

The Preservation of Film and Video by David Walsh, Imperial War Museum Film and Video Archive

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The first thing to say is: Digitisation is not Preservation. So what is Preservation?

This is a brief history of film preservation, followed by an outline of what it means today.

The first films, from the 1890s to the 1950s, were manufactured on Cellulose Nitrate. This material was the best plastic available at the time, being flexible, transparent and reasonably strong. It suffered from two defects. The first was the fact that it is unstable. Over the course of time – an unpredictable length of time – it will decompose. This was recognised at an early stage: the Imperial War Museum commissioned a report from Kodak in 1920 on the preservation of the films in our collection, which stated this:

We do not think that anybody has sufficient experience in the keeping of motion picture film to be able to state what will happen to film kept for fifty years; films [are] often kept for long periods without showing any visible change and it is quite possible that film might be usable in fifty years' time.....Film stock is composed chiefly of nitre cotton and this substance, while apparently stable, is subject to very slow change....Once decomposition has started no treatment will stop it, and copying is the only remedy.

And experience seemed to bear this out: all old film archives have plenty of experience of decomposing nitrate films.

This notion, that nitrate will inevitably and unavoidably decompose at some point, was the basis of a philosophy of copy and destroy. To preserve your films, you made the best possible copy on a more stable medium (cellulose acetate film), and then the original could be thrown out as soon as it showed any sign of decomposition. Archives around the world adopted this idea, although in truth, most of them held on to their nitrate for as long as possible (though normally in poor storage conditions).

How did they pay for this very expensive approach? This perhaps brings us to the second problem with nitrate – it's is very flammable. Very, very. And also liable to produce large amounts of toxic gases if it has insufficient oxygen to burn. The potential for nitrate to go whoomp may seem like a big disadvantage, but it did have the effect of frightening people into providing large sums of money to make the problem go away: ie copy it and destroy it.

The term *Preservation* was used to encapsulate this concept, though it may seem odd that Preservation means throwing your original away.

This policy is now largely discredited. Why? Firstly, nitrate was discovered to be not necessarily so unstable if stored correctly. The Image Permanence Institute, Rochester, US, have estimated the life expectancy of Cellulose Nitrate Film to be between 15 and 500 years! This may not be much help in predicting the lifetime of a particular reel, but it does indicate that nitrate can last a long time in the right circumstance.

Secondly, the new safety film, cellulose acetate, was discovered to be unstable too, in the wrong conditions even more so. Lifetimes as little as 8 years have been reported in hot and humid climates. (This was not actually a discovery, having in fact been long known, but not properly appreciated)

Thirdly, the arrival of high quality digital scanning highlighted just how defective traditional photochemical film copying is. Traditional film printing is good only for a limited range of operations, such as making a print from a camera negative. (Again, not a discovery, but until recently there was no alternative to traditional film copying.)

So in the last 15 years or so a new philosophy has taken over from the traditional notion (which the cynic might put as *the creation of defective copies on an unstable medium*), and this is, of course, conserve the originals.

Anyone from any other museum or archive area may wonder why it took 70 years or more for film archives to come up with what seems obvious.

However good your copy, film or digital, the original will always remain the source, the master. Something will be lost in the copy (something may be gained as well, of course, which could also be a problem). And you will always be able to make a better copy in 10 years, assuming your original has not decomposed.

In practice, there are two things an archive needs to do to conserve its film: identify it and store it.

You need to identify what it is you have got. Film production is a complicated and variable process, and an archive may have all kinds of reels of film, some of which are vital in ensuring that the best possible access copy can be made in the future, and some of which are not. Archivists should not be afraid to sift and select. Ideally you also need to what condition it is in. In the case of acetate film, there is a simple acid level test which gives a reasonably reliable measure of the film's life expectancy.

So, the kind of material and its condition will dictate what the storage conditions should be. What are the recommended storage conditions?

ISO 10356: Cinematography – Storage and Handling of Nitrate-Base Motion-Picture Films

Long term storage:

2 °C
20 to 30 % RH

ISO 18911: Processed Safety Photographic Films - Storage

Long term storage of B&W Acetate:

2 °C
20 to 50 % RH

(Or 5 °C
20 to 40 % RH
Or 7 °C
20 to 30 % RH)

Long term storage of
Colour (chromogenic) Film:

-10 °C
20 to 50% RH
(Or -3 °C
20 to 40 % RH
Or 2 °C
20 to 30 % RH)

How is sub-zero storage managed? There are 2 options, a fully temperature and humidity controlled store (open storage), or preconditioned storage, where the films are vacuum packed in metal foil bags and then stored in any old freezer.

Decomposing acetate and even nitrate could be stored by this means as well, of course.

Now these standards have not been dreamt up for fun. It may be difficult, particularly in some parts of the world to achieve storage conditions like this, but the fact is, if an archive does not store film properly, then it will decompose. There is simply no question about it.

The important point to grasp is that it will always be far cheaper to invest in good storage than spend money trying to rescue the results of poor storage.

What about Video? Well, yes there is an ISO standard for polyester magnetic tape, but storage is not really the problem. You can store videotapes in the deepest darkest most perfectly controlled environment, and, sure, they may well last 50, 100 years, who knows. But is there any point if there is nothing to play the tapes on when they are taken out of store in 100 years time? Because in the video world, format obsolescence is the major issue, of course.

This is not just a problem affecting professional archives. Anyone who owns a home video camera and thinks they will still be able to play back their home videos to their grandchildren in 15 years time is an optimist.

What are the strategies for video preservation? You can play the tape migration game, where you try to copy from one format to the next before it becomes obsolete itself, but in practice an archive can never keep up in this race.

Or, there's digitisation. What did I say, *Digitisation is not Preservation*? And indeed it isn't. It is merely making another copy. But the difference is that you are no longer tied to a particular physical medium. In theory, this means that copying the content to another format when this one becomes obsolete is nothing more than pressing a button and leaving the computer to do some processing. In theory, it also means that you can use established data storage and management measures to safeguard your data.

In practice, safe data storage means multiple copies and constant vigilance, and this is very expensive. It still may be cheaper than attempting to recover data from obsolete video tapes. Though you might well be advised to hold on to those tapes: who knows, in the future there may be a universal tape reader and decoder available.

But if you are looking for the perfect archival medium for digital storage, something which you can put away for hundreds of years in the store, then you will most likely be disappointed. Film itself has been proposed as a long-term digital storage medium, quite seriously, and who knows, this might work.

Finally, can you preserve film by digitisation? You can certainly make a very faithful copy of the content of the film, better than a traditional photochemical copy (if you are prepared to pay). But preserving the resulting vast amount of data will take a huge amount of effort. A 2K data scan of a film yields approx 12 MB per frame. A 90 minute feature film would then occupy a Terabyte. A compromise might be HD TV: the quality is not much worse than 2K, and compressed into a much smaller video file. If you feel that you, and your successors, have the ability to keep all this data alive for the indefinite future, then you might feel that this is an option.

Anyone from a traditional film archive will say that this solution is both a compromise in quality and a dangerous step into the unknown. However, we must recognise that many archives in the world have film which has already deteriorated beyond the point where anything other than below zero storage would preserve them, and where funds are not available for making film copies, and where the quality of the originals (if it is TV news film, for instance) means that even SD TV quality captures most of the information. In such cases, (and this is happening already in many broadcast archives) it may be the only practical solution to capture the content on video and allow the originals to continue their slide into oblivion. Do not think that the process of preserving those videos for eternity will be easy.

But whatever an archive does, preserving film and video remains really difficult – and expensive.