### Analogue and Digital Audio-Visual Preservation

Reto Kromer • AV Preservation by reto.ch

**Film Preservation and Restoration**
Prasad Film Lab, Chennai, India
7–14 October 2017

<table>
<thead>
<tr>
<th></th>
<th>quick</th>
<th>longtime</th>
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<tbody>
<tr>
<td>important</td>
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<td>not important</td>
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Conservation

Conservation encompasses all activities for the care of an object, which delay its further decay and ensure that it remains in the most intact condition for the future.

Restoration

Restoration includes all interventions and treatments that serve to retrieve a certain historical state and contribute to the legibility, aesthetic integrity or reuse of an object.

Restorative actions may be irreversible and require great care in planning, justification, execution and documentation.

An Ounce of Ethics

• The probability that a work is available in its integrity in the future is increased.
• All the options that existed before taking an action remain open after the action.
• Every step is carefully documented.

Analogue
Develop a strategy

1. list the ISO standard for each media type which is present in the collection
2. assess the environment inside each vault at least for one year
3. inspect the condition of the collection
4. analyse the results and find the weak link
5. improve the conservation

Warming…

22 °C 80% RH 30 °C 50% RH

Cooling…

22 °C 80% RH 19 °C 100% RH 10 °C 100% RH
**Statistical method**

The analyse of a randomly chosen subset of **164 items**

of each type of material and in each storage vaults informs about the full collection with the precision of

**80% ± 5%**

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**Principle**

In order to guarantee the conservation, one must know both the **condition** of the each media type and the **climate** in each storage vault:

- condition of the collection
- temperature and relative humidity
Acid catalysed hydrolysis (deacetylation)

\[
\begin{align*}
\text{CH}_2\text{OAc} & + \text{H}^+ \text{ and } \text{H}_2\text{O} \\
\downarrow & \\
\text{CH}_2\text{OH} & + \text{H}^+ \text{ and } \text{AcOH}
\end{align*}
\]

Glycosic cleavage by hydrolysis

\[
\begin{align*}
\text{OAc} & \quad \text{CH}_2\text{OAc} \quad \text{CH}_2\text{OAc} \\
\downarrow & \\
\text{CH}_2\text{OAc} & \quad \text{CH}_2\text{OAc} \\
\text{OAc} & \quad \text{OAc} \quad \text{OAc} \\
\text{OH} & \quad \text{OAc} \\
\text{OAc} & \quad \text{OAc} \\
+ \text{Acid and Water} & + \text{Acid}
\end{align*}
\]
Put the reel into a first bag

Put the bag in a box...

... and add some silica gel

Add a moisture indicator
Put the box into a second bag

Put the package into the freezer

Active measures

Air conditioning:
- refrigerate
- dehumidify
- filter
Air pollutant...

- $\text{SO}_2 < 1 \mu g/m^3$
- $\text{NO}_x < 5 \mu g/m^3$
- $\text{O}_3 < 25 \mu g/m^3$

Outgassed acid

- $\text{CH}_3\text{COOH} < 1 \text{ ppm}$
- $\text{HNO}_3 < 1 \text{ ppm}$

Air flow

Outgassed acetic acid or nitric acid are heavy gases:

- air supply at the ceiling of one wall
- air exhaust at the bottom of the opposite wall
- air supply and air exhaust on the full length of the opposite longer walls
Passive measures

- location
- orientation
- exterior paint colour
- shadow
- insulation
- humidity barrier
- apertures

Interaction

- air conditioning
- insulation
- architecture
- materials
Advantages

Clear and efficient infrastructure:
• smaller air conditioning
• lower energy costs
• less maintenance
• limited material requirements

Live in the real world!

There is only one efficient way:
• keep the source elements
• more prevention:
  → better insulation
  → more efficient air conditioning
• less handling of the source elements
• make copies

Digital

Investments

• working space
• computers
• LTO desk
Running Costs

- staff
- training
- equipment
- LTO cartridges
- maintenance

Migration

**cons**
- imposed
- [wo]manpower
- cartridges
- time

**pros**
- reduces space
- possibility to keep the data updated

LTO

- migrate only every second generation
- make two sets of cartridges instead of three
- two geographically distant locations are mandatory
- store the cartridges a secure room
- workflow must remain consistent if a 50% of the staff and/or funding is cut

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