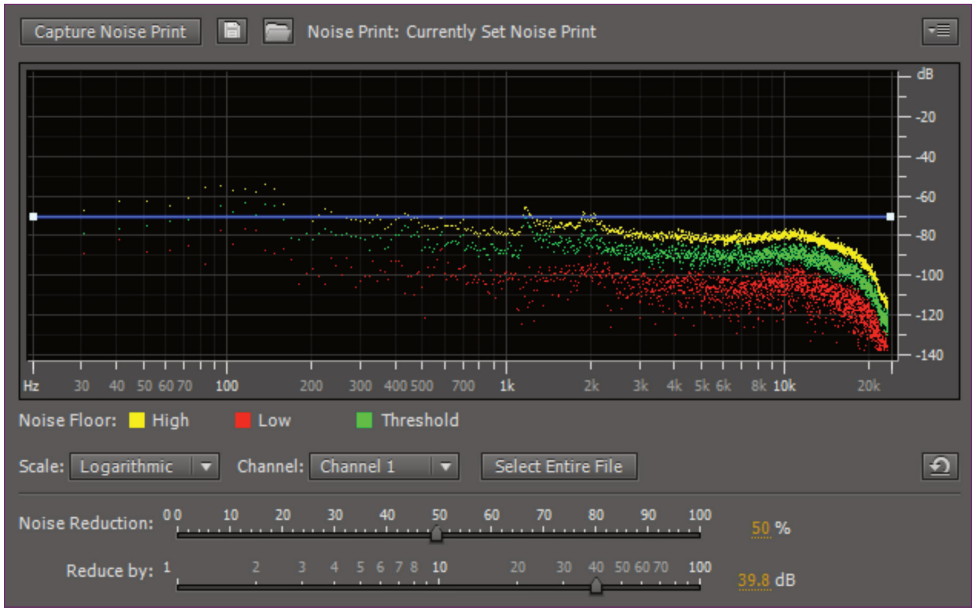

Figure 16: The frequencies ranging from 200 Hz to 20 kHz with threshold reduce by 50%.

The captured constant ambience as 'noise print' used against the *bansuri* recorded on a normal tape bias yield a bansuri with constant ambience removed. The process is not only removing the ambience before the waveform starts, but within the *bansuri* harmonic spectrum too.

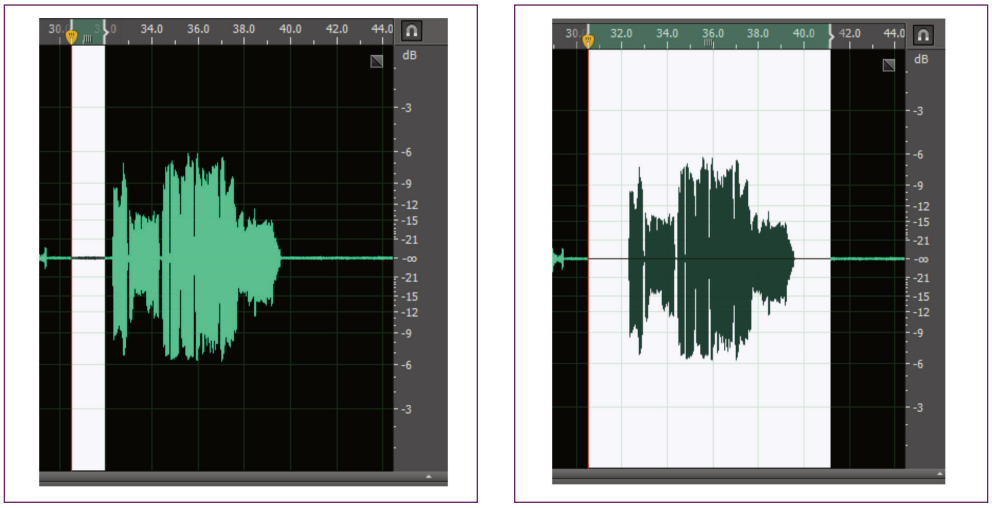

Figure 17: Bansuri waveform on the left illustrate the capturing of the constant ambience found as a backdrop in the normal bias tape. On the right is the bansuri of the same tape with the constant ambience removed. Notice the green center line on the highlighted region is thinner compare to the one on the left.

The constant ambience remnants comprises of mostly tape hiss and the upper harmonics of the bansuri and the ambience. The experiment has its limitation when it comes to uncontrolled dynamic range that involves the representation of the softest signal where background noise becomes a distraction and to the loudest signal where signals begins to overmodulate and to be distorted. Some of the field recording collected by researchers during the tape era contain technical defects such as electrical buzzing, humming, low rumble noise due to faulty connections of microphones; or the recording signal was set too high that causes over-modulation. Although the process to remove these defects can be conducted, it is time consuming and the outcome would just be of a similar bad quality pretending less technical defects.

With regards to other carriers such as the vinyls, signal extraction to another medium such as digitization may incur issues. Particularly materials in which the content is of a concept album, for example, The Beatles in their Sergeant Pepper Lonely Hearts Club Band album entitled A Day in the Life[6] composed by John Lennon and Paul McCartney. George Martin wrote in the program notes of the album synopsis that in the piece after the last crashing piano chords, he had a few seconds of 15 kHz tone generated just to annoy your dogs, few seconds of Beatle chatter, taped, cut into several pieces and paste them back together in random order. He says "This was done on purpose so that to those who bought the vinyl and play it on a non-auto return player, would create a continuous noise until it run out of groove effect" (quoted after Musib 2012, 158).

In this case signal extraction would have to be done from the original master tape. Signal extraction out of the vinyl itself may face other issues such as constant static, pops and crackling aside from restoring other issues such as noise and electrical hums. On some occasions, this would harm the vinyls.

6 "Day in the Life". The Beatles (1967). ***Sgt. Pepper's Lonely Hearts Club Band***. E.M.I. Records CDP 7 46442 2.

8. Final remarks

All these research based findings are to attract interest in the very essential first business: to establish, maintain and develop audiovisual archives that care about their substantial existence for the community, the entire sound ecology within a place, and its primary quality.

Philosophically, it is not about modifying the original recording but about recreating the sound information provided through it in a new data object. Thinking further in this line, this process might be employed again in a couple of decades on recordings produced today.

This or similar ways to approach research partners and promoting AV archiving is an elementary condition in not only serving the community but possibly in giving opportunities for applications beyond contemporary academia.

It is first about promoting the features of sound restoration, sound re-positioning, and sound imaging rather than promoting the philosophy of preservation behind, and only in second instance it is a holistic picture of different preservation issues. Some essential details of the planned teaching course and the way of attracting an increasing interest in AV archiving and preservation issues - exemplarily under Malaysian circumstances - should invite discussion among those dedicated to training and education in IASA.

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10. Audio

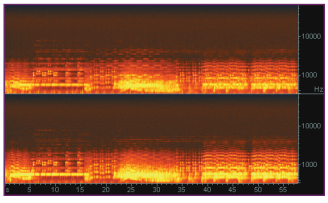
"Day in the Life". The Beatles (1967). *Sgt. Pepper's Lonely Hearts Club Band*. E.M.I. Records CDP 7 46442 2.

LOCATING REPLACEMENT AZIMUTH SCREWS FOR TASCAM COMPACT CASSETTE DECKS

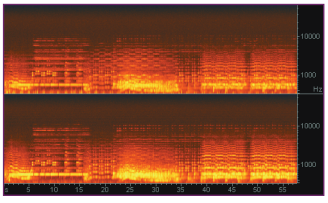
Andrew Thomas, CHL AV Preservation, USA

Audio cassette tapes were widely used for capturing audio events. Many archives are subsequently digitizing extensive cassette tape collections. One of the most important steps when capturing a cassette tape is proper adjustment of the azimuth screw, which allows you to capture the full range of recorded frequency content.

In audio terms, "azimuth" refers to the measure of the angle between the tape head gap and the physical tape itself. Because the angle of the head gap can vary from machine to machine, it is essential to adjust the azimuth for each tape captured for preservation. Failure to adjust the playback head azimuth may result in dull sounding audio. The spectrographic images below illustrate the frequency spectrum from two captures of the same cassette tape. The image on the left shows the limited frequency range before the azimuth screw was adjusted. The image on the right shows the broadening of the frequencies after azimuth adjustment. Clearly, proper azimuth adjustment is essential to preserving the full range of audio.



Before Azimuth Adjustment



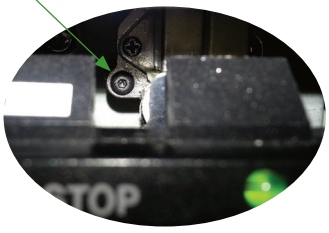
After Azimuth Adjustment

The Tascam 122MKIII cassette tape deck is a favorite deck for playback of cassette tapes by many archives. They are well built machines that have great features like smooth tape handling mechanisms, precise manual bias and level adjustment on the front panel, and balanced XLR inputs and outputs. We've had good experiences with these decks and have found them to be well suited for performing archival transfers. But like any mechanical device, parts wear out and need to be replaced. Because the azimuth screw is adjusted frequently, it tends to wear fast and require replacement. The head of the screw can easily become so stripped that it is almost impossible to adjust. This problem has occurred on every cassette deck that we own (most of which are Tascam 122 models).

Tascam 122 MKIII Cassette Deck

Once we were down to only a few machines that didn't have stripped azimuth screws, we decided to try and track down a replacement. We believed this would be a fairly easy task; but were sadly unsuccessful until recently. We decided to write this short article so others wouldn't have to endure the seemingly endless loop of buying numerous screws only to realize they wouldn't work and then having to sending them back.

New Screw / Stripped Screw



Azimuth screw location on a Tascam 122 MKIII

When the correct replacement was finally found, we also decided to replace the Phillips screw head with a hex head screw. The hex head being less likely to become "stripped" during regular use.

This screw size works with Tascam models 112 MKII, 122 MKII / MKIII, and 134. This screw size might work with other decks, but we have not checked. The azimuth screw size is the following:

M2-0.40x8 MM (Metric)
12.9 ISO 7380

We hope this is helpful in your pursuit of optimal sound.

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

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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/

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/

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

Gecko
Jean-Baptiste Meunier
59 rue de la ferme
Montreuil 93100
France

Capital Vision
73 rue du volga
75020 Paris
France

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Bruce Gordon
Eda Kuhn Loeb Music Library
Music Building, North Harvard Yard
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USA
Phone: +1 617-495-1241
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Swiss National Sound Archives
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CH-6900 Lugano
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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
Bertram Lyons, CA
AVPreserve
634 W. Main St., Ste 201
Madison, Wisconsin 53703
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.

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