

# Access to film heritage in the digital era – Challenges and opportunities

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PEER REVIEWED ARTICLE

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English abstract

## **Abstract**

Unlike archiving most other artifacts and objects, film preservation has always been heavily dependent on industry practice. The complicated and vast machinery involved in shooting, duplication, processing and projection of new films has been the same ones used for preserving and presenting film heritage. The recent shift from analogue to digital technology in capture, post-production and distribution of cinematographic works has led to the biggest challenges ever faced by the global archive community. The digitization of heritage films has the potential of providing access on an unprecedented scale, as new platforms have emerged to facilitate access and the fact that digital copies are not subject to same wear and tear as analogue film elements. But there are severe financial, legal, curatorial and technological challenges to overcome in order to fulfill this potential. The industrial shift to digital technology has led not only to dwindling photochemical laboratory capacity, film stock supply and 35mm projection equipment, which threatens the preservation and access to film heritage in original formats, but also to declining demand for scanning equipment, resulting in the fact that the window of opportunity for high-quality digitization of analogue films is already closing. Unless necessary funding is put in place very soon, 115 years of film heritage may become forever inaccessible in the future.

**Keywords:** Film heritage, access, preservation, digitization, copyright legislation

Since its birth towards the end of the 19th century, film and moving images has become one of the most important forms of human expression. In its various manifestations it has had an enormous impact on culture on a global scale, and the preservation and access to this heritage – be it news-reels, fiction or avant-garde experimental films – is absolutely vital in order for us to understand ourselves and the societies in which we live. Being the result of an industrial process – partly belonging to the realm of art, partly belonging to the realm of commerce – this particular part of cultural heritage has its own specific challenges and opportunities. The preservation and access to film heritage has always been dependent on industrial practices, and the changes in recent years from analogue to digital technology in capture, post-production and distribution of new films have led to the biggest challenges ever faced by the international archival community.<sup>1</sup> Not only because traditional archival tools such as film stock and photochemical laboratory processes are disappearing, but also because – paradoxically – the supply of high-quality digitization equipment will soon cease to exist. Ideally, we could be on the verge of a future where film heritage will be accessed and available on an unprecedented scale, from cinema projection (no longer limited to specialized archival screens) to all foreseeable forms of home entertainment formats, where classics as well as virtually unknown films will find a wide audience. Or we could be facing a future in which 115 years of film heritage will be forever unavailable and impossible to access in neither original nor digital formats. Most people can probably envisage what the potential of digital technologies could be, but the awareness of the financial, technological, legal and curatorial challenges inherent in bringing the heritage to the future is still alarmingly low, as is the awareness of the urgency with which these challenges has to be dealt.

## Access and preservation are inseparable activities

The *raison d'être* of film archives, film museums, or any other entity dedicated to the preservation of film heritage, has always been giving access to the collections. Without the prospect of access, all other activities of an archive – acquisition, cataloguing and preservation – would be meaningless.<sup>2</sup> On the other hand, if films were not at one point acquired, catalogued or preserved, access to them would not be possible. It goes without saying that a film that was never acquired cannot be accessed, and if you don't know on which shelf a print of a film is to be found, it would eventually be impossible to search through the entire collections anytime a request for access was filed. And if the film is not stored in proper archival conditions, and in some cases even restored, the film would at one point become inaccessible. Therefore it is irrelevant and futile to give precedence of any of the activities of an archive over another; it's a question of different facets of the same coin. One could however argue that it makes sense to do things in the right order, and that any access to a film that may endanger the long-term preservation (and ultimately future access) of it should be avoided. As FIAF, the international federation of film archives, states in its *Code of Ethics*, to which all members are obliged to adhere: «Film archives recognize that their primary commitment is to preserve the materials in their care, and – provided always that such activity will not compromise this commitment – to make them permanently available for research, study and public screening». So in order to discuss the future access to heritage, aspects of acquisition and preservation has also to be taken into account.

Film is peculiar in the sense that it is a media or an art form of duplication – the original object is never exhibited.<sup>3</sup> What is projected and presented is always a copy of the original, one or more generation(s) away from the original, and the loss of information resulting from duplication is inherent in the medium. This means that a 35mm projection print can be severely damaged without

this fact necessarily affecting the preservation of the film itself. If preservation elements of the film exist, a good condition printing negative could always be used to strike a new print, being an exact replica of the first one. This has been a pre-requisite condition of the medium, since inevitably every single use of the exhibition element (the print) leads it one step closer to its destruction. Every projection of a film print by default damages the print, to a greater or lesser extent depending on the equipment and the manual handling. The reason why many archives in the past in some circumstances have been reluctant to lend prints from its collections has partly been because preservation elements (that could be used to replace a damaged negative) have been missing, or because the impossibility of replacing a damaged print with a new print of the same generation even if preservation elements exist due to the loss of the original negative. We should also bear in mind that the making of new prints is a costly and time-consuming affair, which is another reason why archives preferred to limit the use of prints in their collections. The permission to give access to prints only for on-premises screenings may also have been caused by the fact that the archive in question itself doesn't hold original or preservation elements; these are in the custody of an archive or a studio elsewhere and funding would never be enough to acquire new prints from outside sources other than on very rare occasions.<sup>4</sup>

## Digitization and new opportunities

The transition from analogue to digital technology has radically changed the potential access to film heritage. In principle, digital copies can be made without damaging originals, and projection, broadcast or any other forms of presentation or transmission will not damage the digital copy in itself. High-quality digital copies can be made for theatrical use, emulating the look of a 35mm original print, as well as rendering copies for various forms of home entertainment media and platforms enjoyed on television or computer screens, or on tablets and mobile phones. Scholars and the general public alike could now, thanks to the shift in technology, get access to treasures in the archives on an unprecedented scale. And by providing access in digital formats, archives can make those parts of the collections hitherto unseen and unheard of, widely known.

A good case in point is the website *www.filmarkivet.se*, a joint project between the Swedish Film Institute and the National Library of Sweden, where films from respective institution's collections are made available as a streaming on-line service, free-of-charge and accessible from any computer in the world. The films posted on the website are mainly films that otherwise are rarely accessed, such as shorts, non-fiction films, news-reels, commercials and other genres of commissioned films – unique moving image material that reflect the transformation of Swedish society over the last century. The external knowledge that these films even exist in the collections has almost been non-existent (which in no small part is the archives' fault). The shift to digital technology has not only provided archives with the chance to make the heritage more available, but has forced archives to go back and re-investigate their collections, and to valorize and curate the collections in a different way. You could argue that shorts, non-fictions films, commercials and other types of commissioned films have been «waiting» for new technologies or new platforms to emerge and develop.

Film collections have of course been made available in non-original formats also before the recent digital revolution, but mainly for a very selected few; scholars and students could view low-resolution, telecine transfers on video or DVD on the premises of the institutions where the collections were housed. Making film heritage available on-line to the general public is a way not only to deepen the democratic aspect of heritage accessibility, but in a way also to give back to

citizens what they over the years have contributed to (at least in countries like Sweden where the preservation of film heritage is publicly funded).

## What does digitization mean?

One has however to distinguish between different forms of digitization, and for what purpose this transfer from one media to another is made. Low-resolution telecine transfer from a fourth generation print differs from a high-end data scan of an original negative. It differs in complexity and the expected time-span of the work to be carried out, it differs significantly on a financial level, and it differs significantly also in what use can be made of the digitized file. If we want our collections to be seen in a theatrical context also in the future, viewed and enjoyed collectively in the dark confinement of a cinema, high-quality digitization is necessary in order to produce a digital copy that emulates the look and quality of an original 35mm print. And this is where the problems begin.

The industrial shift to digital technology in production and distribution has meant that theatre owners have been forced to install digital projectors in their booths, otherwise they wouldn't have any films to screen as the commercial distribution of 35mm prints has more or less ceased to exist. This costly transition threatens the existence of cinema theatres in small cities and rural areas, which in Sweden has been countered by the government providing the Swedish Film Institute with extra funds to support cinemas to finance the installment of new projection technology. By December 31st, 2012 more or less 75% of all screens in Sweden had been converted to digital projection, 613 out of a total number of 816. Eventually all cinemas will be converted to digital projection, and eventually all remaining 35mm projectors will be discarded, due to the lack of space in the projection booth, the unavailability of maintenance of the apparatus, the dying breed of projectionists who know how to handle and run the analogue technology, and of course, the non-existence of prints of new films to screen. This has immense repercussions for the Archival Film Collections of the Swedish Film Institute, if we want to continue to give access to our collections. Unless we have digital cinema copies of the analogue films in our holdings, the films won't anymore be available for cinema projection.

The cost of digitizing an entire collection is very difficult to estimate. The resolution necessary of the scanning may vary depending on the original source, but for most part of the collections 2K or 4K scanning is required to emulate the look of a projected print.<sup>5</sup> There is arguably more information in an original 35mm camera negative than can be captured with a 4K scan, but negatives were never projected, and information was always lost in analogue duplication before a print was made to be seen.<sup>6</sup> The cost of a 4K scan of a two-hour feature-length film can be calculated in different ways, depending on prices charged by a commercial provider, or depending on amortization on equipment acquired to carry out the work in-house (a high-quality scanner can cost anything between SEK 2 and 5 million, depending on the speed). The amount of data of such a scan can be up to 4 TB, which lossless compressed can be down-sized to 2 TB (but then it is advisable to store the same file in at least two different locations). After scanning you also have the cost for hard- and software and staff for treating the raw scans (grading, stabilization, possible restoration), and for creating out-put formats for either cinema distribution or other forms of packages. In order to comply with standard archival practice of reversibility, it is also necessary to store the untreated raw-scans, and not only the treated master files, as future generations should have the possibility to go back and reverse any mistakes carried out by archivists of today, so you could end up with 8-10 TB of data resulting from a single scan of a single film. Costs of storage are also difficult to estimate, they vary depending on

whether the data is stored on discs or on tape (so does the energy costs). In the Archival Collections of the Swedish Film Institute there are more than 24,000 films, but counting the Swedish films only, there are approximately 2,500 feature length films and 6,000 short films, estimated to be around 8,000 hours of film. If 400 hours of film is processed every year (approximately 200 feature films) it would take 20 years to digitize the collection at an approximate cost of SEK 300 million. When this is done, the Swedish film heritage will be available for future generations.

## Time and costs involved in digitization

Let's examine the figures 400 hours, SEK 300 million and 20 years a little closer. 400 hours of film, or 200 feature-length films, may not sound so much at first glance. However, most high-resolution scanners operate at 2–4 frames per second (fps), meaning that the scanning alone of a single two-hour film could take up to 24 hours. The preparation necessary before scanning should also be taken into account, such as selecting appropriate source element (original negative, master positive, duplicate negative – the most suitable element vary from film to film), and carrying out necessary repairs (damaged splices, torn perforation, etc). After the time-consuming scanning comes the even more time-consuming treatment of the image (grading, stabilization, possible restoration). It should also be borne in mind that these scanners only transfer the image; the digitization of the sound entails a separate scanning. If magnetic sound is not available, the sound often has to be captured from a positive source, a print, which means that audio restoration often will be necessary after the transfer (prints invariably has scratches in the sound-track area of the film, resulting in cracks and hums), after which image and sound has to be synchronized. So even a mere 200 features a year requires multiple, very expensive work-stations to be a feasible figure to accomplish. It should also be taken into consideration that creating faithful digital replicas of analogue films require knowledge about what analogue films should look like, to understand and interpret the original source elements' respective qualities; knowledge that is becoming scarce as photochemical film laboratories are being phased out and experienced technicians with them, and replaced with digital post-productions houses where technicians only have experience on working with digital-born films. Some of the pitfalls involved in digitization projects can be found in the FIAF *Digital Technology Guidance Papers*.

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The estimated figure of a total cost of SEK 300 million for digitizing the entire collection of Swedish films is an approximate one, which includes costs for equipment and staff. But the figures correspond with figures estimated at European level, published in December 2011 by the European Commission in the report *Challenges in the Digital Era for Film Heritage Institutions*.<sup>8</sup> It should also be noted that once the digitization of the entire collection is done, there is roughly 25 PB (Petabyte) of data to store. How much it costs to store a film every year is once again not easy to estimate. If a 1 PB tape robot storage system houses only ten films, the average cost per film is substantially higher than if the tape robot contains 500 films. Again referring to the European Commission study mentioned above, the cost of storage today is around SEK 10,000 per TB and year, which would mean that 25 PB would cost SEK 25 million per year, though past experience show that the cost for data storage drops 50% every three years.<sup>9</sup> Anyway, the cost of storing all the data once the entire collection is digitized is substantial (and it should also be remembered that the amount of data increases with the annual influx into the archive of digital-born films).

## The future of analogue access and why digitization cannot wait

The third figure to be examined more in detail is the 20 years allocated to the high-quality digitization of the entire Swedish film heritage as outlined above. If the funding is less than the estimated SEK 300 million, it would obviously take longer than 20 years. Would it in the long run make such a difference if the entire heritage were not digitized until, let's say, 50 or a hundred years? Whatever films not yet digitized can be transferred in lower resolution, by means of video or telecine transfers, and be made available on non-cinema platforms, which anyway is how films more and more are seen today. If one wishes to enjoy un-digitized films in their original splendor, one would have to come to the archival cinemas, where 35mm projection equipment will be maintained. The possibility of viewing all the films in the collections is thus preserved, and cinema screenings will become the equivalent of museum practice. If you want to enjoy a screening of a Swedish film classic until it has been digitized you have to travel to Filmhuset in Stockholm, just as you have to travel to the National Museum if you want to enjoy an original painting.

There are several reasons why this option is not a realistic one in the long run. First of all, film prints are worn by every projection, and needs to be replaced if the possibility of 35mm screenings even in archival cinemas is to be maintained. This requires photochemical laboratory facilities where the duplication is made, and the production of raw film stock on which to duplicate. The industrial shift in the making and distribution of new films from analogue to digital means that the market for laboratories are dwindling, and labs all over the world are folding. Some archives, like the Swedish Film Institute, have set up their own photochemical laboratory facilities now that the services of analogue restoration and duplication are disappearing from the market. Again, the challenge is to find experienced and skilled technicians who can carry out the work. The second requirement is the availability of film stock. The global archival community's demand of film stock has always been miniscule compared to the amounts used by the industry (a single world-wide release in the beginning of the millennium of a Hollywood feature in 15,000 prints used as much film stock as a small to medium-sized national archive has in its collection after more than half-a-century of existence),<sup>10</sup> and now that new films are shot and released in digital formats the market for film stock manufacturers is disappearing. Fuji announced last year that they will cease production of film in March 2013, and Kodak's bankruptcy protection in the US is up for renewal in the beginning of 2013, and it is uncertain how long they will continue to manufacture film stock, though they reportedly have struck an agreement with the major Hollywood studios to continue at least for another three years. But one day, film stock will no longer be available. And even if laboratory services and film stock manufacturing were secured, the suppliers of spare parts and optics for traditional projectors are closing down as commercial cinemas no longer have any demand for these products. So if high-quality digitization of analogue film is not carried out, there comes a day when worn 35mm prints can no longer be replaced, and films will become impossible to screen in the traditional way.

Another reason why high-quality digitization cannot wait is the fact that video or telecine transfers in lower quality eventually won't be acceptable even in non-cinema platforms. The standard for home screens is improving, and already now prototypes of television sets with a definition equivalent of 4K are being produced. Whatever low-quality transfers made in the past for the home entertainment market (DVD, Blu-ray, VoD services) are likely to become inadequate before too long, and the high-resolution digitization of analogue films necessary to obtain good quality digital copies for the cinema is likely to be required also for the smaller screens.

Therefore a mass digitization of analogue collections cannot wait, if the film heritage is to be available in reasonable form for future generations. As indicated above, to accomplish this within 20 years requires a lot of money and infra-structure, both in terms of equipment and in terms of skills. But signs are that this won't be enough to achieve the aim of providing access to film heritage in the future; 20 years may in fact be too long. High-quality scanners of reasonable speed (2 fps or faster) were developed by the industry at a time when films were edited and later distributed in the digital domain, but still shot on film. Today however, most new films are shot with digital cameras, which have developed a lot in recent years, and the commercial need for scanning capacity is therefore rapidly decreasing. Again, the question is whether global archival needs would make it sustainable for manufacturers to continue production. And again the answer is: probably not. In fact, the above-mentioned European Commission study states that «the window of time when digitization is possible at reasonable costs and with realistic expectations of obtaining reasonable quality, has already started closing», and concludes by saying «the window of opportunity for such mass digitization projects is already closing, and it is not realistic to assume that it will last more than 7–10 years». Indeed, Digital Film Technology, one of the very few leading manufacturers of data scanners, stated in October 2012, when they were acquired by the Indian company Prasad, that they will maintain service of existing scanners for another ten years, but did not confirm that they will be making new ones. There is an imminent danger, even if funding is allocated, that part of the heritage won't be available in any format in the future, and curators are faced with the unenviable task of making selections, of deciding which films will be passed on to future generations, and which films will be sentenced to oblivion.

## Collecting and preserving digital-born films

The *Challenges in the Digital Era for Film Heritage Institutions* study mentions the concept of the dual black holes, one of them being the unavailability of 115 years of past heritage unless digitization projects on a vast scale are initiated and funded. The second black hole in the study refers to the risk of losing the heritage of today and tomorrow if legislation, funding and archival structures are not up-dated to handle the deposit of elements of new, digital-born films, so called D-cinema elements.

There is no legal deposit of films in original format in Sweden. In 1979, the government agency Arkivet för ljud och bild (ALB) was founded (later re-named Statens ljud- och bildarkiv, SLBA), to be the repository for legal deposit of everything broadcast on Swedish television, and everything released for the home entertainment market in more than 50 copies (in the beginning in the form of VHS, later also DVD and Blu-ray). In 2011, SLBA merged with the National Library of Sweden. For films released in cinemas, the distributor was obliged to lend a 35mm print, which was then transferred by SLBA in low-resolution on video, disc or file format, and then made available for individual research at the premises of the library. Since Swedish legislation does not cover films in original format, the Swedish Film Institute in 1981 established a set of regulations for the deposit of preservation elements by contractual obligation from producers receiving production subsidies from the Institute. By this arrangement at least the majority of Swedish films produced are preserved for future generations in the best possible condition, as well as the possibility of making new copies in original and non-original formats. Traditionally, what was required was a 35mm inter-positive, but due to the shift in technology the specifications for the deposit by contractual obligation were revised in 2012, and now also cover D-cinema elements. Producers are required to deposit a digital master – either a standardized DCDM (Digital Cinema Distribution Master) or other masters

according to specifications – and a digital distribution copy, a so called DCP (Digital Cinema Package), in unencrypted form.

But many countries are still ill-equipped to handle elements on digital-born films, and there is a serious danger that the films of today and tomorrow will be lost. Unlike Sweden, many national film heritage institutions across Europe do not yet have a digital infra-structure in place, and they collect and acquire D-cinema elements without having proper means to archive them.<sup>11</sup> Digital archiving, unlike traditional film archiving, is a continuing process. You cannot put hard-drives or a data tapes on a shelf, and expect to be able to use them a few years later. You need to convert various production file formats into archival, open-standard file formats, and monitor the files and check for migration needs from the day the file enters into the collections. On a European (and global) level there is a danger that parts of the heritage of the future will be lost. 80% of the total production of silent films in the first decades of cinema are estimated to be lost – when in the future looking back on the first decade(s) of digital cinema, we may end up with similar figures.

The Swedish system of deposit by contractual obligation covers only films receiving production subsidies from the Swedish Film Institute. All other elements in the holdings of the archive have entered the collections via voluntary deposit from producers, distributors, individual film-makers, etc. Since the storage of digital films are so complicated and expensive, and since the relationship between the archive and the Swedish production milieu is and has always been very good, we are confident that we will receive preservation elements and viewing copies also from Swedish producers who are *not* obliged to deposit films to the archive. However, in our collections we also have viewing prints of some 14,000 foreign films, deposited by distributors when their exploitation rights expired. Foreign films are also an important part of a nation's cinema heritage, as they have influenced the visual culture of a society to a great extent, sometimes even more so than the national production. This voluntary deposit has come to a complete halt since the shift to digital distribution. We can only guarantee the long-term storage of unencrypted files, and Swedish distributors of foreign films are only allowed to offer encrypted DCPs to the archive.<sup>12</sup> So viewing copies of foreign films will no longer become a part of the archive's collections. It is of course true that if Swedish cinema owners in the future want to screen a foreign film, they can rely on a foreign source to get the copy, but it is highly unlikely that all films will be available in theatrical format in the future, and they will definitely not be available with Swedish sub-titles.<sup>13</sup>

## Copyright legislation and rights holders

Returning to the danger of the first of the black holes, that past heritage may become inaccessible in the future unless funding for large-scale high-quality digitization is allocated very soon, there are other aspects to take into consideration besides the immense financial and technical challenges. One of them has to do with copyright legislation. As in Sweden, most national archives do not hold the rights to the films in their collections. Clearing rights can often be a very time-consuming (and sometimes costly) affair, not least for older films where rights may have changed hands many times over the years, and where production companies have ceased to exist. There is also uncertainty on how the 2006 European Union directive on copyright and related rights for audiovisual works should be interpreted in national legislation, and it is not always easy to distinguish the relation between producers' rights and authors' rights.<sup>14</sup> A legitimate rights holder may also have licensed certain rights for certain media and certain territories to a number of different entities, meaning there are several rights holders to an individual film. Once the legitimate rights holder is established, the right

for an archive to carry out the actual digitization shouldn't be very controversial though, since the financial burden will be carried by a national, publicly funded archive, at least in the case of Sweden. Agreements on the right for the archive to use the digitized elements will be reciprocal, meaning that the rights holders would then have access to the material for commercial exploitation if they wish to. Any third party use of the material, for instance a cinema wanting to screen a DCP created from an analogue print, would surely have to pay a screening fee, but this doesn't differ from the procedure when accessing analogue prints. But nevertheless, the distribution of digitized heritage films, whether as DCPs for theatrical projection or for home entertainment platforms, be it physical objects (DVDs, Blue-rays) or as streaming files, involves further negotiations, and possible intervention at government level to decide who is obliged to do what in order to disseminate heritage to the general public.

It should in this context also be mentioned that rights holders themselves are involved in bringing their back catalogues of films into the digital domain. Many elaborate digitizations and digital restorations have been carried out in recent years, not only by major Hollywood studios but also by important producers and rights holders in Europe, also in Sweden. A lot of money has been poured into these projects, and naturally the films subject to this digitization have been the very prestigious and famous titles, films where the cost invested can be recuperated. Some of these high-end digitizations have been made with the utmost care and respect to the original, and have resulted in beautiful and faithful renderings of the original films. But there are also non-archival digitizations where curatorial aspects have been neglected. Things always present in the film have been removed (such as image instability due to splices in the original, or permanent defects in the original camera negative), or things never present in the film have been added (such as additional credits, extracting information in the original that was always lost in analogue duplication, stereo sound), not to mention unfaithful grading and distortions of aspect ratios, resulting not in a digitized or restored original, but a 21st century simulation of an original film.<sup>15</sup>

Though one might have justified, grave concerns for how heritage is presented in such cases, the immediate focus for non-commercial heritage institutions has to be on the un-exploitable films, which without interventions of the archives will never be digitized. And these include not only unknown short films or news-reels, but also the vast majority of well-known feature-length fiction films. Legal obstacles might arise when different entities claim the rights to the same film. But what to do in the cases where a legitimate rights holder is nowhere to be found, when a work is to be considered as orphan? In academic contexts the term «orphan» is often used to denominate any unjustly neglected film, but in fact «orphan work» is a legal term, used when either a film is unidentified, or when the rights holder cannot be identified, or when the rights holder is known but cannot be located. There has until now been no legal protection for making orphan works available, but in October 2012 the European Parliament and the Council passed an Orphan works directive, to be implemented in all member states by 2014.<sup>16</sup> This directive gives archives the right to digitize orphan works, and to make them available on the internet once a diligent search has been duly conducted and documented (however, it does not give the archives right to give access to orphan works by screenings in the cinema). This is an important legislation, and could hopefully function as a precedent for other pan-European legislations to facilitate for archives to give access to their collections.

## Film preservation and industry practice

Preserving film heritage is a very peculiar archival practice due to its very technical nature; the vast machinery once needed to produce the artifacts was also needed to preserve and give access to them. Because of this, film archiving, unlike most other archival practices, has always been very dependent on industry procedure. The same laboratories needed to process new films have been used by archives to preserve and duplicate historical films. Variations in industrial production of film stock have influenced the way archives carried out their preservation activities. The same playback apparatuses used for commercial releases have been used to project heritage films. When the commercial market has changed, the archives have had to adapt, whether they would wish to or not. Among the many archival implications of the recent industry change in capture, post-production and distribution, is the fact that many archives still have unpreserved films, mainly on inflammable nitrate stock. Apart from the obvious fact that films should be preserved in their original format (and then accessed in original as well as non-original format), the making of new preservation elements on film stock is often a necessary pre-requisite to carry out efficient and high-quality digitization. But the making of preservation elements, and the replacing of worn prints, is dependent on the availability of laboratories and film stock, which as earlier discussed is disappearing due to the industrial demise in demand for these services. This endangers the survival of, and potential access to, vast collections of film around the world which are still unpreserved.<sup>17</sup> And as we have seen, the commercial film industry's decreasing demand for data scanners threatens the possibility for archives to transfer their analogue collections into the digital domain before it's too late. It's hard to think of any other form of human expression where the preservation and possible presentation of the original artifacts is so dependent on industry practices.

But even if all films were digitized in time, technological obstacles for the faithful representation of heritage films still remain, for instance in relation to the question of how to project digital cinema copies of silent films. Silent films should be projected at a slower frame rate than the standard 24 fps in order to avoid an exaggeration of speed in characters' movements, etc. 35mm projectors can rather easily be equipped with a frequency adaptor to screen films at any speed ranging from 16 to 24 fps. Digital projectors can project films at 24, 25, 30 and 48 fps. FIAF representatives lobbied for many years within the SMPTE (Society of Motion Picture and Television Engineers, an international standards organization based in the US), and managed to accomplish an alternative frame rate standard, accommodating also for digital projection at 16, 18, 20 and 22 fps.<sup>18</sup> However, this standard is non-mandatory, and so far no single manufacturer of digital projectors has included this possibility, which means that the only way to present silent films in digital cinemas involve unsatisfactory manipulations.<sup>19</sup>

## Conclusion

Digital technology creates unprecedented opportunities and possibilities of disseminating film heritage, known and unknown, to a much wider audience than at any previous time in history. Instead of having to turn down most requests for giving access to the collections by lending prints, due to the borrower being incapable of handling or projecting the prints in a correct way, digital cinema copies can be made available at almost every cinema. And apart from providing access in a theatrical context, high-quality digitization also means that film heritage can be made available in other windows from other platforms. But in order to fulfill the potential of digital and to accomplish this vision, funding needs to be made available before it is too late, and it is becoming too late very

soon. In a Swedish context, SEK 300 million is in a way a staggering figure, but looked at from another angle, the cost of ensuring the future availability of more than a century of film heritage is just the equivalent of financing a mere dozen of new films. Without receiving any extra funding, the Swedish Film Institute will make high-quality digitization of some 20 films in 2013, but at this pace it will be 200 years before the Swedish films in the archive's collections will be digitized (!). Some countries have realized the urgency, and are funding digitization projects on a large scale, most notably France, where the government will provide the Centre National du Cinéma et de l'image animée (CNC) with 400 million euros over the coming years in order to have 15,000 films digitized.<sup>20</sup> In Finland, Kansallinen Audiovisuaalinen Arkisto (the National Audiovisual Archive) gets 1 million euro annually for this purpose,<sup>21</sup> and other examples include the *Images for the Future* project involving several audiovisual archives and institutions in the Netherlands, and the British Film Institute project *Film Forever* in the UK. Apart from financial support, copyright legislation should be adapted to give archives the possibility of not only digitizing the films in their collections but also make sure that it can be disseminated even if the rights situation is unclear, or if legitimate rights holders are unable to provide distribution options.

There is a choice to be made at political level. Either the necessary resources are put to archives' disposal, or the day will come when the last print of a film is being shredded to pieces in the last film projector, after which it will be talked about, eventually reminisced, and ultimately forgotten.

- 1 It should be noted that this text is solely focusing on the actual films, and not on the preservation and access to stills, posters, manuscripts, corporate records and any other non-film items that are also an important part of film heritage. These kinds of artifacts are not unique to the world of film archiving, and are not subject to the same challenges as the moving image material.
- 2 It is of course true that archives who are repositories for legal deposit don't receive elements which can be accessed by screening, but the acquired elements can be used to create new viewing elements, either by the archive or by the depositor or the rights holder.
- 3 It would theoretically be possible to project, let's say, a 16mm original shot on reversal stock (the developed camera original renders a positive image). For example amateur and experimental filmmakers frequently used reversal film.
- 4 Access can of course be also refused due to the fact that the borrower is not able to obtain a screening permission from the rights holder.
- 5 2K refers to a resolution of 2048 pixels (picture elements) on the horizontal axis, and 4K to a resolution of 4096 pixels. Please note that the number of pixels of course also increase on the vertical axis with higher resolution, meaning that a 4K scan generates four times as much data as a 2K scan.
- 6 Resolution is not the only factor, the bit-depth, i.e. the range and definition of grey-scale and colour space, also matters.
- 7 Available at <http://www.fiafnet.org/~fiafnet/uk/publications/sep.html>
- 8 Available at [http://ec.europa.eu/avpolicy/docs/library/studies/heritage/final\\_report\\_en.pdf](http://ec.europa.eu/avpolicy/docs/library/studies/heritage/final_report_en.pdf)
- 9 The estimated cost for data storage also includes costs for staff and continuous checking and migration.
- 10 15,000 prints of a two-and-a-half hour film equals 61.5 million meters of film.
- 11 Some archives have for the time being chosen the route of recording data files onto film stock, which is easier and cheaper to store. Due to the declining availability of film stock, and the fact that giving access in original (digital) format means costly digitization, this route has to be considered ill-advised and a short-term solution.
- 12 DCP's sent to cinemas for commercial distribution are encrypted allowing that particular file to be played back only from a particular server (digital projector) during a limited period of time.

- 13 For more in-depth information on the various implications for archives if voluntary deposit of foreign films will cease to exist, see Jon Wengström's article *Collection building and programming in the future – the fate of non-national films in archives in light of the change from 35mm to DCP in theatrical distribution*, in *Journal of Film Preservation* # 88 (FIAF, Brussels, April 2013).
- 14 Directive 2006/116/EC of the European Parliament and of the Council on the term of protection of copyright and certain related rights, available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0012:0018:EN:PDF>
- 15 Some festival announcements or back-cover presentations of DVDs or digitally restored films state «The film as you have never seen it before!» which, in fact, is just the problem.
- 16 Directive 2012/28/EU of the European Parliament and of the Council on certain permitted uses of orphan works, available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:299:0005:0012:EN:PDF>
- 17 Discussions at global level include contacting UNESCO to declare film a heritage medium, which would keep analogue technology a viable option.
- 18 ST 428-21:2011 Archive Frame Rates for D-Cinema.
- 19 One option is to make a low-resolution video transfer, where the speed can be adjusted. A second option is to multiply existing frames at certain intervals which often results in jittery movements. A third option is to create new and additional frames that never existed by interpolation. For more information on the problems of upgrading existing digital projectors with archival frame rates options, see *FLAF Digital Projection Guide* (Torkell Sætervadet, Brussels, 2012).
- 20 Rights holders can apply for funding from the CNC on condition that they cover 10% of the cost themselves and that the digitized films will be released on two or more digital platforms.
- 21 The Finnish archive has spent parts of this extra funding to acquire all rights (except television) for all 160 feature-length films made by major producer Suomi-Filmi during the period 1921-80, in order to avoid being hampered by copyright issues.