PRESERVING OUR PAST in
FILM, VIDEOTAPE, and DIGITAL VIDEO DISC

INTRODUCTION

This paper will cover some of the more important points in the preservation of recorded media involving the moving image which use the technologies of Motion Picture Film, Videotape, and Digital Optical Disks such as DVD. Each of these media have unique issues and handling considerations, but, they also share certain similar approaches in achieving their preservation. I will briefly discuss each medium separately, addressing their individual attributes, then provide general guidelines for treatment which apply to them all.

Too often, when an old but apparently insignificant artifact from our past is uncovered, the immediate impulse is to "clean house", to dispose of such items in the most expedient way. To us Historians, Archivists, Researchers, and, might I add, "Collectors", this impulse conflicts with our goal of preserving the historical record -- formal or informal, official or unofficial. We favor the "pack-rats" among us who can't seem to bring themselves to toss-out the trinket, the bundled letters, the home movie reels which fill our junk drawers. The "pack-rat mentality", sometimes thought of as a character flaw, is thankfully responsible for saving many of the small details which round-out the historical record.

FILM

(35mm Nitrate)
In film we will be dealing mostly with the amateur gauges of 16 Millimeter and 8mm, but I do want to make one cautionary note:

Even though a chance encounter is remote, should you ever find a roll of 35mm movie film, it is important to know that, depending on age, it is potentially dangerous, so the first step should be to have its vintage positively identified. Up to about 1950, theatrical 35mm film prints were made with a hazardous film stock called 'cellulose nitrate', a chemical sibling of *gun-cotton*. Highly flammable, and emitting very toxic gases when burning, 35mm nitrate prints must be clearly labelled and handled as 'hazardous material'. Until a roll of 35mm film is confirmed to be 'safety stock', it should be treated in a manner similar to, for instance, an open can of gasoline.

GAUGES

As a quick reference:

35mm film is about 1 3/8 inches wide;
16mm film is about 5/8 of an inch wide; and
8mm film is about 1/3 of an inch wide.

16mm & 8mm (Cellulose Acetate)
16mm was introduced as an amateur film gauge in the 1920's, although it eventually acquired a semi-professional status for documentary and industrial film production, and even the occasional feature. 8mm emerged in the 1930's. Commercial 16mm and 8mm stocks were *never* made with nitrate film base. They have only been manufactured with a low-flammable Cellulose Acetate base called 'safety film', which burns no more readily than ordinary paper. Rumor had it that some unscrupulous suppliers took 35mm nitrate stock and slit it down to 16mm rolls, but this is considered to be very rare and none of us are ever likely to encounter it.

When you find a roll of 16mm or 8mm film, the first thing to do is give it the "sniff test". If you detect a vinegar-like odor, you will know that the fate of the film is sealed -- it is well on its way to serious, inevitable decomposition. When cellulose acetate film degrades, its acetate content turns increasingly acidic. The film starts emitting the acrid odor of acetic acid, which is the same substance giving vinegar its characteristic smell. In a roll of film the "vinegar syndrome" is a sure sign of deterioration, and the only way to save its content is to make some kind of duplication. The process of degradation can be slowed somewhat by storage in a cold environment, but, once begun, it cannot be stopped. Vinegar syndrome is a self-feeding, contaminating process -- affected items should be isolated from unaffected items.

Be careful to avoid overly breathing-in 'vinegar-syndrome' fumes -- too much exposure may induce a headache.

For both nitrate and acetate film stocks, advanced stages of deterioration involve the physical breakdown of the film itself, first becoming warped to the point where it is no longer projectable, then becoming sticky and gummy, and finally

disintegrating into a crystalline powder. Thus, the first evidence of vinegar syndrome is telling you to plan on making a duplication as soon as practical. In the meantime, like all other archival materials, keep the film cool and dry, and, again, isolate affected samples. Metal film cans and reels can corrode and are also affected by acidic 'vinegar' gases, and should be replaced with plastic cans and reels.

COLOR and BLACK & WHITE

Color film rolls may need separate handling from Black & White. Besides issues involving the physical breakdown of the film base, some color film emulsions can also suffer a form of degradation, where the image fades in a way that all colors disappear *except red*. Certain color film stocks use unstable organic dyes, so that over a period of several years, such fading can become quite evident. The phenomenon is called "red-shift", or "turning red". Early stages of red-shift can be corrected to some extent by using color filtration when making a dupe print, and modern digital telecines offer advanced color correction at advanced prices, but, after a certain point, the original colors are lost forever. Color film prints should be stored at substantially lower temperatures than what's required for black & white.

Two exceptions to the color fading tendency are the well-known trade names, Kodachrome and Technicolor. These two processes use dye chemistry unique unto themselves, and five- and six-decade-old examples can retain vibrant colors as if they had come out of the lab just yesterday.

GOAL of ARCHIVAL STORAGE

The goal of storing film material at appropriately low temperature and humidity conditions is to slow down the process of deterioration, as well as to inhibit the growth of mold. Film properly stored from the beginning can be maintained in pristine condition for archival periods -- perhaps a century or so. But, if film material has been kept under less-than archival conditions for an extended period, the decomposition process has probably already begun, and some form of duplication will be called for, sooner or later.

POLYESTER FILM BASE

A third, modern type of film base, now used for practically all motion picture film prints, employs polyester plastic (polyester film base has been used in certain other areas of photography since the 1950's). Polyester film is more stable and far tougher than any previous film base, and appears to be naturally archival, so that the main concern now is to concentrate on protecting the image-carrying emulsion.

DUPLICATION: FILM or VIDEO?

In the past, when a roll of film was found in need of duplication, the normal recommendation would have been to send it to a film lab to strike a dupe print. But, with the evolving technology of today, the situation is not so simple. As a means of non-theatrical distribution, 16mm essentially has been replaced by video. And, of course, the video camcorder has replaced the 8mm home movie camera. Few 16mm or 8mm film projectors remain available, either for sale or rental. And now, portable video projectors achieve impressive quality at remarkably affordable prices.

Does it thus make sense anymore to consider making film dupes when it is unlikely they'll ever be used for public screenings?.... For the time being, this is what I would recommend:

Although new video technologies like High Definition Television have narrowed the gap, in terms of pure visual quality the film medium still comes out far ahead. Particularly with 35mm, the film image achieves a much higher resolution and superior tonal range and quality compared to what is yet possible with video, including HDTV.

Despite its age, 35mm has no rivals in the moving image field when aiming for the utmost in archival quality and stability. It may remain this way for perhaps decades. For smaller formats, 16mm also has quality-based advantages, but its practical longevity is less certain. Nevertheless, a well preserved 16mm copy will endure for decades. So, I believe it is still worthwhile, if you can afford it, to make a dupe print or negative, on polyester base film, and then have a video transfer

-- a telecine copy -- made for use as a video master from which additional copies, tape or disc, are acquired.

If film duplication is not feasible, for whatever reason, then, by all means, go with the video transfer option, choosing the best quality your budget allows. Now that HDTV is progressing commercially, costs will be descending, and telecine copies of film originals will make even more sense.

VIDEOTAPE

It is well known that older recordings on videotape can experience a few problems. The magnetically recorded video signal can undergo a gradual loss of signal strength, and the iron oxides or metal particles in the tape emulsion, within which the video signal is recorded, can begin to exhibit shedding, with the flaking particles clogging the heads of video playback machines. At this stage, duplication can be performed only after the problematic tape cassette has been treated with a mild baking procedure which temporarily hardens the emulsion long enough to use in a video player for dubbing. For master copies, digital video technology is now the preferred choice.

Of course, as with all magnetic recordings, when using or storing videotapes, avoid proximity to strong electromagnetic fields, e.g., as generated by loudspeakers or electric motors.

DVD and VARIANTS

As an archival medium, the DVD and other related digital optical disc formats remain an uncertain entity. Technical standards in this realm can evolve rather rapidly -- Hi-Def DVD is currently in development -- and the physical stability of the format is still to be tested. The Laser Disc, DVD's obsolete 12-inch diameter predecessor, sometimes experienced over time an unexpected phenomenon called "laser rot", which destroyed the recorded signal and rendered the disc unusable; also the glues employed in some discs to sandwich the layers together began to decompose, causing bleeding around the disc edges and destructive separation of the layers. The chemistry used in DVD's was consequently reformulated to avoid these problems, and as best as we can determine up to now, so far, so good.

RECORDABLE DVD vs. COMMERCIAL DVD

It should be noted that Recordable DVD's use a different technology from commercial DVD movie releases for the method of recording digital data. Commercial DVD's are made with an imprinting process where the digital data are imbedded in a thin reflective metallic layer. Recordable DVD's employ a dye layer for recording the digital record. The jury is still out regarding the archival stability of the dye layer in the Recordable DVD formats.

The DIGITAL REALM

Unquestionably, one of the greatest benefits of digital recording -- which can legitimately be called a *breakthrough* -- is the ability to make multi-generational copies with no loss in quality between the master copy and the last copy. This somewhat offsets the instability of a rather rapid technical evolution of digital hardware, with the probability of frequent cycles of advance and obsolescence. By contrast, the historical pattern in film reveals that it achieved high refinement through long-term standardization.
While there have been many gauges and formats introduced over the course of film's one-century-plus history, generally only a few have gained commercial acceptance. Those that have, however, achieved a beneficial predominance which endured for decades. 16mm was a viable production and distribution medium for seventy years. Two variants of 8mm were used in the home movie realm for sixty years (combined). And, astonishingly, a well-preserved roll of 35mm film shot in the late-1890's can be threaded-up in a modern movie projector and, with only minor adjustment, shown in any existing multiplex theatre (notwithstanding fire-code restrictions on projecting nitrate prints).

Perhaps in an unreflective emulation of the computer field, no such respect for technical stability and continuity seems to exist in the digital video arena. A two-decade lifespan for any given video format is impressively durable indeed, though after such a long period the format would appear to be getting long in the tooth.

If we were to wait for long-term technical stability in a competitive digital video market, we might *never* accomplish the

essential goal of preservation by duplication. If we are to utilize intra- and trans-media copying as a necessary means of maintaining the historical record, we may have no choice but to accept the transitory nature of the digital video domain, and employ the best media available at any point in time. We may have to adopt the concept of generational preservation, acknowledging the necessity of saving the content of obsolescent formats by transferring to newer media, as determined by the life-death cycle of the technology.

Although an alien concept in the computer world, it is conceivable that eventual quality in digital A/V recording will reach such a high level that format replacement becomes pointless, where refinement occurs within an existent format, rather than in an unnecessary 'next-generation' development. At that point digital video could access the enduring benefits which 35mm motion picture film experienced for well over one century.

In the meantime, even with evolving technology, where existing formats are replaced by newer formats, the promise of digital media is the possibility of maintaining the historical record without generational loss, and therefore to preserve our heritage into virtual perpetuity.

FINAL RECOMMENDATIONS

So, finally, as with all archival material, we should store original and master elements of film and video under cool and relatively dry conditions, have "protection" or "back-up" copies made, and duplicate deteriorating originals as soon as is practical.

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