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# Keep Our Sounds Alive: Principles and Practical Aspects of Sustainable Audio Preservation

(including a glance on video)

## Part 1

## Ethics, Principles, and Preservation Strategy

*Based on IASA-TC 03*

Workshop at Inforum 2016

Prague 23 May

**The tasks of sound archives**

- acquisition
- documentation
- access
- preservation

***Preservation is not an aim in itself, but the the indispensable prerequisite to make information accessible***

**Documents contain primary and secondary information:**

- primary: content, signal, “essence”
- secondary: associated materials and information, “meta data”, technical representation

**All** kinds of information are part of the document and must be preserved

**Instability and vulnerability of carriers**

Except metal matrices, av carriers have an even shorter life expectancy than paper-bases documents

**Obsolescence of formats and replay equipment**

All analogue and most specific digital audio formats are already obsolete – tendency goes toward true file formats

Similar development has happened for video

Audio and video production and archiving has become part of the IT world – film presently following

With obsolescence of formats, dedicated replay equipment vanishes from the market

**Safeguarding the information**

**a) By preservation of the carrier and replay equipment**

Although, eventually, life of carriers cannot be extended indefinitely, physical an chemical integrity must be preserved as long as possible

However: preservation of equipment (almost) impossible

**b) By copying the information**

Long-term preservation of information can only be achieved by subsequent, lossless copying from one information storage system to the next

Lossless copying can only be achieved digitally

Analogue contents have to be digitised first

…long term preservation can only be achieved in the digital domain by subsequent migration – Why?

Because:

Digital information is

- well defined, and can therefore be copied exactly – without losses
- basically simply structured, and can, within limits, be "repaired"
- consequently, digital data can be checked for their integrity and, up to certain levels of errors, be reconstructed ("refreshed")
- (Archival paradox: thus a refreshed copy is "better" than the original)
- Soft- and hardware obsolescence remains, but less critical if part of IT world

**Optimal signal extraction from analogue originals**

Recording and replay distortions do not compensate, but multiply each other

Modern replay equipment minimises replay distortion, thus extracting ultimately the quality of the recorded signal

Modern replay equipment must comply with historical format in terms of speed, equalisation, track parameters, etc – *possible for audio, difficult to impossible for video*

**Unmodified transfer to target format 1**

The document consists of the intended, possibly historical imperfect signal, plus all undesired artefacts through deterioration and damage, which cannot objectively be removed

Imperative is the unmodified extraction of the entire document,  the intended signal plus the unintended and undesired artefacts

**Unmodified transfer to target format 2**

Aesthetical signal processing is always subjective

Signal processing tools are subject to further significant improvements

Process signals

•when you need them

•according to the specific task

Consequently: Aesthetic “improvements” must only be made in a second process on the basis of an objective archival master

**Improvement in transfer technologies**

Generally, transfer technology has reached high perfection

Further possible improvements:

- Analogue audio tapes: bias extraction for wow & flutter compensation
- optical signal retrieval from mechanical carriers
- sub code extraction from R-DAT and video originals
- component extraction from composite video originals

**Ever higher digital resolutions will be available at ever lower cost**

Transfers should be considered to be preliminary

Keep the originals whenever possible

## Digital target formats and resolutions 1

Do not use proprietary, but openly defined formats: Wave (BWF) for audio, video standardisation yet under debate

Target resolution must take undesired artefacts into account

Analogue audio:

- 48 kHz, 24 bit - IASA minimum recommendation
- 96 kHz, 24 bit - standard for memory institutions
- 192 kHz, 24 bit - upcoming for historical mechanical carriers

Analogue video SD: ITU 601, colour depth10 bit, 12 bit upcoming

## Digital target formats and resolution 2

Restoration and post processing profit enormously from higher digital resolutions

*“The worse the signal, the higher the resolution”*

Digital original signals should be stored in their original resolution, but converted to true file formats, e.g. wave

**Data reduction – often mistakenly called data "compression"**

Reduction algorithms based on *perceptual coding* are omitting information considered to be irrelevant

- Audio MPEG (e.g. MP3), ATRAC (MD), RealAudio
- Video MJPEG, MPEG1, 2, 4, H264

Data reduction for analogue and linear digital source material is **incompatible** to archival principles

**Archiving of data reduced originals:**

- unmodified in case of openly defined formats (e.g. MP3)
- pseudo-linearised and converted to wave in case of MD

**No objection against lossless compression** (= no reduction) algorithms, e.g. lossless MJPEG 2000 for video (compression rate up to 3:1)

## Digital archiving principles

- digital archival master must be free of uncorrectable errors and with a minimum of correctable errors – check each carrier and keep an error status record; digital originals may contain uncorrectable errors – retain error status record including error position
- check data integrity (error status) at regular intervals
- copy contents to new carrier before signal becomes irretrievable (refreshment)
- copy to new systems before hard- and/or software becomes obsolete (migration)
- check sum for verifying integrity

**Minimum of two identical digital masters imperative**

**Ideal: three copies, two different technologies**

**Digital mass storage systems DMSSs**

**Routine installations for audio and video**

Combination of HDD arrays and near-line tape robotic systems

Permits remote access

**plus automated**

•data integrity checking

•refreshment of endangered carriers

•migration to new system before the old becomes obsolete

DMSSs are cost intensive, specifically software

**Small scale solutions**

HDD and computer backup tapes have come within financial reach

Audio and (more recently) video file archiving has become standard

Small scale manual approaches to digital audio archiving were successfully underway, feasible also for video collections

**Metadata**

In addition to descriptive and administrative metadata:

**Preservation Metadata Set**

- original carrier, its format, and state of preservation
- replay equipment and parameters
- digital resolution, format, all equipment used
- operators involved in the process

## Strategic considerations

Dramatic situation of increasing unavailability of replay equipment specifically for all tape based format make immediate action urgent

Time window was cited to be 10 - 15 years – unfortunately it is already much shorter for most single carrier originals

## IASA Technical Committee

Standards, Recommended Practices and Strategies

IASA-TC 03 The safeguarding of the Audio Heritage: Ethics, Principles and Preservation Strategy

Version 3, December 2005

English :
www.iasa-web.org/sites/default/files/downloads/publications/TC03_English.pdf

Also available in German, French, Swedish, Spanish, Italian, Russian, and Chinese

Thank you!

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