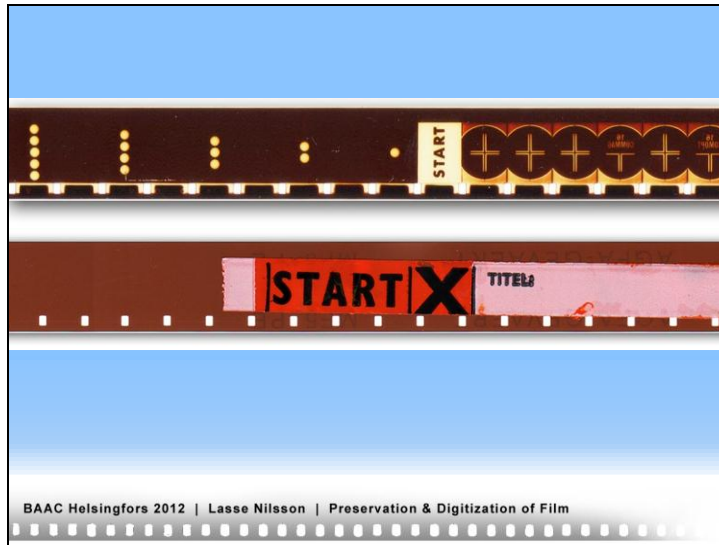
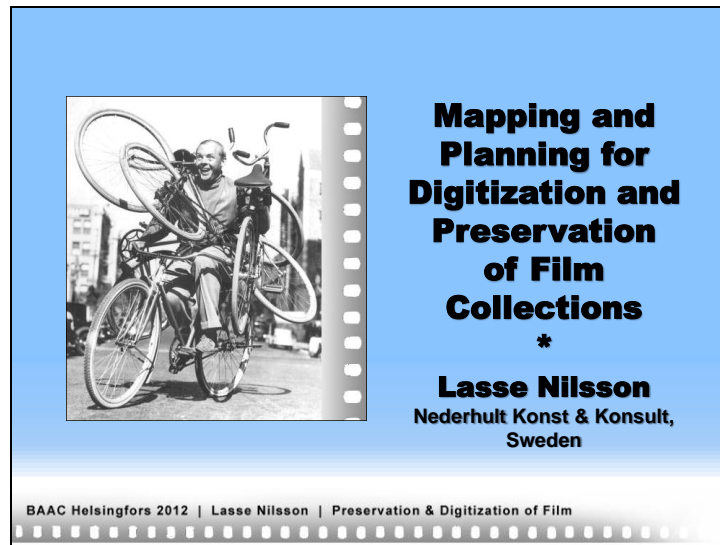


Bild 1



Picture and sound synchronized!

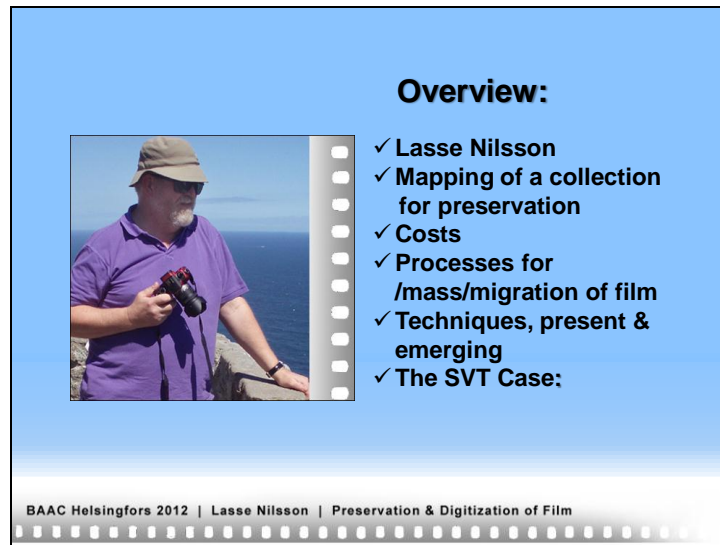
Bild 2



Mapping and Planning for Digitization and Preservation of Film Collections

Does it really have to be so difficult, using this guy transporting a number of bikes as a metaphorical expression – or is it just a matter of keeping in your archives in order and well documented for future activities ?

Bild 3



Overview:

- ✓ Lasse Nilsson
- ✓ Mapping of a collection for preservation
- ✓ Costs
- ✓ Processes for /mass/migration of film
- ✓ Techniques, present & emerging
- ✓ The SVT Case:

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Hopefully I will succeed to give an answer, ticking off these items on my overview... (The picture taken at the Cape of Good Hope may symbolize my expectations!)

About myself:

I started working with the Sveriges Television 1976 as an archive editor, followed by managing positions within the media archiving area.

After a couple of years interlude as environment controller, still at the SVT, back on the audiovisual archiving scene project manager and producer of programmes based on archive material.

Today just recently retired, I´m acting as independent consultant in the audiovisual archiving area.

On the international level, I´ve been an active representative on behalf of the SVT at FIAT/IFTA since 1991 in different commissions, the Executive Council and as Secretary General.

I´m especially happy to be here today as one of the founding persons of the BAAC and back on the board.

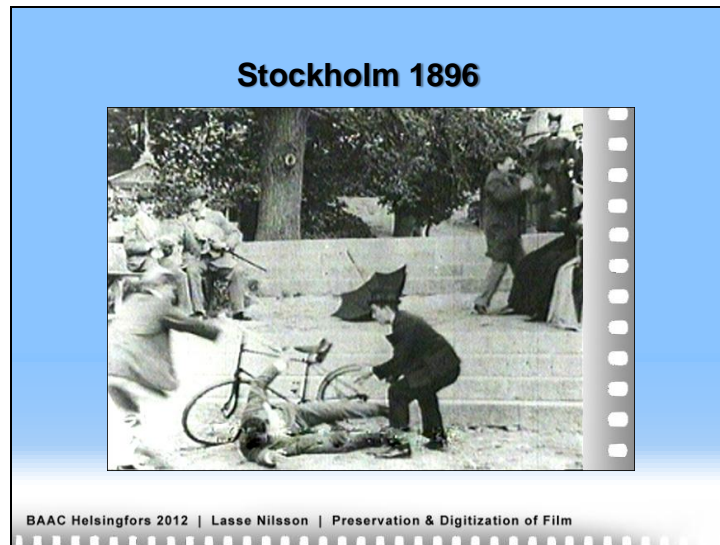


My latest project at the SVT - before digging into this film collections project - was part of the huge video migration project together with the Educational Radio & Television and the Royal Library Department of Audiovisual Media. The SVT part of it contained migrating 100.000 hrs of mainly analog video content to digital files. A really useful experience!

One of the starting points of this film project was the knowledge that already in the very beginning of regular Swedish TV broadcasting in 1956, standards for handling, storage and documentation was adopted for film material used in programming. Professional archive staff was engaged and in the mid-60:ies the archives were moved to the new broadcast building, now with controlled climate for the film storage.

Also at the same time the company started to acquire all the important Swedish newsreels and short film archives as stock-shots for programming purposes. It meant – already at that time – important preservation and documentation efforts for a huge and unique national - and international - film legacy.

Bild 5



SVT archived programming on film, together with acquired film archives and occasional private deposits today comprise of roughly 50 million meters of film and magnetic tape. More than a century of Swedish history in moving images.

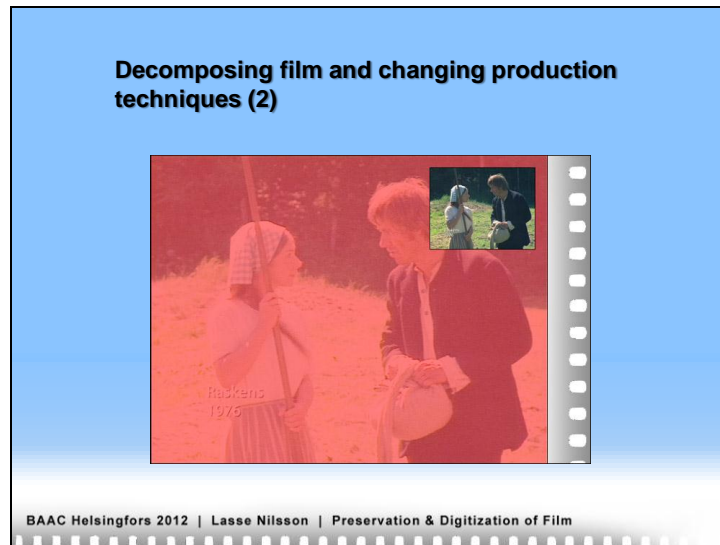
Among them the first film shot in Sweden 1896 by the famous filming brothers Skladanowsky on Djurgården in Stockholm.

Bild 6



Despite orderly collecting, accession and storage, there are signs of more than 50 years current wear and tear from programming, archive sales and media research. Not to mention the threats of vinegar syndrome appearing - the chemical decaying process in all acetate film material – together with fading of colour, shrinking, sticky or broken splices.

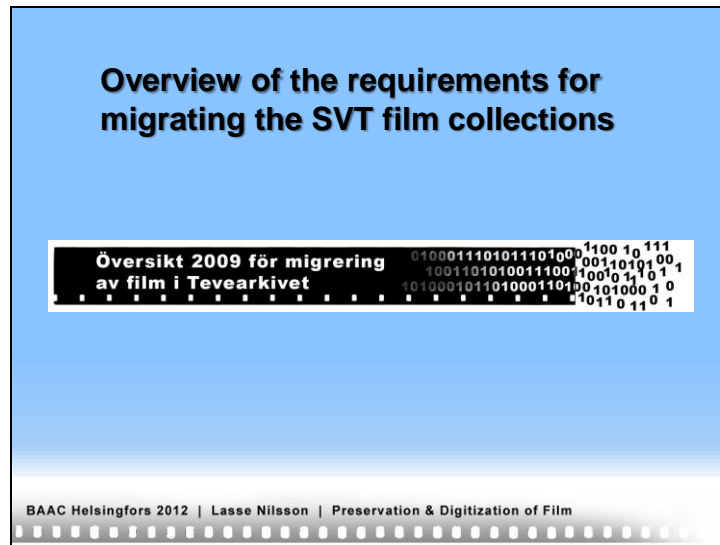
Bild 7



We also have seen radical changes in production techniques during the last decade. The film-film and videotape as production formats in a very soon totally digital and file based production process becomes obsolete.

The practical means for doing research in film as original format, as well as transfer of film to digital file are getting more and more difficult to find. Together with the actual threats to film media as such, the consequences for access of film content for programming, research and as cultural heritage at large – are evident.

Bild 8



The experiences of the SVT video migration project - while still in progress - resulted in a demand for an overview of the requirements for migrating the extensive SVT film collections.

The report it resulted in was handed over to the management in 2009.

The task comprised the mapping of:

- Film collections
- Available film technical resources
- Staff resources assigned to preservation and migration of film
- Account for preservation and migration techniques
- Account for market of external preservation and migration service providers
- Categorizing of necessary preservation efforts of film formats and programme genres
- Proposals for prioritizing preservation and migration measures

Methods

- Collection and analysis of documentation on SVT film collections
- Documentation of available equipment and staff
- Staff interviews on preservation and migration processes
- Literary survey on external sources on film preservation and migration
- Market survey on available providers of film preservation and migration services





Main sources for the overview was a battery of reports produced by the two PRESTO-projects within the framework for European Commission Information Society Technologies Programme (IST):

”**PRESTO** – Preservation Technologies for European Broadcast Archives” (1999-2002) and ”**PrestoSpace** - Preservation towards storage and access. Standardised Practices for Audiovisual Contents in Europe” (2004-2008).

There are actually quite a number of competent sources on the internet to scoop up useful knowledge from in this area, such as:

Columbia University Libraries **Audio and Moving Image Survey Tool**, 2008;

The Image Permanence Institute (IPI) at Rochester Institute of Technology, **Kodak**, **EBU** (European Radio Union),


SMPTE Recommended Practice PR131 on filmstorage and **ISO** (International Standardization Organization),

National Film & Sound Archive (Australien) Film Preservation Handbook, 2008,

National Film Preservation Foundation (San Francisco, USA) The Film Preservation Guide, 2004.

Bild 12

SVT sources



- Vinegar syndrome test (2001-2002)
- Save news film current (1990 -)
- Save fading colour films (1993)
- Inventory (2000-2001)
- SVT archive & programme catalogues
- Running documentation on accession 2001-

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Among the internal SVT sources on film (current or finished projects):

Bild 13

| Mapping for preservation | | | | |
|--------------------------|-----------|-------------------------------------|---|---------------------------------|
| format | ålder | förvaring | genre/värde | kondition |
| 16mm s/v film negativ | 1950-1970 | arkivet; ocirkulerad | unikt mastermaterial | god |
| 16mm Ektachrome | 1968-1982 | redaktion första 5 åren sedan arkiv | nyheter; högt återbruksvärde | viss färgblekning |
| 16mm s/v kopior | 1950-1970 | arkiv | Inget värde över tid, använd negativ istället | ganska bra, använd i produktion |
| 16mm sepomag | 1950-1980 | arkiv | original | vinägersyndrom! |
| 16mm sepomag | 1950-1980 | arkiv | kopior; inget värde över tid | vinägersyndrom! |

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For a systematic preservation work you have to map your collection as detailed as possible.

Start out with dividing it into film formats and types (format – gauge: 35 mm, 16 mm, 8 mm etc; type: negative, copy, copy with magnetic strip, magnetic tape, colour or b/w reversal etc.)

- How old is each format/type, number of films of each format, physical status over time within a format/type?
- What do we know about storage history and how it has affected the material; climate (temperature, relative humidity, ventilation), material of film boxes or cans, earlier occurrence of vinegar syndrome, electromagnetic fields, frequency of usage (wear and tear), storage during re-use?

Bild 14

Mapping for preservation (2)

| format | ålder | förvaring | genre/värde | kondition |
|-----------------------|-----------|-------------------------------------|---|---------------------------------|
| 16mm s/v film negativ | 1950-1970 | arkivet; ocirkulerad | unikt mastermaterial | god |
| 16mm Ektachrome | 1968-1982 | redaktion första 5 åren sedan arkiv | nyheter; högt återbruksvärde | viss färgblekning |
| 16mm s/v kopior | 1950-1970 | arkiv | Inget värde över tid, använd negativ istället | ganska bra, använd i produktion |
| 16mm sep mag | 1950-1980 | arkiv | original | vinägersyndrom! |
| 16mm sep mag | 1950-1980 | arkiv | kopior; inget värde över tid | vinägersyndrom! |

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Grading of physical status:

Usually a random sample of each format/type to provide a kind of simplified map of reality for the preservation work (**example from the BBC**):

Vertically: Formats/types

Horizontally: age – timespan/storage/genre-value/condition

Who is going to do the work? Internally or externally?

- Do you have the staff for all parts of the process? Prioritizing, quality grading, renovating, digitizing, logistics
- Technical equipment? Spare parts/maintenance? For cleaning, renovating, obsolete formats, to digital video or files directly, suitable premises for the work, appropriate archive storage, quality control,
- Metadata,

Detailed metadata already at hand often simplifies the mapping process and cuts costs.



The Presto project – today more than ten years ago, tried to define costs for the film preservation process including digitization to file per hour - though **not** the total costs in a longterm perspective as for storage of original material and digital files. In comparison they arrived at:


- Audio € 120
- Video € 200
- Film € 2000

As most important cost driving factors Presto identified:

- The number of films
- formats & physical status
- migration cost/film
- file quality
- archiving costs for filmoriginal and files after migration
- pre-migration activities
- updating of metadata for files and original
- Measures handling problem material

Processes for mass migration of film: Filmbase

- Celluloid film/ Cellulose nitrate/ "Nitrate film" 1890-1950
- Cellulose Acetate / "Acetate film" and -Triacetate/ "Safety film" 1909 -
- Polyester 1950 -



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Looking more closely at the mapping and selection actions/elements of the migration processes of film, presumably starts at investigating the volumes of different filmbases.


Three groups of filmbases could be sorted out chronologically – more or less:

- Celluloidfilm/ cellulose nitrate/nitrate film – Properties: decomposing and highly inflammable 35: 1889-1950
- Acetate film/ cellulose acetate and –triacetate/safety film – Properties: not inflammable, subject to decomposing process: vinegar syndrome, contagious to other acetate based material 16: 1923, 35: 1948-/50- (1928 KodaColor, 1928 optical sound, AgfaColor 1941, KodaChrome 8 o 16 mm 1938 colourreversal
- Polyester, more stable from mechanical and chemical point of view 1950- 35mm, 16, 8

Apart from that all kind of film material are chemically decomposing at different rates of speed, they are also affected by shrinking, damaged perforation, tape or cement splices, mould etc.

Bild 17

Technical considerations before / under / after the migration process




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Every preservation strategy has to – apart from mapping of the collections on the factors I have already mentioned – also take into account especially such factors as the presence of vinegar syndrome and how these films and tapes should be kept separately from the rest of the collection longterm and during the preservation and migration processes. Also:

Before:

- Change of start and tail leaders?
- Repair of splices and perforation?
- Consider different kinds of film cleaning?
- Polishing
- Copying of magnetic tape
- Handling of programmes consisting of separate rolls – splicing to one roll?

Technical considerations before / under/ after the migration process (2)



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During – will the film during scanning demand:

- Wet gate?
- Colour correction?
- Noise reduction?

After scanning:

- Digital film restoration – there are a number of sophisticated hardware and software providers like DFT's Flexxity or Diamant's software
- Cold/freeze storage? FICA-method?
- Molecular sieve storage (acid molecular catcher)?
- Separate storage environment for original/copies/magnetic tape?



Old film – the only original format

Film has been used in television as long as the media itself. We have estimated that up to the mid-1980s it is approximately 60 % of the total archived programming at the SVT is as film.

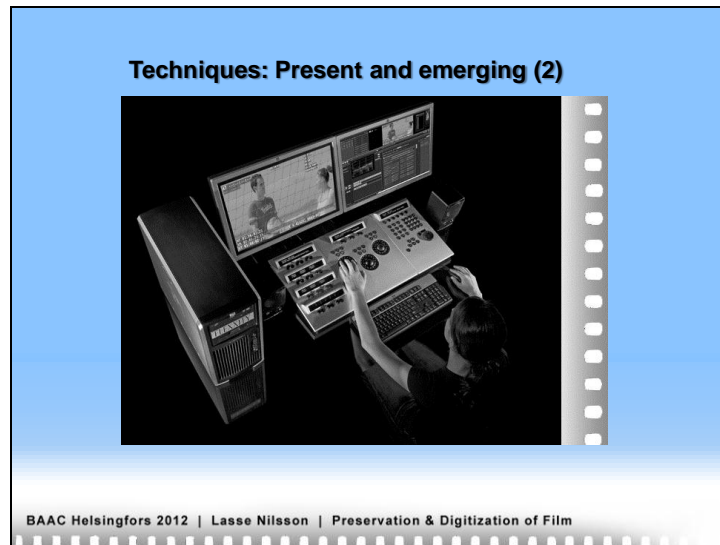
The scanner was – and still is – the main tool in transferring film to electronic/digital media.

Film was also the only way in archiving live TV broadcasts via a Kinescope (telerecording), a recording by filming the a video monitor until the introduction of videotape recording in 1956.

Reversal and negative film

News and sports – and other actualities - were dependent on fast access to their material and therefore used reversal film. The same film as used in the camera could after editing be scanned directly. That meant a greater risk for the wear and tear, since the same film also were used for research and copying.

For some time negative film was used likewise, with editing in the camera original before scanning.



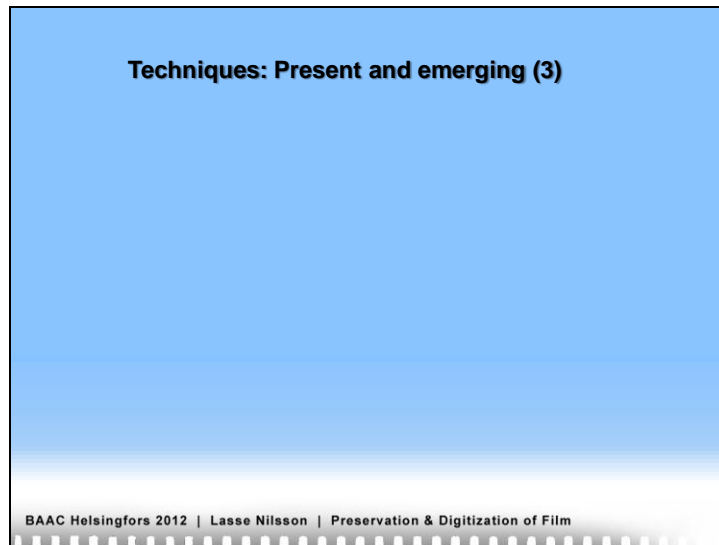
The use of negative film in prestige productions like drama was only one step in a more complicated process – from archiving point of view meaning the archived material of one production could be represented of different stages in this process.

Today's scanning technique often means the transfer of the camerafilm unedited to digital file where the editing and coloring takes place and also post production tools for digital restoration.

Decomposing of film base

We have already mentioned the chemical instability of the nitrate film. Highly inflammable it demands a high degree of fireproof storage and handling.

The following generations of acetate filmbase is also subject to a decomposing process called the vinegar syndrome. The process is accelerated by factors like higher temperature, humidity and presence of cathalysts like metal cans or magnetic metal oxide tapes. The same goes for magnetic tape on acetate base and film with magnetic strip along the picture area.



Many archives store the film and the magnetic tape of a programme in the same box. Then it of course doesn't help with a tape on polyester base since you still got the metal oxide layer. Coming to the polyester base it also decompose chemically, but last 5 to 10 times longer than acetate.

Tape splices

That is a special problem on 16 mm reversal film. After a decade or so the tapesplices begin to dry, brake and the adhesive material smear the equipment and other parts of the film. This often requires a lot of manual labor in cleaning and repairing the splices.

Decay of the film picture

Metallic silver of the b/w picture emulsion is subject to oxidization and the picture is fading away. That also goes for colourfilms, but here we have a degradation process in the organic colours.

ISO & Image Permanence Institute (IPI) recommendations

| Storage Conditions | Glass Plates | Nitrate | Acetate | | Polyester | | Photo Prints | | Ink Jet Prints | Magnetic Tape | | CDs DVDs |
|--------------------|--------------|-----------|-----------|-----------|-----------|-----------|--------------|-----------|----------------|---------------|-----------|----------|
| | | | B&W | Color | B&W | Color | B&W | Color | | Acetate | Polyester | |
| ROOM | Fair | No | No | No | Fair | No | Fair | No | Fair | No | No | Fair |
| COOL | Good | No | No | No | Good | No | Good | No | Fair | Fair | Good | Good |
| COLD | Very Good | Good | Good | Good | Very Good | Good | Very Good | Good | Good | Good | Fair | Good |
| FROZEN | No | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good | Very Good | No | No | No |

Frozen = - 0 C
Cold = 4 C
Cool = 12 C
Room = 20 C

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Storage conditions

The matter is storing what material in what kind of controlled climate, using ventilated or unventilated boxes of what kind of material.

Unventilated boxes has shown to speed up the level of vinegar syndrome. So does the cardboard boxes of a certain acidity level. Metal cans could speed up acidity working as catalyst.

Boxes of polyethene of controlled quality seems today to be the most suitable alternative, still though expensive.

Temperature and humidity

Roughly you can say that a constant temperature and controlled humidity prevents or halts the decomposing of film.

ISO recommended measures on storage temperature and relative humidity for different film bases in archives. Temperature are recommended not to alter more than + - 1°C/tim, relative humidity +- 5 %/day

Image Permanence Institute (IPI) in Rochester has produced this table for estimating the environment for a number of audiovisual media in your archive.

Processes for film preservation

- Copying of film to film
- Scanning of film to videotape
- Scanning of film to digital tape/file



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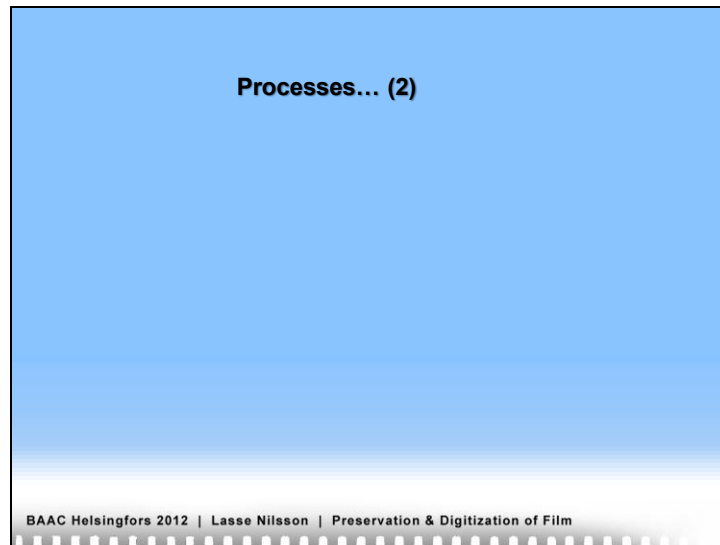
Techniques for preservation of film

Preservation through copying has for a long time been regarded as the method for long time preservation, but since film is used in a digital environment transfer to such media have to be considered. It stops the decomposition of valuable **content** on film original as well as the wear and tear of handling film for different purposes though not the actual physical film itself. Digital formats are also possible to migrate without loss of content quality.

Three processes are in general distinguishable for film preservation:

- Traditional copying of film to film
- Scanning of film to videotape
- Scanning of film to digital tape/file

The latter probably the only reasonable choice for an extensive migration program.

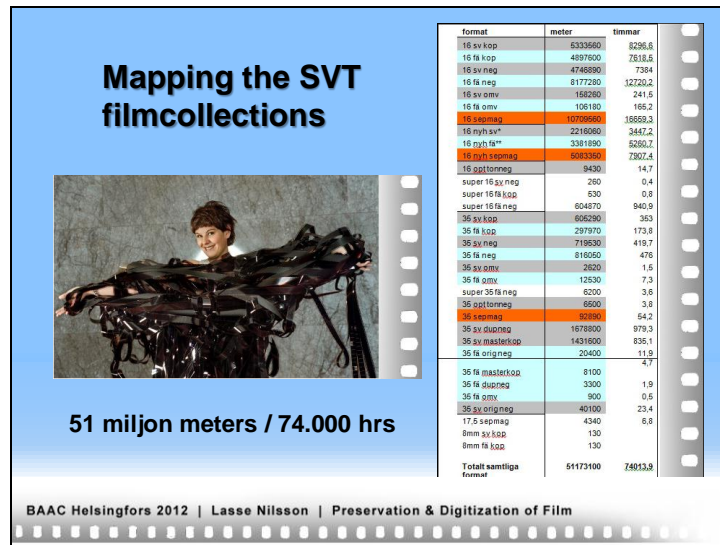


Present there are two ways of transferring film to electronic media:

- Real time scanning to videotape – a process very much dependant on the skills of the operator for the result. Using SD- or HD scanners of today, this is much easier.
- Digitizing the film in a HD scanner and store it on digital videotape or as digital file on datatape or disc. Demands expensive equipment and large storage capacity.

Two ways of approach depending on the re-use needs:

- Use the best possible correcting techniques allowing instant re-use
- Use only general correcting measures for later completion with restoration equipment.



Mapping the SVT filmcollections

The inventory was made fall 2000-spring 2001 and completed with the documented accession up to July 2008.

Regarding number of meters/format/type (i. e. 16/35 mm etc, b-w/colour, copy/negative, reversal original/reversal copy, film with magnetic strip, magnetic tape.

The counting was based on a number of assumptions on average length by box size and film format.

We found more than 30 formats/types!

A total of more than 51 million meters / 74.000 hrs distributed on formats and types according to this table.

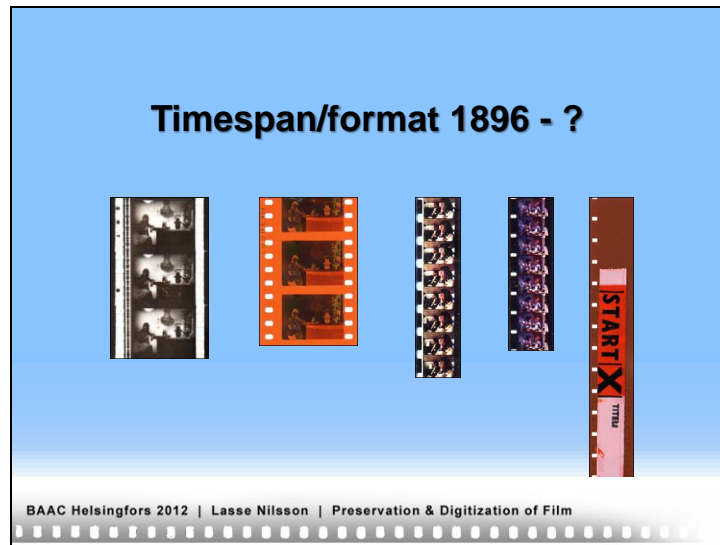


Through the accession documents in the archive and the archive catalogue we could **estimate the timespan** of each format and sort.

For example we knew that all 35 mm nitrate film without any exception had been manufactured and processed during the period 1896-1952. They were acquired during the 1960:ies and 70:ies. From then on we have a full record on the storage history. Renovating and copying to safetyfilm (triacetate) and separate magnetic tape for the sound was made during same period.

Today the remaining nitrate originals are deposited in special vaults at the Swedish Film Institute (SFI) film preservation unit in Grängesberg – according to the FIAF directions for this kind of film.

The duplicate negatives from these nitrate originals as well as negatives and prints of our oldest 35 mm films are deposited in the SFI freeze vaults outside Stockholm and according to the FICA-method.



This way we have meticulously documented every single format. Via the archive catalogue we can not only decide during what timespan a certain film format has been used, but also for what kind of genre.

That gives us more than a hint of what measures has to be made for preservation and migration, and long term storage.

For example to what extent there is viewing material parallell to the original film, to what externt there already is a digitized copy on tape or file etc.

Or how much magnetic tape on acetate base should we expect to find in our collections and thereby what we may expect of vinegar syndrome problems, since we also know that SVT stopped to use that kind of magnetic tape in favour of polyester based tapes in the late 60:ies. That is because we acquired a larger number of new 16 mm tape players and the old acetate tapes just didn't play ok in these players!

Or that 90 % of the b/w newsfilm (appr. 1 million mtrs) consist of negative b/w. Of news on colourfilm, 90 % is colour reversal film. Introduced in news in the end of the 60:ies and disappeared 1986 with electronic news gathering!

Our extensive holdings of colour copies origins from colour camera negatives and the three last decades dominates with 95 % of that format and type.

Assessment of physical status of the SVT Film Collections

- Climate controlled archive
- All nitrate copied to safety film
- Documentation from start 1956 –
- Technical archive staff at hand
- Acid free boxes
- Camera editing table for making of video viewing copies



Assessment of physical ... (2)

- Acquired newsreels- & shortfilms collections digitized 1997-2003
- "Driving ban" on viewing originals in editing table
- Archive policy
- Outsourced freeze storage of old originals (FICA)
- Preservation project for early TV newsfilm running 1990 -
- Preservation projects for colour film 1987 & 1993
- Vinegar syndrome tests 2001 & 2003

Danček 24-Hour Acidity Tester - Size 1 - 1x4cm - 250 pcs *228 094*
Fresh film

| Danček Color Scale | Small | SPF | SPF |
|--------------------|--------------|---------|---|
| Blue | No Small | Level 0 | Fresh film |
| Light Blue | No Small | Level 0 | Degradation is beginning |
| Green | No Small | Level 1 | Degradation is increasing |
| Yellow-Green | Weak Small | Level 1 | Degradation is increasing more |
| Yellow | Weak Small | Level 2 | Autocatalytic Point From now on, film should be watched |
| Orange | Strong Small | Level 2 | The film should be duplicated |
| Red | Strong Small | Level 3 | The film has a very high priority for duplication |



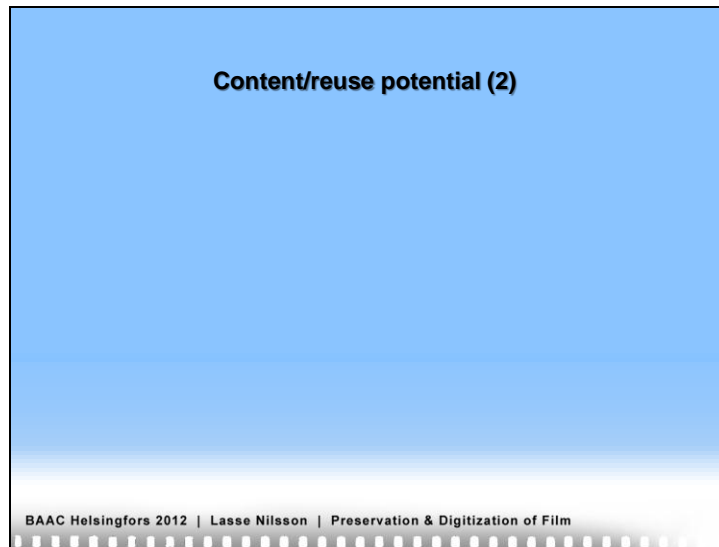
Estimating in what order measures for preservation and migration should be taken may differ from time to time depending on production requirements and resources.

Within the SVT awareness of the value of its archive collections is evident. The new documentary on the former Swedish prime minister Olof Palme, now showing in the cinemas, is a good example. It is of course mainly the result of the combination of a brilliant script, direction and editing and the interesting life story of Olof Palme. But also to a large extent based mainly on well documented SVT archive material of good technical quality.

Preservation of the SVT film collection and migration of it for the digital production environment of today and the future – and an even more competitive market - demand a management with thorough knowledge of the content and technical status of the archive collections.

The archive collections are one important element that distinguish the public service broadcaster SVT from its commercial competitors. At the same time the SVT sales has been a commercially successful provider of archive material to the same competitors!

Bild 31



Questions

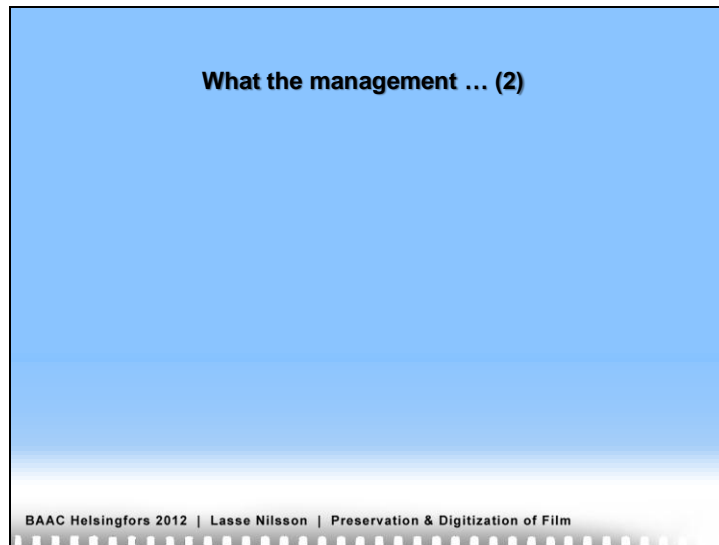
It is a matter of knowing what kind of content has to be easily accessible in the short and long perspective, from a market point of view?

Should preservation and migration activities be guided by content values or merely the physical status of the material?

If the management dares to make the prioritizing, do they have enough information to estimate the actual costs of different alternatives?



- There is a considerable need of renovating originals (used historically as viewing copies).
- Broken or sticky splices is a big problem in the scanning process.
- A great number of damaged filmboxes through wear and tear of research and production is the immediate greatest threat to the material.
- SVT lately invested in a very competent scanner.
- A number of facility houses are at hand in Europe and elsewhere for preservation and migration services.
- Climatized archive storage is at hand internally (though need for part adaptation for vinegar syndrome material) and externally in Sweden.
- Shortage of archive technical staff. At disposal today only one trained film preservation staff.
- SVT catalogues needs to be extended on documentation of preservation/ material condition metadata.
- In comparison of video migration, costs for film to digital file migration we deal with a factor 10.
- SVT have at disposal necessary equipment for quality assessment for migration and manual renovation.



- For the technical maintenance of this equipment SVT has to rely on external service providers.
- The question of storage costs can be divided into three parts:
 - 1) Suitable archives awaiting migration, including space for vinegar syndrome material.
 - 2) Longterm storage post migration
 - a) Optimal without freezing
 - b) Freezing storage according to the FICA-method
 - c) Space for vinegar syndrome material
 - 3) File storage after migration

Recommended preservation measures - Short Perspective

- Exchange of worn filmboxes
- Change to 100 mm cores
- Separation of film & magnetic tape in the same box
- Barcode labelling of boxes and rolls
- Always migrate complete rolls
- Strategy for measures when demand for prompt preservation



**Recommended preservation activities
– Longterm Perspective**

- Prioritizing for batch migration
- Periodical vinegar syndrome tests
- Periodical colour film tests
- Upgrading of film archive storage
- Barcode labelling of boxes and rolls
- Always migrate complete rolls
- Decisions on measures at demand for prompt preservation
- Splicing rolls to save scanning time
- Updateing of documentation
- Outsourcing of preservation & migration

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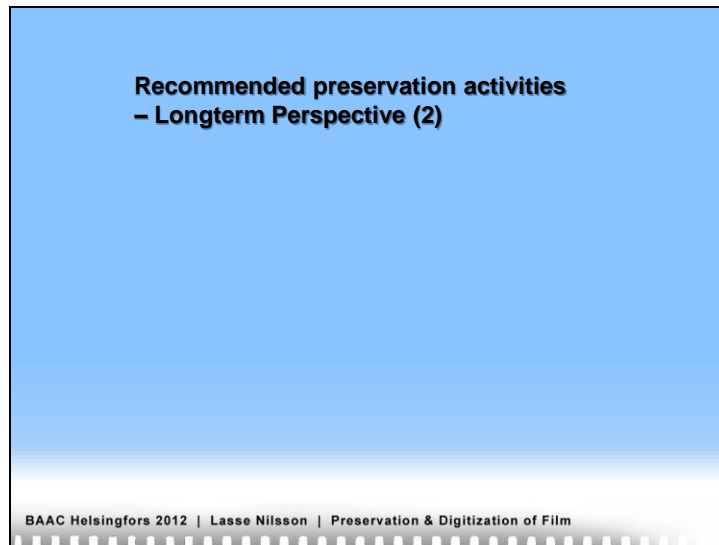
Priority order for migration

Decision on what material should be subject to batch migration in what order depending on,

- a) results of vinegar syndrome- and colourfilm tests
- b) assessment of preservation needs based on age
- c) assessment of content value for immediate programming
- d) interest of academic research

Outsourcing of archive services

All kinds of physical archive service including storage and migration could be outsourced. Functions such as documentation, prioritizing, selection and quality control to be kept internally.



Post migration measures

- Alternatives for longterm storage of migrated film
- Storage for vinegar syndrome affected material
- Outsourcing of longterm freeze storage

Alternatives longterm storage of migrated film

- a) Today's SVT archives upgraded to ISO-standards regarding temperature and relative humidity (lower than today),
- b) as under a) but all material equipped with vinegar indicators on boxes,
- c) as under a) but boxes with vinegar affected material equipped with molecular sieves.

Separate archive for vinegar affected material

According to ISO-standard within SVT.

Outsourcing on long term freeze storage with external provider

**Digitization of film – prioritized hours
- a matter of budget!**

| Period | Content | Format | Hours |
|---------------|------------|------------|--------|
| 1953-2000 | Programmes | Film/Sound | 40.000 |
| 1956-1985 | News | Film/Sound | 15.000 |
| Documentation | | | 30.000 |

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Based on key figures the management has arrived at costs of several hundred million SEK for digitization of a prioritized selection!
A matter of national interest of cooperation for saving a national audiovisual legacy.


If you want to make approximately 10 % of this prioritized quantity accessible through the "Open Archive" service on the web the estimated cost arrives at more than 60 million SEK. A matter of interest of the general public.

In the meantime focus is on the imminent programme production needs when it comes to preservation/restoration and digitization.

There is obviously still a lot of work to do!

What now at SVT?

- Of collection total: 27 % digitally born, 33 % digitized
- 300.000 hrs high resolution in archives
- 100.000 hrs of video digitized
- 50.000 hrs still to be digitized
- 55.000 hrs of film of total 75.000 to be digitized
- 5 million stills, 170.000 digitized,



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Some SVT archival statistics to contemplate

Ca 80 000 hrs of total archive digitally born.

No definite decisions on digitization of film depending on costs and still good quality status. Digitization is made on demand and only for re-use purposes.

Costs for making available via “Open Archive” of 10 % of prioritized film collections estimated € 7 million.

Stills

Totally more than 5 million stills in collections.

Running activities of digitization of stills: 100 /week.

SVT Play 2009, 1 400 000 visits/week. 1500 hrs continuously available.



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