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Preserving Film (on Film) in a Digital Age

During the First World War, the British War Office released a feature film called *The Battle of the Somme*. The Imperial War Museum's database (http://www.iwm.org.uk/) includes these notes on this film:

> Remarks: the classic First World War film in every sense, widely used for stockshots even today. It established the basic structure of the 'big battle' film, which was to continue for a further two productions until the spring of 1917. The only British official film to have a major impact on the perception of the war, both at the time and in historical terms. Also the only official film of the war with a claim to be regarded as great art in its own right. The unprecedented and unexpected public success of this film established cinema as a major factor in British propaganda for the rest of the war.[1]

The claim of "great art" for *Battle of the Somme* is especially important. Certainly the film's recording of historical events in the Great War has value, but the skill and achievement of the filmmakers also had a significant effect on the development of the documentary film as an art form. This

achievement was recognized in 2005, when *Battle of the Somme* was named to UNESCO's Memory of the World program. At the time, it was one of only three motion pictures on the registry. This recognition did not come only with the perspective of time. Penelope Houston, in *Keepers of the Frame: The Film Archives*, notes how contemporary critics immediately saw the lasting significance of this film. She quotes *The Times* of London, which in a 1916 review declared: "In later years, when historians will want to know the conditions under which the great offensive was launched, they will only have to send for these films and a complete idea of the situation will be revealed before their eyes – for we take it as granted that a number of copies of them will be preserved in national archives."[2]

This assumption was certainly logical, but unfortunately the original materials for *The Battle of the Somme* were not protected as well as they should have been. The film is not lost, of course, and copies were kept in "national archives" as the critic of 1916 hoped. But as the images became famous and then iconic, the negative was cannibalized for use in other productions, and by the 1930's there were only poor quality duplicate copies of the original version. The artifact itself was in danger of degrading slowly, losing both content, through multiple versions and repurposing of footage, and image quality, through constant duplication and the loss of original material. Despite its historical impact and iconic status, the film only recently received a full-scale restoration by the Imperial War Museum – and only *after* it was named to the UNESCO registry.

The idea that motion pictures, either on film, videotape or in digital format, will somewhere, somehow be archived for future study is quite pervasive, both historically and in the present. Motion pictures were often recognized for their value as documentation, even if the possibility of film as art was slower to be acknowledged. It is a strange and often frustrating fact than more often than not these moving image artifacts, lauded in their original context, could be forgotten, neglected or even destroyed. This essay, adapted from my presentation at Jadavpur University in 2008, surveys the problems film archivists face in the digital era. When I use the term "film archivists," I am referring to those who curate and preserve moving images that originated and were projected on film. The broader term "moving image archivist" includes those who also care for videotape and digital media. I separate the terms for one simple reason: the process for preserving motion picture film is one we understand well, while a long-term solution for videotape and digital data has yet to be developed. Preserving film requires a specific set of technical and practical tools, and a historical appreciation of how film artists worked in the medium. In some ways, preserving video images comes down to nothing more than a system

of computer networks, owing more to Information Technology than to Library Science. In truth, both disciplines are more alike than dissimilar, and become more so every day. Most of all, the problems of film preservation are instructive to all moving image archivists, as we share many challenges: "lost" works, format obsolescence, and the need to engage the materials as well as the artists that created them.

Raising awareness, and the awareness of loss

Moving image archives and archivists have succeeded in increasing awareness of the issues of film conservation and preservation; yet very few people actually know who, if anyone, is actually responsible for this work. Archivists have tried to bring their concerns to a wider audience, with slogans ("Nitrate Won't Wait!"); conferences and symposia (the annual Association of Moving Image Archivists conference, and Orphan Film Symposium); and through international events like Home Movie Day. Still, it can be frustrating to see these efforts co-opted by studio marketing departments, morphing into stickers that announce "Digitally re-mastered!" on DVD cases, or the less-than-enlightening "before and after" shots used in commercials for the re-release of a film on DVD or Blu-Ray. The inescapable truth is that film preservation remains a small field, and archival concerns and the consequences of an "all digital" world are rarely considered outside of that small community.

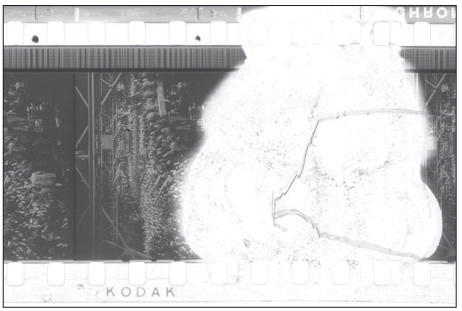
The simple fact is that there is no consensus and no established method for preserving digital movies. In contrast, while film preservation is slow and expensive, it has a set of shared procedures, standards and practices common in archives around the world. Our capability to preserve film is, perhaps, greater than ever, even if the resources to do so are almost always lacking. Even with all the technical and financial tools we could have to preserve motion picture film, we will always be hampered by many decades of neglect or active destruction of film elements. Much of film history throughout the world has already been lost to posterity. Figures compiled by the Fédèration International des Archives du Film, or FIAF, suggest that up to 80% of the movies made in the silent era have been lost forever. The sound era has its losses as well; of all the movies made before 1950, only half are believed to survive.

While lost silent films get most of the attention, the impact of having lost so many films from the sound era is still being realized. All known copies of the first sound feature film to be made in India, 1931's *Alam Ara*, have been lost. The loss is doubly disappointing, for beyond being India's first "talkie", *Alam Ara* helped shape the future of Hindi cinema and the film industry throughout India. It used sound not just for dialogue, but prominently

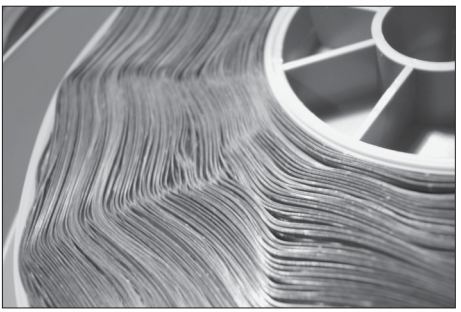
featured popular songs. According to Shayam Benegal, *Alam Ara*, "…was not just a talkie. It was a talking and singing film with more singing and less talking. It had a number of songs and that actually set the template for the kind of films that were made later."[3] Any historian wishing to consider how songs and popular singers gave rise to the film industry in India would certainly view *Alam Ara* as a primary document, one that is now lost to audiences forever.

Deterioration and loss

There are countless reasons why movies become lost: the elements are actively destroyed, carelessly misplaced, or neglected until they deteriorate beyond the point of salvage. Sometimes they exist, but are held by individuals or organizations that refuse all access to the material. Guarding against destructive, careless or selfish behavior is certainly one way we can protect moving images for the future, but these aspects of human nature are unpredictable and, perhaps, inevitable. These are problems not at all limited to the archival field. We do, however, face the more particular problem of decomposition. Before 1950, film base was made of nitrocellulose, which, in addition to being highly flammable, can degrade, causing the film base to bubble, melt, or turn to powder (see illustration 1). After 1950, the dominant film base was triacetate, considerably less flammable but also subject to degradation. Acetate deterioration is commonly known as "vinegar syndrome", since the production of acetic acid smells very much like vinegar. Though less catastrophic than nitrate decomposition, the breakdown of safety film base can cause extreme shrinkage and brittleness (see illustration 2). In regions of extreme variations in heat and humidity, acetate deterioration can be completely irreversible. As part of the Academy Film Archive's Satyajit Ray project, we examined some safety film of Ray's original negatives that were fused into a solid block. Since the 1970's, modern preservation film stocks use a polyester base, which appears to be extremely stable, and



1. Nitrate decomposition



2. Acetate deterioration

thus suitable for archival storage of moving images.

Though decomposition can devastate motion picture holdings, we do have some understanding of how to control it. Though it is difficult to isolate specific causes, a major contributing factor to both safety and nitrate decomposition is storage conditions. Film lasts longest when stored in low temperature and humidity, and, equally important, constant levels of both. The Image Permanence Institute in Rochester, New York, has provided long term empirical studies that offer film archivists guidelines for storing audio-visual materials. While simple in concept, the difficulty is, as usual, funding. Building temperature and humidity controlled vaults is expensive, and the energy demands are a constant financial drain — and also dependent on a developed infrastructure and stable utilities.

There is another threat to film holdings, and that is format obsolescence. While the basic film gauges and formats have been fairly stable over the last century, there are still a great many short-lived and obsolete formats. Many of these rolls of film may be quite stable, but the equipment and experience to handle the format may no longer be available. Here is a case where living in a hybrid age is to the archivist's advantage. These formats can be scanned digitally and recorded back onto standard polyester film for preservation. An otherwise unidentified short "trick film" from the turn of the century, *Coppelia,* was among the films in a batch of 28mm reels that were donated to the Academy Film Archive. As 28mm was developed by Pathé for use in the home, the base was not nitrate but an early safety stock called diacetate. Though these prints can suffer from a version of acetate deterioration, when they do survive they can be the only remaining copy of a film. Though 28mm film printers still exist, most have not been used for photochemical duplication in many decades. The 28mm print of *Coppelia* was scanned at Haghefilm, a lab in Amsterdam, and recorded onto 35mm black and white negative. We now have both the digital data and the negative for preservation purposes, and new 35mm prints for access.

The 1911 Edison film *How the Hungry Man was Fed* was more daunting to preserve, as it survives only as one 22mm print in the Academy's collection. For roughly four years between 1912 and 1916, the Edison Company sold a home viewing format called the Edison Home Projecting Kinetoscope[4], which used a 22mm wide band of film with three rows of images (see illustration 3). The film ran

3. 22mm Edison

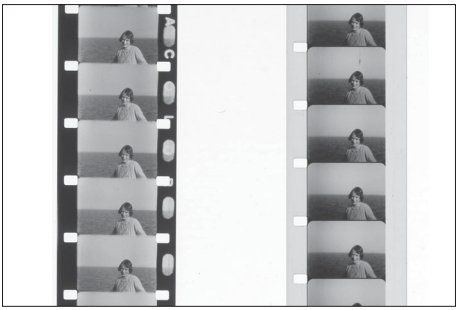
forward through the projector until the end of the reel, and the home user simply slid the entire reel over to the next row of images. The reel then ran through the projector backwards. After the center row of frames had been projected, the reel was slid over one more time, and the film ran once again in the other direction until the end of the reel. The challenge was not simply to scan the three rows of images; instead, as the center row runs in the opposite direction of the outer rows, the work demands careful reconstruction to put the frames back in the correct order. Again, Haghefilm performed this work for the Academy, generously performing the work on *How the Hungry Man was Fed* and two other 22mm shorts as a donation to the archive. While many more Edison films survive in archives throughout the world, few institutions have the resources to pay for this kind of work.

There are also formats which are not entirely uncommon but require specialized knowledge to fully understand the nature of the images. Another common home format was 9.5mm film. Both projectors and cameras were sold for 9.5mm, meaning that surviving rolls contain both commercial movies for home consumption as well as home movies shot by individuals. When feature films or other commercial movies were reduced for 9.5mm, the intertitles were often printed in an abbreviated form. In order to save in film stock, the titles were only printed for a short section, and a notch was cut into the side of the film. A mechanism on the projector caught on the notch, and slowed or stopped the film and brought a protective shield down to stop the frames from burning in the gate. The few frames of titles would be projected long enough to be read, and then the projector would continue at a normal speed. If a 9.5mm print with this set-up becomes a preservation source, the intertitles cannot simply be copied frame for frame, but would have to be stretched or repeated so that they were on-screen long enough to be read. (see illustration 4)

4. 9.5mm with notches

In the case of Kodacolor, the identifying aspects of the format may go entirely unnoticed. This lenticular color process used 16mm black and white film with an embossed base. When viewed, projected or copied under normal circumstances, the image produced is black and white. Originally, a filter in front of both the camera lens and the projector produced a color image. In the Academy Film Archive's holdings of Alfred Hitchcock's home movies, one reel was discovered to be lenticular film.

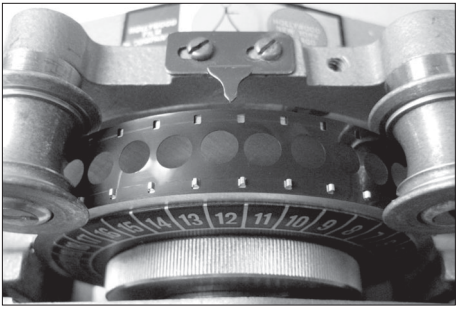
Fortunately, one laboratory in Los Angeles, Film Technology Company Inc., can still copy the Kodacolor original back to color stock. The illustration shows the exact same frames in the original element, on the left, and a print from the new color negative on the right (see illustration 5).



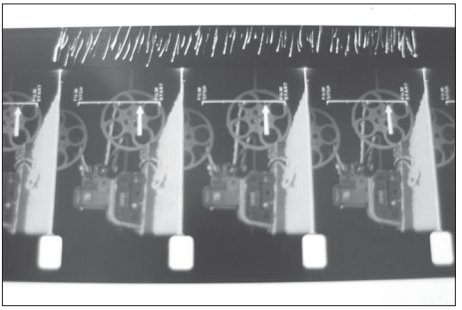
5. Hitchcock lenticular color

Artist's films

While commercial film making is what most people think of when we talk about our moving image heritage, there is also a strong tradition of personal, non-traditional filmmaking. These works are sometimes called experimental, avant-garde or artists' films. Some of these filmmakers produce challenging work, but use the traditional methods of photography to create images. Frequently, these film artists engage the medium on a more direct level, challenging not just the audience's expectation of what cinema is, but how it can be produced. The challenges multiply when, long afterwards, the archivist is tasked with faithfully persevering works crafted with non-standard and experimental methods. Stan Brakhage made nearly 400 films, and composed images by painting directly onto film stock, scratching through the emulsion of existing film images, and even by taping down bits of plants and insects. Lewis Klahr made *Her Fragrant Emulsion* (1987) by cutting up thin strips of Super 8mm and making a collage of the slivers of images. The original elements for Fred Worden's *Insomnia* (1981) consist entirely of holes of two sizes punched out of black leader. (see illustration 6) Often artists came up with new ways to produce sound to accompany their images. To make the soundtrack for his film *Specific Gravity* (1969-70), Standish Lawder made short scratches into the soundtrack area of the one positive print (see illustration 7).



6. Fred Worden



7. Standish Lawder

Frequently, randomness and accidents were incorporated into the finished film.

When Ben Van Meter unintentionally used the wrong temperature of water while hand-processing some 16mm footage, the emulsion became reticulated and wrinkled. Fascinated by the result, he used the technique to make *Acid Mantra* (1967). These films cannot be properly preserved without an understanding and appreciation of the artist's methods and intentions. If we approached the elements for *Acid Mantra* with no knowledge of the filmmaker, we might assume the elements had been damaged after the fact, and that the reticulated emulsion was not originally part of the film's aesthetics. Even when experimental filmmakers use traditional photographic methods the results still require careful consideration. For his found-footage film *Hot Leatherette* (1967), Robert Nelson repeated a shot of a car rolling off a cliff, gradually slowing the speed as the shot repeated. The scene was printed on a home made contact printer, and the final shot contains a great deal of printed in dirt and scratches. These become more and more visible as the speed of the images slow down. This effect may not have been planned, but it was always accepted by the filmmaker as part of the finished work. When *Hot Leatherette* was preserved photo-chemically, the appearance of the shot in the new negative was not altered. In contrast, some film scanners and many digital restoration tools use automated systems to remove perceived defects, and could have removed the scratches and dirt which should be in the image. Future archivists will have to approach these works with consideration for the film artist, and with an appreciation of the material reality of film materials crafted in an independent and highly personal environment.

How do you preserve a film?

One of the most common questions I'm asked as a preservationist is how we go about preserving films. The examples above document some of the interesting problems for preservation, but there are many examples of preservation projects that are more straightforward. While there are a lot of technical choices to be made during the lab process, I would like to answer this question by focusing on the larger process. A good place to start is by defining some simple terms that often get used in confusing ways. I prefer to categorize our work using the terms *conservation*, *preservation*, *restoration* and *reconstructio*n. Not all institutions will use the terms in the same fashion, but the definitions we use help explain our approach to archival work at the Academy Film Archive.

The largest and all-embracing term is conservation. *Conservation* is a continuous part of archival work. At a basic level, it means the film elements stored at an archive are protected from long-term decay and damage. It

requires secure vaults with temperature and humidity control, as well as the use of archival materials for storage (e.g., non-reactive film cans and cores – see illustration 8). In addition to these material requirements, conservation is a set of practices that minimizes threats to the collection. Removing paper and foreign materials from cans, limiting access to fragile materials, controlling and tracking the movement of elements – all help ensure a safe environment for archival elements. Finally, disaster planning and emergency training for staff are increasingly featured in many archives' long-term conservation plans.

8. Cans on Shelves

Conservation plays a part in *preservation* as well. At its core, preservation, as we use the term, means protecting a work by making new archival film masters. It is, essentially, duplication, but not just duplication for distribution. The new masters provide long term storage, and back up should the original elements degrade. New preservation elements should be in the original format, when possible, or in a standard film format in the case of obsolete gauges. They should also be reserved for use as masters, and accessed infrequently and only for future preservation work.

A preservation project should start from the most original materials. Well before any lab work is contemplated, research may be necessary to determine what may be the best surviving material. Logically, the most original element for the picture is an original camera negative, but unfortunately this does not always survive. In the case of many 16mm films, the camera original may be a positive element. Whether positive or negative, the new preservation master should be made directly from the most original element. In the case of color films, true preservation involves making separation elements on black and white stock that capture all three of the color values. While color stocks have improved, there is always a fear of color fading, and making separations is the most stable way to preserve color motion picture film. In the case of sound, preservation involves making a new master, often an optical track or a 35mm magnetic element on polyester base, in the original format and with the original mix. All preservation projects involve the vaulting of new masters for long term protection, but also the production of access copies as well.

Preservation is an expensive process, especially for color film. All institutions face administrative pressures to cut costs, and frequently the

pressure will be to ignore or limit photochemical preservation. Frequently the term *passive preservation* is used to imply that simply keeping materials in a vault is sufficient. The concept of passive preservation is troubling, as it leaves the elements subject to further decay, albeit at a much slower rate if the storage conditions are good enough. Even more problematic is the fact that a passive preservation strategy abandons the concept of access. By producing access prints as part of a preservation project, the need to subject the new preservation masters to additional use is minimized.

Restoration is one the terms most in need of a strict definition. Most lab work done by archives is simple preservation, but if the best surviving materials are compromised, damaged, or censored, it may be necessary to restore the sound and image to their original state. Unfortunately, restoration is often used interchangeably with preservation, especially in the marketing for commercial home video. While this may be, for the most part, harmless, there are situations where it is more detrimental. Though now out of favor, the colorization of black and white films is the most infamous example. Less obvious to most movie fans is the pressure to take a monaural soundtrack from a film and produce a fake "stereo" version for re-release. This new version is not authentic to the original intent of the filmmakers, and should not be considered restoration or preservation, but rather *repurposing*. If repurposing allows a copyright holder the chance to profit from an intellectual property, which in turn provides an economic incentive for full preservation, then this is perhaps slightly less insidious. But as the furor over colorization of black and white films resurfaces – it has even been suggested that Ray's *Pather Panchali* be colorized — archivists will have to clearly distinguish between true restoration work and these other forms of image manipulation.

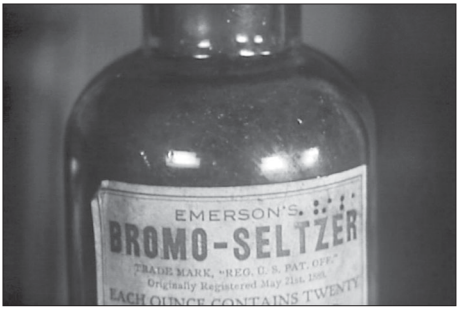
Finally, there is the concept of *reconstruction.* There are times when so much is missing from an element that it cannot be fully restored, but we may have enough evidence to do a speculative reconstruction. In the case of the 1928 silent version of *Sorrel and Son,* the climatic last scene of the movie was missing. However we found a full script in the Academy's Margaret Herrick Library, and there were multiple production stills from this final scene. The remaining action was summarized with text, and the stills were used to illustrate the action. While the remaining reels have been preserved, and any interested scholar could watch the film with the missing ending, the reconstruction allows for public screenings to a larger, less specialized audience.

Sometimes the reconstruction of a silent film requires simpler fixes, and the distinctions between preservation, restoration and reconstruction can become more elusive. In the silent era, American feature films were widely

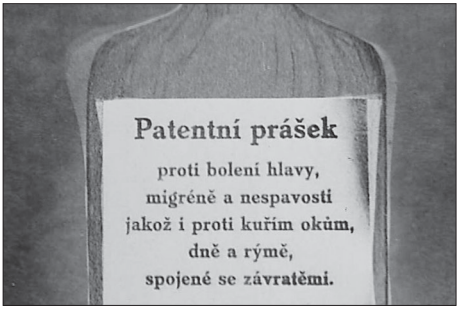
distributed abroad, and sometimes the only change was to replace the English intertitles with text in the native language. Often these foreign language prints are all that survive. In some cases, no other source for the intertitles may be known, and the only way to return the text to the original language is to do a translation. Other times there may be a script or title list, but even then the font and layout can only be guessed at, and many cards had artwork or other illustrations that were not copied to the foreign version. Also, shots of signs, newspaper headlines or other text in scenes may be removed and replaced with simple texts.

This was the case with a Colleen Moore film released in 1927, a comedy called *Her Wild Oat.* Few of Colleen Moore's features survive intact, despite the financial success of her films. *Her Wild Oat* was released during the time of her greatest popularity, and was a modest success. It appears to have been forgotten, and never re-released or copied to 16mm. It was, effectively, a lost film until the National Film Archive in the Czech Republic identified a single nitrate print in their collection. In part the film had not been previously identified as *Her Wild Oat* since it had been given a new title in Czech. Loosely translated, the film was known as "Princess from a Mobile Restaurant," since the main character runs a lunch wagon. When this discovery came to our attention, we asked for a loan of the print for a preservation project.

When we began our research, we uncovered a complete titles list and early script at the Warner Bros. Archives at the University of Southern California. We hoped we could simply replace the Czech intertitles with the original English versions. It was not surprising to discover that the main titles and some inserts with text had been replaced (see illustrations 9 & 10). However, this meant we were no longer substituting just text, as at times we could only provide substitutes that were clearly speculative. For example, the script refers to two separate close-ups of newspapers, but does not provide the exact language of the headlines. Translating the text in the Czech version was our only option, inexact as it may be. Even more instructive were the cases where we did know the



9. Her Wild Oat - Bromo Seltzer



10. Her Wild Oat - Bromo Seltzer - Czech insert

title text and placement, since we could see how many scenes were slightly altered to make the translation work better. *Her Wild Oat* derives much of its comic effect from the writing of the intertitles, which are filled with puns and American slang. To give the jokes their full effect, some titles were split into multiple cards, others were condensed from two cards to one, and some were simply dropped entirely.

What, then, is the result of our work on *Her Wild Oat?* Is it a preservation project or a restoration, or a reconstruction? The best answer is that it is all three. The original nitrate print was preserved when we made the new negative. The English language version was restored, since it had been lost and we knew that the Czech version was more than a direct translation. It is a reconstruction, since we could only guess at certain decisions. Educated guesses, surely, since we had such clear paper documentation to guide and support our decision process. Perhaps, for the average viewer, the only fact that is important is that the movie can now be seen again. While this is absolutely true, at the same time it is essential to acknowledge where the preservation and the reconstruction diverge. Thus all the title cards and inserts that were recreated have a small tag reading "AMPASA 2007". So future archivists and scholars will always decipher our intervention.

The hybrid era

In both the archival world and in commercial cinema, we still live in a "hybrid world," where both digital and analogue co-exist. *The Digital Dilemma*[5] , a report released in 2007 by the Academy of Motion Picture Arts and Sciences' Science and Technology Council, details how even the richest stake-holders in this situation — the major Hollywood studios — continue to protect their cinema assets using both digital means and traditional photochemical preservation. Even more significantly, the report highlights the fact that commercial studios are also struggling to find solutions to digital preservation. This should be comforting to archivists in non-profit and under-funded institutions. It is clear that we, as archivists, all face the same digital dilemmas. More importantly, the archives may be able to benefit from digital preservation strategies developed by the Hollywood studios. After all, the specialized film labs that handle most of the preservation projects for the archives can only exist because they do similar work, on much larger scale, for the commercial studios. Our grant money and limited preservation funds would not keep them in business.

There will come a day when film stock is not widely available, and the spare parts and first-hand knowledge of film projection simply don't exist. Film archivists will have to adapt at some point to the fact that cinema will

be entirely digital, and that film stock will no longer be part of the process of commercial film making. None of will change the fact that our first century of cinema was one of film, and regardless of technological developments, the archivists' job is to protect that history. While we may not know how we should best preserve digital data, we can currently preserve movies made on film on film, and we can try to maintain film projectors and reproduction equipment. For now, understanding the current problems in preserving film on film is essential training for future archivists. Even in an era of a "perfect" digital solution for moving image preservation, archivists will have to be more than just Information Technology and computer experts. All moving image archivists should appreciate the richness of movies in all their forms, and the value of working closely with film and with film artists. The loss of so many films should also be a call to action to prevent similar losses in a new era of "born digital" motion pictures.

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[3] "India's first talkie lost in silence." <http://www.idleburra.com/2007/03/indias-first-talkie-lost-in-silence.html>

[4] For more information on the history of the 22mm format, see Ben Singer, "Early Home Cinema and the Edison Home Projecting Kinetoscope," *Film History*, Vol. 2 1988.

[5] *The Digital Dilemma: Strategic Issues in Archiving and Accessing Digital Motion Picture Materials* (Academy of Motion Picture Arts and Sciences, 2007). This publication is available for free download at <http://www.oscars.org/science-technology/council/projects/digitaldilemma/register.php>.