DIGITAL DECAY

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> *Swift to its close ebbs out life's little day;*
>
> *Earth's joys grow dim; its glories pass away;*
>
> *Change and decay in all around I see;*
>
> *O Thou who changest not, abide with me.*
>
> —Henry Francis Lyte, "Abide with Me," stanza 2

INTRODUCTION

The fate of 35mm as an acquisition and exhibition medium is intimately connected with questions of future-proofing, archiving, preservation, and access, which are currently at the foreground of recent debates around screen heritage in the UK. In this article, I explore the threat of digital projection to the viability of the 35mm release print, the impact of this on film stock production, and how this will affect film preservation. Whilst these issues are universal, this article is oriented toward a UK perspective.

First, it is important to state my allegiances. I am not an archivist. I am a filmmaker. My interest in this area stems from my current research through documentary film practice, making a film about the impact of digital technology on feature film production and consumption. Whilst I am not a Luddite, embracing digital technologies in my own film practice, I do have a fondness for film as a medium. My fascination with, and passion for, film started when I was at film school at the University of Bristol, MA Film and

TV Production. I majored as a film editor, learning to edit on 16mm film, using the English bench system, "pic synch," and Steenbeck at a time when the industry was switching wholesale over to nonlinear digital editing systems such as Avid. The act of handling the film, hanging it on hooks trailing spaghetti-like in the bin, the satisfying crunch of the splicer as it chops through a frame of celluloid: all these signal a tangible relationship with the medium. Whilst my classmates all cut on Avid, I chose to cut on film for the final project, the last student in the history of the degree to do so and, although I went on to work as an editor in the industry cutting on Avid, Lightworks, and later Final Cut Pro, the unique discipline of cutting on film has always remained with me. As part of our training, we visited the Technicolor labs, where I was struck by the smell of the developing baths, the sounds of whirring cogs and bubbling of liquid in neg cleaning, the intimate material relationship that the craftspeople (mostly men in white coats) have with celluloid as a medium, the practice of wearing white gloves to protect the film, the physical effort of rewinding a large film reel, the almost sensuous act of touching the film to one's lips in the dark to see which is cell-side up when preparing to lace-up the unprocessed film for the developing bath.

This article is not intended as a nostalgic paean to the death of film, but as an objective look at the impact of digital exhibition and the potential end of the 35mm release print on film preservation and archiving. The article draws on the insights garnered from the interviews I have been conducting in the course of my current practice-based research project. During a Higher Education Fundionc Council for England (HEFCE)-funded promising researcher fellowship, July–December 2006, I began developing a documentary research project on the impact of digital technologies on the feature film industry.[1] In the course of my research, I conducted interviews with key UK film companies, including Clive

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Ogden at Kodak, Jeff Allen, managing director of Panavision, and Lionel Runkel at Technicolor. In addition, I interviewed retired film projectionist Maurice Thornton, and Jon Webber, ex-manager of the Curzon Community Cinema, Clevedon, UK, which claims to be the "oldest, purpose-built, continually-operated cinema in the world" yet also has a brand new digital projector courtesy of the UK Film Council's Digital Screen Initiative.[2] My current practice develops out of my own personal, tactile experience of film and those who handle film. One of the aims of the project is to document these people and practices before they disappear and to explore what Raymond Williams calls "structures of feeling" around the cultural, as well as the technical, shift to digital within the film industry.[3]

DIGITAL IMPERIALISM

One of the key themes which emerges from a discourse analysis of both the trade press and academic research is the almost religious fervor with which digital technology is being heralded by the film industry, the media, and the academy alike.[4] This "faith" in digital media, with its language of the "cutting-edge," the "revolutionary," "unique," and "advanced" is so ubiquitous that it has become almost axiomatic. Take, for example, Howard Kiedaisch, CEO of the Arts Alliance Media, the company that won the consortium bid to implement the UK Film Council's Digital Screen Network, speaking at the Screen International conference on digital cinema: "Digital cinema is here to stay. Rollout initiatives across all territories are taking different routes. Pioneering global corporations are revolutionising the d-cinema landscape, driving both the market forward and offering successful models and solutions to the entire industry … will alternative content, liberated by the digital format, be the saviour of exhibitors?"[5] This is clearly only so much free advertising copy—magazines such as *Screen International* and other trade press are funded through their advertising revenue, both

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through explicit advertising and promotional copy. But this is not only the language of corporations, as attested by the UK Film Council's utopian claims about the impact of digital projection on specialized film distribution in their consultation document on "Film in the Digital Age": "digital technologies have now begun to transform the range of films available."[6] A brief analysis of this market-speak draws out two central paradigms—that of imperialism ("pioneering global corporations," "territories," and "solutions") and that of hagiography, with digital technology as the almost Christ-like liberating "savior."

As I go on to argue, this religious imagery is both insidious and dangerous, particularly in its ability to often obfuscate any useful debate. Godfrey Cheshire, wrote in 1999 in the wake of the first wave of cinematic digital projection that "bedazzled and excited by the new technology, people don't want to ponder the loss of the old, so they minimize its importance," but, as he goes on to emphasize, "this change could have profound implications, ones that the corporations pushing the new technology perhaps prefer you not to scrutinize." Invoking Bazin's belief in cinema as the "true image," recalling the indexical link between the photographic image and the real, Cheshire suggests that, "thanks to their physicality as well as their relation to the things they represent, photographs, including those in motion, are not just idle records. They are objects of contemplation whose fascination comes from the way they connect us to the world." And, whilst video might look similar, there has been a rupture of the indexical link between the photographed and the real, particularly with Computer Generated Images (CGI), which "dispenses with reality altogether."[7] This break between reality and its index clearly has profound repercussions for the question of screen heritage, a point I shall return to later on.

As Winston points out, the use of this discourse of progressive technological determinism is nothing new.[8] The drive toward digital

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is marketed as being done in the name of aesthetics, but as Lionel Runkel states, it is in fact "all down to finances."[9] Digital imperialism, in which a few global corporations are directing technological development, the market, and government policy, also speaks the language of the transformative, democratizing potential of new media, with its ultimate goal being to seduce the consumer market. As Dovey asserts, "Dixons and Argos will be the site of propagation for the so-called information revolution. A digital utopia is predicated on lots more shopping. Lots more money to circulate within the global systems that control production. Lots more profit."[10]

Even companies embedded in the manufacture and processing of film are embracing the digital revolution. In an interview, Clive Ogden at Kodak argues eloquently in defense of film, insisting that Kodak still see a future in film as an acquisition medium. He claims that Kodak are investing heavily in developing film technology, recently introducing a range of improved film stocks designed to outperform HD, such as the Vision 2 series. However, in the same interview, he also explains that the company as a whole is simultaneously investing strategically in a broad variety of digital technology through a policy of company acquisition and diversification, from digital postproduction to digital cinema projection. According to Ogden, Kodak have acquired Cinesite Special Effects house and Laser Pacific, Hollywood, they have been developing color calibration software, such as the Kodak Display Manager (KDM) and Kodak Look Management System (KLMS), and are investing in the digital cinema business with the Kodak Theatre Management System in order to get a head start when cinemas move to digital projection.[11]

Whilst championing film, Kodak are buying wholesale into the digital revolution. Roger Ebert, critic for the *Chicago Sun-Times*, commenting on a visit to Eastman House in Rochester in a room full

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of "the best film people," bemoans the fact that whilst "not a single person in the room thought they had seen digital projection comparable even to ordinary 35mm … they said Kodak was being 'repositioned' as a digital company and would not be investing in new film projection systems. That may work in the short run and be suicidal in the long run."[12] Tellingly, whilst Kodak have never manufactured film projection systems (apart from 8mm and 16mm for home and classroom use), they are now investing in digital ones. Godfrey Cheshire argues that "the movie business today seems as incognizant as audiences (and most critics) of the impending effects of this technological leap … digital's studio backers regard it as a money-saving, technically superior means of delivering their wares; they seem barely aware of how extensively it will reshape those wares and the culture and business surrounding them."[13] We have already witnessed the closing down of Kodak's 16mm and 8mm facilities, memorialized in Tacita Dean's 16mm film entitled *Kodak* (2006).[14] Works such as Bill Morrison's *Decasia: The State of Decay* (2002) and Paolo Cherchi Usai's *Passio* (2007) also reflect on the organic, ephemeral nature of both film and cultural memory.

In an article in the business section of *The Times*, James Doran interviews Antonio Perez, the chief executive of Kodak. According to Doran, Perez "believes that the traditional film business has just a decade of growth ahead of it."[15] Doran goes on to argue that,

> The Hollywood movie industry is the last big film customer in the world, but that digitisation is gathering pace. "Digital film is in its infancy in Hollywood, but in maybe three years we will see much more of it," Mr Perez said, adding that he expected Hollywood to have almost completed the switch to digital within ten years. … "We will do

> whatever is good for this company and whatever is good for shareholders."[16]

Technicolor are similarly diversifying with Technicolor Creative Services, pioneering the Digital Intermediate (DI) workflow, which Ogden claims has revolutionized postproduction. As Cheshire points out, "most media companies are far less interested in publicizing the impending changes than they are in positioning themselves to take advantage of them."[17]

Differentiating between "film" (the traditional technology of motion pictures), "movies" (as entertainment), and "cinema" (as art)—the prognosis for which he suggests is "rapid decay"—Cheshire's main argument is that technological changes, powered by large corporations, will lead to the "overthrow of film by television," the "dissolution of cinema esthetics [*sic*], and the enforced close of cinema's era in the history of technological arts."[18] Cheshire seems to be suggesting that the change to digital exhibition will kill the culture of cinema itself, potentially ending the production of moving images for exhibition to large audiences in a collective space. If this is the case, then why is the industry investing so heavily in developing digital cinema, and why, in the UK, is the government subsidizing the installation of digital projectors? According to a memorandum to the UK Parliament Select Committee for Culture, Media and Sport entitled "Is There a British Film Industry?" it is "widely accepted that theatrical releasing is often a loss leader, but establishes a profile for a film that reaps dividends in the video and televisual markets."[19] This is corroborated by the UK Film Council's statement that cinema release has already become a mere marketing tool for the more lucrative DVD release of feature films: "There is increasing evidence that distributors use theatrical release as a loss leader for revenues earned through other channels, and in particular DVD sales/rentals … theatrical release is seen more as a marketing tool than as a

revenue generator."[20] Whilst the story is clearly different for producers and exhibitors, it seems as though the culture of cinema going in the digital age is likely to be sustained as a glorified advertising window for other revenue streams, in the UK at least.

I will now draw these arguments out in my discussion of the impact of digital technology at each stage of the production process, drawing some conclusions about the implications of this for film preservation and archiving.

HIGH DEFINITIONS

When I began my practice research project, I thought it was going to be about High Definition. I soon realized my mistake. First, there is no singular definition of "HD," which covers a number of different standards and specifications with different compression rates and codecs, and can refer both to images recorded on tape, such as HDCam, and to images saved as files to hard disk (the abbreviation for which is also, confusingly, HD). During my first interview with Clive Ogden at Kodak, Ogden identified High Definition as the latest in a long "broken chain" of video formats that, because of rapidly changing technology and the issue of built-in obsolescence, together with the chemical instability of the various media themselves, clearly raises issues for archiving and preservation. According to Ogden,

> With the number of video formats that have come out since video was basically invented in the 1960s, there is a huge broken chain of formats where all that material that did get shot on video now is extremely hard to see but, with film you are actually preserving the image for many years to come and you will always be able to get an image off a bit of film, whereas you won't always be able to get an image off the latest video format

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> …. Based on history HD is just another format that will be superseded by something better in years to come, or so they say, and therefore anything that is acquired now could potentially not be able to be viewed in fifteen or twenty years.[21]

This echoes Paolo Cherchi Usai's argument that "at the dawn of an era where the moving picture is gradually suffering the loss of the object that carries it—in this case, the photographic film—the object itself is becoming more valuable than ever. The season of laserdiscs was brief, it's already history. Videotapes will probably last a bit longer by virtue of being cheap and easier to market in developing countries, but their days too are numbered. DVD may or may not set the standard for years to come, but our grandchildren are likely to see yet another episode in the archaeology of the motion picture. … What next? Something new every year as in the fashion industry?"[22]

Technology is changing very rapidly. Indeed, by the time that this article is published, much of the technical detail could well be out of date—but the overall argument I hope will still be valid. The point is that in this era of mass consumption and "update" culture, in which the rate of technological change is more rapid than ever before, our expertise is in danger of becoming out of date even before it is fully mastered. This is a concept that Alvin and Heidi Toffler have coined "obsoledge" or obsolete knowledge.[23] For example, HD is not yet an entirely stable format, but the technology has already moved on. As Ben Kempas argues, "while so much about HD still needs to be sorted out, the pioneers of High Definition are already much further ahead," referring to NHK Japanese TV's development of the next big thing: "new ultra-high-definition technology (super Hi-Vision … possibly six times better than today's HD."[24] Another competitor for HD is the 4K Red One camera which, when I set out on my research project in July 2006,

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had recently been launched at NAB Spring 2006, claiming to supersede existing HD resolution. There was no demonstrable working prototype at the time, but one was launched at the IBC Exhibition, Amsterdam, in September 2007, and it has since been used in a limited number of productions (often alongside film or HD cameras as a cheap second camera unit, if you actually check the technical specifications of their list of "Shot on Red" films on the Internet Movie Database).[25] Furthermore, the "prosumer" market is being bombarded with new developments, from HDVCam, hard disk, and DVD recording, and nobody knows which will stick and become the market leader. Kempas claims that HDV is "a pipe dream" (arguing against the marketing of such products in the name of democratization and affordability for the "prosumer" indie filmmaker), quoting John Willis, BBC, who doesn't mince his words when he says that "HDV is crap."[26]

In terms of digital cinema image acquisition, there is a great deal of discussion of High Definition versus film. But, as Jeff Allen, Managing Director of Panavision, suggests, High Definition is not a straightforward advance on, or replacement for, film. It is important to remember, as Ogden observes, that film is also constantly being developed and improved and could be said to be as equally "cutting-edge" as digital technology, notwithstanding its long history. Rather than seeing the two media canceling each other out, Allen presents them as choices in the filmmaker's "palette": "I think it's not just about the capture format, it's about the flexibility of being able to use that format when you're creating a project. There are limitations, still, in HD, that you don't see in film, for instance. Conversely, there are limitations in film that you don't see in HD, so it's horses for courses to some degree."[27] Allen goes on to suggest that "the subtleties in the end will be maybe quite minor in some cases, in other cases they won't be … let's not kid ourselves here, this is certainly an economic change that's taking place, in terms of

manufacturers wanting us to go out and spend money on the next set of new electronic kit."[28] As with many other technological shifts, such as the introduction of sound, the coming of color, widescreen, and other special formats, it seems that the surge toward digital is not so much about aesthetics as economics, driven largely by market forces and the interests of global manufacturing corporations, not necessarily by the needs of the industry itself. As Godfrey Cheshire concurs, "the change is occurring for the usual reasons: the technology is there, and money."[29]

High Definition is also having an impact on broadcast television, with the BBC's announcement at their "Road map for HD" event, September 2006, that they would no longer be accepting drama that had been originated on 16mm film. This is significant in this debate as it is likely to have just as big an impact on local film companies such as Technicolor and Kodak, as digital cinema. In a special report in their trade magazine, *Exposure*, Fuji Film outline how the British Society of Cinematographers "bit back" at the BBC after the event.[30] According to the report, Alan Yentob, Creative Director of BBC, and Jane Tranter, Controller of BBC Fiction, both admitted to having little knowledge about the subject, basing their decision on information from technicians at the BBC's research facility in Kingswood Warren, led by Principal Technologist Andy Quested. Quested stated that "there will be no Super 16mm on the HD channel." It emerged that this was "not because Super 16 is an inferior medium, far from it":

> The problem lies with the MPEG 4 compressors the BBC uses to squeeze HD into a limited broadcast spectrum. These compressors have difficulty handling the random grain pattern of film, particularly on high speed, pushed and/or under exposed material. This results in blocky artefacts and a general softening of the image

> that the BBC "white coats" think the audience at home will find unacceptable.[31]

Apparently, even when the MPEG 4 codec[32] is updated to deal with this issue, the BBC intend to use the better compression rate to "squeeze even more channels into the available spectrum," rather than to improve quality.[33] It seems as if the promise of high quality resolution and HDTV is a bit of swindle. As the report goes on to argue,

> All the advice given to the BBC bosses seems to have come from electronics engineers who only understand and feel comfortable with their own subject. They seem to be saying: "We don't know film, so let's get rid of this messy organic process and spend lots and lots of money on shiny new kit." The reliability of which is such that, as one delegate said, "if it were an aeroplane, I wouldn't get on board!" Even Quested said: "Do not buy an HD camera, let the rental companies take the risk!"[34]

The shift to digital acquisition in the face of the instability, rapid development, and built-in obsolescence of the various digital formats is worrying for the world of film preservation. Whilst digital is being heralded as a potential "savior," crucial issues in terms of format standardization, longevity, and back compatibility are being overlooked, a point which I go on to explore in further detail below.

DIGITAL INDETERMINATE

In terms of postproduction, the DI is becoming the workflow of choice for films, even if they are originated on film stock, with agreement among cinematographers (even cinephiles) that this is desirable as it allows them more immediate control of "the look" of the image than the analogue processes such as optical printing and

light grading. According to Ogden, the DI is a process whereby, if originated on film, each individual frame of the film is digitally scanned as a high-resolution (2K–4K) digital data file.[35] The film is edited and color graded digitally and then either burnt back to film for traditional release prints, or formatted for digital distribution. For films that are "born digital," that is originated on a digital format such as HD, CGI animation or a mixture of both, this process remains digital throughout, with the option, of course, of burning out an interneg at the end of the process for release on film. This has had a direct impact on the traditional role of negative cutter, which Lionel Runkel claims is now a thing of the past.[36]

Just as the use of the term "digital intermediate" to describe a digital postproduction workflow borrows from the language of traditional film processing, Technicolor Creative Services' "Digital Printer Light" service also uses the terminology of the traditional film lab. As Joshua Pines, of Technicolor Digital Intermediate, argues, the DI process "re-establishes a vernacular already used by directors of photography."[37] Carolyn Giardina reports on the positive reception of these technologies by directors of photography who extol its "ability to emulate in the digital realm exactly what a release print would look like at given printer light settings in a film lab" but on an HD monitor: "this is bringing the control back to the DOPs."[38] Similarly, Kodak's Display Manager and Look Manager Systems use digital technology to enable the cinematographer to reassert control over the image. According to Ogden, these systems also emulate the film print in the digital environment, offering on-set previsualization and allowing the Director of Photography (DOP) to try out different filters, stock, and processing choices without exposing any film, and then relaying these to the postproduction house.[39]

But it seems that the digitization of the postproduction process is not without its perils, and there are lessons to be learnt

from investing blind faith in digital technology, without fully understanding the issue of digital longevity, that are crucial for the archivist. As Ian Macdonald asserts, summing up Ian Christie's contribution to the "Future of Screen Heritage" symposium, "We need to be aware that digitisation does NOT mean preservation—recent film processes involve making a digital intermediate copy rather than an internegative, and the disappearance of the data on such copies has resulted in serious damage to at least one major film."[40] Speaking to Carolyn Giardina, in the wake of Universal Studios' recent fire, Grover Crisp (head of asset management at Sony Entertainment) outlines how major Hollywood studios are using "geographic separation" to ensure the safety of each asset. Both Sony and Twentieth Century Fox have a policy whereby they create a negative and two duplicate copies and store them in different parts of the country. Crisp also warns against the danger of heralding digital copies as an easy "solution" for preservation: "Just because it is data—not a physical thing that you hold in your hand—do you suddenly throw out all your years of conservation? … You still want to maintain and hold on to the original, make copies, make sure the copies maintain the integrity of the original data, and store them geographically separate."[41] This demonstrates that the holy grail of digital, seen as a replacement for the messy organic, deteriorating format of film, is not exempt from its own kinds of decay. This is clearly of direct concern both in terms of the use of digital media in the process of preservation by duplication and in the long-term conservation of films that are "born digital." Digital assets are at just as much risk of decay as those originated on film, if not more so. According to the Academy of Motion Picture Arts and Sciences archival report, "The Digital Dilemma: Strategic Issues in Archiving and Accessing Digital Motion Picture Materials," the dilemma of digital is currently one of the Science and Technology Council's most important issues.[42] In a review of the report for

Hollywood Reporter, Carolyn Giardina states that "the council already has identified instances where digital content could not be accessed after only 18 months."[43] Giardina goes on to summarize Milt Shefter, project leader on the Academy of Motion Picture Arts and Sciences (AMPAS) Science and Technology Council's digital motion picture archival project, arguing that any digital preservation system,

> must meet or exceed the performance characteristic benefits of the current analog photochemical film system. According to the report, these benefits include a worldwide standard; guaranteed long-terms access (100-year minimum) with no loss in quality; the ability to create duplicate masters to fulfill future (and unknown) distribution needs and opportunities; and immunity from escalating financial investment. "There's nothing in the digital world that comes close to this at this point" [Shefter] said.[44]

Ironically, then, it seems that the existing analogue film preservation route is more robust than the digital asset management systems presently available. Indeed, leading digital restoration experts Crisp and Giovanna Fossati advocate burning out a film element for the preservation of digital assets.[45] In addition, contrary to perceived wisdom, digital assets are also more costly to store than film. Shefter argues that "we need to understand what the consequences are and start planning now while we still have an analog backup system available."[46]

DIGITAL PROJECTIONS

Writing on the eve of the first full-scale digital cinema releases in the summer of 1999, "a date to set beside May, 1895" (the date of

Woodville Latham and Sons' first projection in New York, which he claims predates the "erroneous mythology" of the Lumières' first public projections), Godfrey Cheshire explains that "the new system went on display in Los Angeles, New Jersey and New York. … Digital will sneak into theaters largely unnoticed, perhaps even welcomed. But should it?"[47]

The main arguments propounded in favor of digital projection are that digital prints are cheaper to make and transport than film prints (especially if beamed by satellite, rather than on hard disk), making it not only cost effective but also environmentally friendly, at least in terms of stock and transportation costs.[48] In addition, the digital release print is not subject to dust and scratches as a film print is wont to be, meaning that a second- or third-run cinema, such as the Curzon Community Cinema, Clevedon, UK, can benefit from much cleaner projection than when they inherit a worn-out print that has been through weeks of abuse at the local multiplex.[49] As Cheshire asserts, "the new digital projection systems resemble the old method in that they project images onto the screen from a booth behind the audience. But the images aren't produced by light shining through an unfurling series of photographic transparencies on celluloid. There is no film, which alone saves distributors the costs of prints (a couple of thousand each), plus shipping, handling and storage. It also eliminates scratches, jumps and the other physical imperfections of film."[50] Ian Christie claims that "most cinemas are on their way to becoming digital. It's often a better spectator experience, and it is not necessary to preserve the celluloid viewing experience at all costs."[51]

Why, then, is it taking so long for digital projection to be universal? Predicting a two- to ten-year transition to digital in 1999, Cheshire suggests that the "the main factors likely to slow it somewhat are financial. Exhibitors are presently undertaking huge expenditures to convert from multiplexes to megaplexes" and are

negotiating with distributors "over how to share the expenses of converting to digital, which will be a huge economic boon to the studios," suggesting that ultimately the costs will be passed to the consumer.[52] As Cheshire predicted, one of the factors that has delayed the uptake of digital distribution, until more recently, is the fact that there are conflicting levels of incentive for the studios, distributors, and exhibitors. One way around this is to explore the business model of a "virtual print fee" model as a method to pay for the installation of the equipment, with the initial outlay provided by a third party, but there is little in it for the exhibitors, with the cost savings and profits largely remaining in the hands of the studios and distributors.

Another reason why digital projection may not have been taken up is the issue of built-in obsolescence. According to Lionel Runkel, Technicolor Film Services, whilst film as a medium has "principally remained the same for the best part of a hundred years …. It has now changed considerably and because we are now in the digital age it will continue to change." Runkel is concerned that the rapid development of digital technology may cause problems for the film industry further down the line:

> The one thing I fear about digital cinema technology is that, as we know with anything digital, computers, etc., it has built-in obsolesce. Five years, three years, whatever, that digital projector could be obsolete, so is somebody now going to put their hands in their pockets and spend another fifty, sixty, seventy, eighty, ninety thousand pounds, dollars or whatever, to buy a new one? No. A good old-fashioned film projector lasts absolutely years, provided you've got good maintenance, it will last absolutely years. So, we'll see won't we…?[53]

Runkel makes a key point here: with the shift toward digital, what is going to happen in terms of maintaining the equipment which will enable us to view our screen heritage? Who is going to train the next generation of archivists to use and maintain this residual technology? However, film technology, arguably, is so robust and mechanically simple that, as Torkell Saetervadet, editor of *The Advanced Projection Manual* suggests, this is unlikely to be a major problem.[54] A possibly underestimated negative outcome of the switch to digital projection, from the point of view of film preservation, is the resultant de-skilling of the projectionist; now managers can program shows (Digital Theater System).[55] At the "Futures of Screen Heritage in the UK" symposium, Leo Enticknap expressed a concern that "whilst the BFI was taking preservation seriously, there were doubts over their ability to do it, following the loss of key staff and expertise in recent years."[56] There is clearly a broader training issue here that needs to be addressed, particularly in the UK where conservation and restoration is increasingly being outsourced. Maurice Thornton, retired film projectionist, describes his induction into the role of projectionist: "I can remember the chief at the Granada at Kettering when I went to work there, grand old fellow he was, he'd started way back in 1916 at the Stoll Theatre in London. I remember when he said to me, it was my first day there and I did know a bit about projection and I had been on the Granada's week's course, and he said 'look, you're the most important person you are, there's hundreds of people that have made this film,' he said, 'but you're the icing on the cake because you are going to show it to an audience, so you're an artist and you've got to behave like as if you're on the stage, instead of being on the stage you're in the projection room, but you are showing, you are giving a performance' and I've never forgotten that. That's the difference between showing a film and pressing a button."[57] Later on, Thornton claims that he likes film because "if it gets

poorly, I can make it better," again emphasizing the tangible material nature of the medium, as opposed to the "out of reach," abstract "ones" and "noughts" of digital data. As Runkel argues, "with computer technology: as soon as you plug in a new computer it is out of date. The same thing will happen with the digital age of film."[58]

Another factor in the slow take up of digital projection has been the lack of, again until recently, an agreed digital cinema standard. John Borland, in 2004, wrote that "a technology consortium called the Digital Cinemas Initiatives (DCI), created by the major Hollywood studios in early 2002, is finally nearing completion on a set of technical recommendations that is intended to rally the industry around a single technological standard. A few details remain to be completed, largely dealing with securing the files against unauthorized copying while in the theater. But the fundamental technology specifications, based on the JPEG 2000 video format, have now been chosen."[59] DCI 1.0 was published in October 2005, with version 1.2 announced in March 2008. There has been some debate about the DCI's technical standard, with its emphasis on digital rights management (DRM) and the fact that it does not support many of the standards needed to reproduce digital surrogates of many legacy formats (e.g., lower frame rates and older aspect ratios).

According to their Web site, DCI is "a joint venture of Disney, Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios. DCI's primary purpose is to establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of technical performance, reliability and quality control."[60] DCI's detractors might argue that it is an attempt to tie up the market with a proprietary standard. The voice of dissent is particularly loud in territories outside of the United States. As Patrick Frater reports,

"Rajaa Kanwar, vice chairman of UFO Moviez and chairman of the FICCI (Federation of Indian Chambers of Commerce and Industry) digital entertainment forum, described standards put together by the Digital Cinema Initiative's committee of Hollywood studios and vendors as 'rigid, unrealistic,' and 'not appropriate' to many territories, including India."[61] In terms of digital image acquisition, Sony and Panasonic are collaborating on a new codec to record straight to disc.[62]

It seems then, that whilst competitors within the industry are beginning to collaborate in order to standardize and get the technology off the ground, this is happening in a vacuum with no international consultation, and no input from the archivists. There is, for example, no reference to preservation or digital image longevity in the DCI's digital cinema specification system guidelines.[63] Clearly both the DCI and the Sony/Panasonic collaborations are taking place in the interest of exhibition/distribution and image acquisition respectively, not with the longer-term view of establishing a standardized format for film preservation, and arguably why should they be? In terms of digital projection, the Hollywood industry is standardizing at 2K–4K resolution (DCI), whilst 1.3K is the resolution most commonly used in the developing world. On the other hand, Clive Ogden asserts that digital projection does not currently match the resolution of modern film stocks, which he claims to be at least the equivalent of 6K.[64] Thus, as with other technological developments in the history of film, standardization seems to be not necessarily about choosing the best long-term resolution, but a question of the economics of scale, whereby the industry has compromised in order to encourage early adoption of the technology. Indeed the standard recommended by the DCI is not suitable for film preservation. Given that it allows for the use of lossy compression, the film data in the form it would be distributed to a DCI-compliant digital projector

server would not necessarily be the data one would be aiming to preserve.[65]

In 2005 in the UK, the government subsidized digital projection through the UK Film Council's Digital Screen Network in order to stimulate take up of the technology by the exhibitors, who are perhaps rightly reluctant to commit to an expensive new distribution system with little in it financially for them. Michael Karagosian suggests that "had exhibitors bought into 1.3K projectors 2 1/2 years ago, they would be sitting on technology that would be considered obsolete today. This is a humbling thought, and sits heavily on the minds of exhibitors today."[66] According to their Web site, the UK Film Council claims to have "access" and distribution of "specialized (or nonmainstream) films" at the heart of their Digital Screen Network strategy. Digital projection is again seen as the "solution" to the problem of the cost of release prints curtailing the release of specialized film, which, in a chicken-and-egg fashion, contributes to the lack of audience development. "Digital technology offers a potential solution to this economic constraint as the cost of producing digital copies can offer significant cost savings on striking 35mm prints."[67] Whilst the UK Film Council claims that "the goal of the Digital Screen Network is not to replace 35mm cinema, but rather that the digital equipment will be in addition to the current 35mm projector," in the next paragraph, they champion the convenience for distributors, who "will be able to release their specialised film more widely at a reduced cost thus freeing up more marketing expenditure and potentially generating improved returns. For UK audiences, the Digital Screen Network will mean greater choice and improved access to a broader range of film."[68] It remains to be seen how much more "specialized" film has been exhibited at these Digital Screen Network (DSN) cinemas. More recently, Jeff Allen, Managing Director of Panavision in the UK, reports that at a British Screen

Advisory Council conference sponsored by Time Warner, "the two MDs of the largest theatre chains Vue & Odeon as well as Curzon all agreed on one thing that Digital screens were giving them flexibility, reducing cost. They all agreed that digital cinema screens were going to rapidly come in over the next 3–4 year period including a huge increase in 3-D."[69]

The Curzon Community Cinema, Clevedon, is one of the screens on the UK Film Council's Digital Screen Network. When I interviewed the then manager, Jon Webber, he had clearly bought into the UK Screen Council's agenda: "come February or March, we'll have a hundred and thirty-five thousand pounds of digital equipment installed, which will be quite good, it gives us a lot more opportunity in terms of the variety of films that we can show, it's about having eclectic programming."[70] Webber is impressed by digital projection:

> Hopefully as the mainstream distributors realise the cost-savings that are there for them on using digital, everything will probably move over to digital. I was very sceptical about it until up to about twelve months ago in that I didn't ever think that 35mm would be replicated or superseded in any way, but the digital prints that I've seen, particularly some of those that have been enhanced old films, look fantastic.[71]

This demonstrates the power of the restored classic, what Webber calls "enhanced old films," as a tool in the drive toward adoption of digital projection. The motivation for such film restoration is not simply renovation, but to provide compelling product for both DVD release and digital distribution. It is more about re-platforming profitable archive material in order to sell a digital infrastructure for which there is not currently enough native "content," than about the moral imperatives of moving image conservation. For example, the

recent digital restoration of *Casablanca* (Michael Curtiz, 1942), the first to be screened on the Curzon's new digital projector, was undertaken by Lowry Digital Images, later renamed DTS Digital Images, a "wholly owned subsidiary" of DTS Digital Entertainment, which was recently sold on to a company based in India. Originally an audio technology company pioneering digital cinema sound (with investment from Universal Studios and Steven Spielberg), DTS then diversified into the consumer market, licensing the encoding and decoding software to DVD producers and players manufacturers for a consumer version of the DTS cinema sound system (now the largest proportion of their business), expanded with offices in Japan and Europe, and extended into digital cinema distribution (hardware, software, and content). A global corporation with studio backing, DTS's restoration wing is clearly not an altruistic operation. Screen classics, with proven box-office appeal, are far more likely to be restored (again and again, as both the theatrical and the consumer playback systems improve and audience expectations increase), than other neglected, but less-profitable films in the archive. According to Claudia Kienzle, "eventually, many of the top 100 AFI films will likely have to be restored again to optimize them for the significantly higher compression required for HD DVDs," whilst other lesser known films remain unrestored.[72] As Martin Scorsese points out, in his preface to Usai's apocryphal book, "many of the films made available today through electronic media are misleadingly hailed as 'restored,' while nothing really has been done to enhance their chances to be brought to posterity. No less damaging than the 'vinegar syndrome,' the mystique of the restored masterpiece is condemning to obscurity thousands of lesser-known films whose rank in the collective memory has not yet been recognised by textbooks."[73]

Convergence is a key part of the UK Film Council's strategy, as outlined in "Film in the Digital Age": "in order to ensure our

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policies can be adapted to the digital age, we are watching closely the ways in which on-demand digital technology can be used to enhance access to UK independent and specialised films, on home platforms via TV sets and on mobile platforms."[74] Another aspect of digital projection is the ability to transmit straight into cinemas via satellite, which some commentators fear will alter the function of the cinema irrevocably, moving it toward a televisual rather than cinematic experience. Cheshire suggests that whilst cinema will appear to go on as normal, it will become "in effect, television, from the transmission by satellite to the projector, which for all intents and purposes is simply a glorified version of a home video projection system."[75] Whilst this will create new revenue streams for the exhibitors, the impact it has on the experience of cinema going is uncertain. "When the digital approach finally takes over at theaters, the 'films' being shown at a given 'plex' will be beamed in by coded satellite signal, which will allow distributors to supply as many–or as few–theaters as they like, with minimal advance planning and maximal scheduling flexibility."[76] But, satellite projection also offers the possibility of alternative content, changing the use of cinemas. This is already happening in the UK with performances of the New York Metropolitan Opera transmitted live via satellite to the City Screen Picture Houses chain of cinemas. According to City Screen Picture Houses' publicity, " 'The Met's experiment of merging film with live performance has created a new art form,' said the *Los Angeles Times* of the groundbreaking series of high-definition performance transmissions to cinemas around the world. In its inaugural season, the series enjoyed critical acclaim and box office success, attracting an audience of more than 325,000 globally."[77] Vue Cinemas have also been cashing in on satellite projection with their "Larger than Live" simulcasts of music, sport, and most recently, comedy. In their publicity for the live transmission of stand-up comedian Ross Noble, the press release

emphasizes the "state-of-the-art digital technology on a two-way link that enables Ross to interact with audiences."[78] However, according to one reviewer,

> Being in the cinema was a fairly sterile experience. Despite the fact that the cinema audience was directly addressed from time to time, it still felt very remote. Our audience were clearly smiling and happy, but there was no atmosphere of shared enjoyment and exhilaration. There should be a great DVD out of this night, but that will be when the editors have hacked away at some of the jarring camera moves and not necessarily hilarious phone calls and audience interjections.[79]

This review appears to confirm one of Cheshire's main fears: that the combination of digital projection with satellite distribution will turn the cinema into a glorified television set. Cheshire predicts that this will then erode modes of engaged spectatorship usually associated with the theatrical experience: "the 'moviegoing' experience will be completely reshaped by—and in the image of—television." In particular he fears "newfangled *interactivity* [emphasis original]."[80] In an interview with Keith Uhlich in 2001, Cheshire comments that "the decay has progressed since then … this technological change that we're facing with the conversion of movie theatres to these new kinds of facilities will rapidly hasten that decay."[81]

DIGITAL ACCESS

There have long been tensions between the project of film preservation versus access, and within that, between commercial and public access. The age of the Internet promises to make screen heritage available to a wider audience than ever before. But the

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issue of online access, digitization, and web-streaming is also more complex than it might at first appear in terms of the technology. According to Matthew Power, there are "numerous software companies flooding the market with different formulas for video compression" and it is easy to get "bogged down with a dozen different codecs (programs that enable video compression or decompression for digital video) to choose from."[82] Power reveals "the dirty little secret about web streaming: different compression software tools affect different components of your film, turning some to trash and preserving others."[83] There is also the issue of lossless and lossy compression and the tension between the need for losslessness to preserve content and the need for compression to save on storage space. In an article comparing the "lossless" JPEG2000 with the "lossy" MPEG-4 format (used by the BBC for the HDTV transmission), Gilmour and Dávalia define true "lossless" as occurring when "the output from the decompressor is bit-for-bit identical with the original input to the compressor. The decompressed video stream should be completely identical to original."[84] Whilst "lossy" compression might be suitable for online access, it is not perceived within the archiving community as appropriate for preservation. At present, web-streaming requires smaller file sizes, lower resolution, and higher compression rates, which are clearly not high-resolution enough for film preservation, and neither is the DCI's 2K–4K digital cinema standard. This demonstrates the need for a coherent, well-thought-out strategy for digitization, and an understanding of the separate purposes of online access, digital distribution, and preservation submasters, including some sort of international agreement on standard formats for each. Without further international debate and collaboration on this, the project of digitizing existing archive material could become a costly white elephant as the codecs, formats, and compression rates are rapidly superseded by new improved versions, and

different territories digitize to different formats, undermining the possibility of joining up archives globally in future.

However, sorting out the access issue on its own is not enough: there also needs to be a coherent approach to the curatorial practices of contextual interpretation. Wheeler Winston Dixon draws attention to the dilemma of access bereft of context, leading to "an inchoate glut of imagery that resembles a new forest of the imagination."[85] Similarly Godfrey Cheshire challenges the assumption that availability is inherently a good thing: "I don't know that easy availability of everything really encourages knowledge of what's there. It's just available," again stressing the need for interpretation.[86] One telling example of what happens when access is left to the "creative commons" is the fact that there are two different versions of the seminal Lumière brothers' film *L'Arrivée d'un train à La Ciotat* (1895) on YouTube, both claiming to be the original version, with no contextualizing explanation about the source of the footage.[87] Nevertheless, Dixon has an optimistic view of the role of "digital" access in film preservation:

> The archival concerns raised by the digital shift are many and varied, but as Val Lewton observed in the 1940s of his own work in film, making movies "is like writing on water." Some images will survive, others will not. I would argue that the digitisation of our visual culture will lead to the further preservation of its filmic source materials, rather than the other way around. With a whole new market opening up for these films of the past, the master negatives are being taken out of the vault and digitally transferred for popular conservation, with one especially desirable side effect; newer audiences now know of the film's *existence* (emphasis original). Entombed in 16mm

> and 35mm frames for projection equipment that is becoming less and less prevalent (especially in the case of 16mm), these films might otherwise never reach a 21st century audience. Perhaps film isn't disappearing after all. Perhaps it is coming back to life.[88]

Similarly writing about growing up in the age of the VHS and DVD, Bryant Frazer claims that he owes much of his love and knowledge of film history, particularly of "foreign" and art house movies, to viewing copies, not through traditional cinema distribution: "If I long for a return to the era of movie palaces and real repertory cinema, it means I'm nostalgic for an experience that I never had."[89] Indeed, this is the generation that feels able to "mash-up" and "remix" content accessible, often illegally, on sites such as iFilm and YouTube.[90] However, whilst both Dixon and Frazer celebrate the revivification of cinema as an art form through new technologies, both video and digital, they both ignore the issue of obsolescence and degradation through compression. There is clearly a danger in conflating digital access with preservation here, revealing a lack of understanding of the tensions between online access and preservation.

Writing in 1999, Cheshire predicted that the last resting place of film would be the museum, once the last commercial cinema in the United States makes the switch to digital projection: "Thereafter, to see actual films displayed, as opposed to things that for a while may call themselves 'films' but in fact are not, you will need to go to places like the Museum of Modern Art and the America Museum of the Moving Image, where projections of celluloid classics will probably remain very popular even while gaining an increasingly archaic air."[91] More pessimistically, Usai envisions a forlorn final theatrical performance:

> Unable to preserve cinema by means of cinema,

> the archives … will be forced to face up to reality and go for other options. Projecting film will become first a special circumstance, then a rare occurrence, and finally an exceptional event. Eventually nothing at all will be projected, either because all the surviving copies will be worn to a frazzle or decomposed, or because somebody decides to stop showing them in order to save for future duplication onto another format the few prints that remain. There will be a final screening attended by a final audience, perhaps indeed a lonely spectator.[92]

Whilst Cheshire predicts that digital technology will consign cinema to the museums, the irony is that the museums' faith in digital technology as a means of film preservation may contribute to its death knell. After Usai's final screening is over, perhaps people will just be happy to watch pirated copies of films out of their original context on YouTube.

PRESERVATION

So how does this all relate to film preservation? As we have seen, both Runkel (Technicolor Film Services) and Ogden (Kodak) bring up the issue of "built-in obsolescence" and the "broken chain" of video formats, both of which are of particular importance in the context of archiving and film preservation. As Usai asserts, "a viable answer is yet to be found to the obsolescence created by every new hardware system. The best solution we ve [*sic*] been able to arrive at so far is to duplicate all moving images from one system to another before the new technology has thoroughly killed its predecessor."[93] Digital is just the latest duplication format, but with each new transfer, whether it be from nitrate to acetate or polyester to digital, the original master is subjected to yet more wear.[94]

Furthermore, as we have seen, with the increasingly rapid development of new technology, it is difficult to identify a stable, universally accepted digital format, codec, or compression rate and/or associated playback equipment that will be a safe repository for our screen heritage. The problem is that digitization is perceived as being the quick answer for preservation, when in fact more attention should be given to the less glamorous but more tried-and-tested and underfunded solutions, such as a unified strategy of stabilization, active conservation, passive subzero storage, and preservation by duplication. Bamboozled by digital "solutions," audiences and government bodies alike are putting too much faith in digitization. As Scorsese asserts, "somehow, audiences are being led to believe that digital will take care of it all with no need for special storage conditions."[95]

In its "Guide to Good Practice in Digital Representation of Cultural Heritage Materials," the National Initiative for a Networked Cultural Heritage (NINCH) describes some of the problems of digitization as a means of preservation, outlining how in 2002, many organizations were still predominantly reliant on analogue formats. "The downsides are financial (e.g., considerable investment in equipment, and large storage is necessary if high-quality masters are to be stored), technical (e.g., methods of compression are still evolving, high-bandwidth networks are not yet universally in place), the difficulty of data recovery from digital tapes in comparison with analog formats, and the continuing uncertainty about the suitability of digital formats for preservation."[96] The paper goes on to list the Library of Congress, National Library of Norway, British Film institute (BFI), and USC Shoah Foundation as all using tape-based formats, such as Digital Betacam, as opposed to hard disk storage, to duplicate masters. It states that "The National Library of Norway argues that digital video formats are not yet good enough, and storage system resources are

insufficient in size to make feasible the extensive reformatting of analog material into digital form" and that it is "common practice among film archives, such as the British Film Institute (http://www.bfi.org.uk), to create analog copies, known as sub-masters, of their tape and film masters for viewing and exhibition purposes," suggesting that more recent digital formats and data files are not yet trusted.[97]

Whilst the issue of digital longevity has been of concern to many in the archiving community for some time, in some quarters, there is still a tendency to conflate access and preservation and a false perception of digital as coming to the rescue of the archive (see, for example, the UK screen heritage strategy document).[98] In fact, worryingly, the term "digital" is bandied about by bodies such as the UK Film Council and BFI without a thorough unpacking, or understanding, of the complexities of the plethora of new and emerging technologies that come under its umbrella. Sometimes the term "digital" is used to mean "online" or "interactive"; sometimes it is shorthand for High Definition (which as we have seen is just another link in the broken chain of video formats); sometimes it refers to "HDTV" going "digital"; sometimes it stands for "digital projection." However, as Howard Besser points out, "though most people tend to think that (unlike analog information) digital information will last forever, we fail to realize the fragility of digital works. Many large bodies of digital information (such as significant parts of the Viking Mars mission) have been lost due to deterioration of the magnetic tapes that they reside on. But the problem of storage media deterioration pales in comparison with the problems of rapidly changing storage devices and changing file formats."[99] The "difficulty of digital recovery" is even more of an issue with the advent of hard disk recording, and content that is "born" and/or stored digitally is not itself immune to decay. Some would argue that this is due to the oft invoked severing of the

indexical link between reality and its representation in the image, which André Bazin found so magical in the photographic process.[100] We are left with the intangible, abstract status of the digital artifact as opposed to the tactile, mechanical, material nature of film. Malcolm le Grice argues thus:

> While cinema, based on optics, wheels and cogs, the physical base of acetate film and chemistry, can be treated as physical substance and manipulated in a way continuous with the "tactile" traditions of art, the computer has no graspable substance—or what graspable substance it has, the boxes in which the components are housed and the micro-chips themselves, have a completely arbitrary relationship between their visual form and their function. Where we can see, however small, the picture on a film strip, and grasp the relationship between projected image, camera shutter, mechanics, physics and chemistry, the "image" in the computer is no more than an invisible sequence of electronic impulses combining together at the speed of light. Though obeying the laws of physics, the physicality of the computer function is beyond reach.[101]

Both film and digital are carriers for storing image information, each with its own strengths and weaknesses, but the fact that the photographic image is "human readable" has important implications for the technical process used to retrieve, view, and copy images originated on film relative to those originated as pure data. Le Grice emphasizes the underlying paradox of digital as a preservation medium, as it bears no indexical relation to the original. Not only is the data "beyond reach," it is also subject to transformation in the

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process of encoding: "the data in a computer does not resemble its source in any sense, it is sheer codification. Without an agreed system for interpreting the coded data, the data for one type of information looks exactly like the data for any other type of information. It is difficult to imagine a greater degree of abstraction than digital information."[102] As Usai argues, "Computer programmes [*sic*] become hieroglyphs within a short time, but you'll always be able to build a projector and make a screen. All you need is a light source, a lens and a shutter plus a large white surface."[103]

When we inevitably shift over to full digital projection, it may no longer be profitable for companies such as Kodak and Technicolor to manufacture and process film stock. Whilst the actual sales figures remain trade secrets, it is fairly safe to assume that the bulk of their trade comes from 35mm release prints, not origination stock. Whilst the cost savings for distributors and studios (and arguably to the environment) in the transition to the digital release print seem clear and, many would argue, desirable, this has not been properly thought through in terms of the impact it will have on the production of film stock for film preservation. Joost Hunningher reports on the contribution of Mitchell Mitch from Cinesite (expressing his personal opinions and not those of his employers, Kodak) at the D-Cinema CILECT workshop in 2006: " 'These blockbuster release runs use a phenomenal amount of film stock and are big business for the film laboratories and Kodak and Fuji. This is huge, huge business.' He explained that manufacturers of film make much more from release print stock than they do from (in comparison) the very small amount of camera stock they sell for feature film production. Mitch saw the gloomy possibility that Kodak and Fuji (now the only providers of film stock) might cease manufacturing when D-Cinema projectors replace 35mm exhibition."[104] When release prints are no longer required, it will not make financial sense for key industry players to continue to produce

film, and it will cease to exist as a viable creative choice for the filmmaker, let alone the archivist. As Usai argues, "the day will come (and sooner than you think) when 35mm film will no longer be made because Hollywood will no longer need it, and there will be absolutely nothing that anyone can do about it. What company would willingly maintain a complex and costly facility for a handful of institutions whose demand for archival film stock would not even meet the cost of its operation?"[105] With that, the science, technology, and expertise of over a hundred years will gradually disappear. Film will become a residual media, limping on as an acquisition format for several decades, like Super 8mm, still used by a few enthusiasts to create a particular nostalgic effect.

This is more than a sad loss for a few film aficionados mourning the passing of their preferred medium; it has wider moral and cultural implications for the art of film preservation, conservation, and screen heritage. At the moment, according to Technicolor, the most effective way to future-proof a film master is by making a color separation master, but according to Usai, this is costly and storage-intensive: "a separation negative (consisting as it does of three masters, one for each primary colour) is far more stable, but it costs three times as much as a standard print and occupies three times the space in the vault. In an enterprise so costly in every way, no wonder so few colour films have been restored with the most adequate technology."[106] But, given the current instability of the DI, and the "unknown" of digital longevity, it is clear that at this time, even the cheaper option of a straightforward film negative is preferable as a storage solution, and some might argue that this is true even for contemporary films that are "born digital."[107] If we do not recognize and articulate this threat, it could prove catastrophic for the endeavor of saving our moving image culture for posterity.

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However, it is just as dangerous to throw the digital baby out with the bath water. It seems highly likely that whilst digital is not currently a suitable preservation "solution" as it stands, in the long term, it will have to become one. What is needed is structured debate and joined-up strategic thinking. As Usai argues, "surely an effort at specifying what its proper uses and limitations may be would put both sides of the argument into sharper focus. Much as we have learned to fight against those who would have us jettison altogether those frail but cumbersome artefacts called film prints, we should be no less adamant with those who reject all kinds of technological advance in the name of tradition."[108] Emphasizing the importance of interpretation, Usai argues for the moral imperative of replacing what he coins as the "ideal of the Model Image" within film preservation with the more pragmatic "ethics of vision":

> In monitoring the progress of image decay, the conservator assumes the responsibility of following the process until the image has vanished altogether, or ensures its migration to another kind of visual experience, while interpreting the meaning of the loss for the benefit of future generations.[109]

As Howard Besser argued in 1999, at the beginning of the digital revolution, "our community needs to insist upon clearly readable standardized ways for a digital object to self-identify its format and the applications needed to view it … to develop a concrete set of guidelines that can be used by people and organizations wishing to make information persist … understanding how reformatting these into another format may affect the understandability and the usability of those works."[110] But, whilst there have been a few lone voices decrying the death of film as a projection medium (Cheshire, Ebert), and some concern (mainly from Usai and Scorsese) about the impact of this on film preservation, there has not yet been a

strong public debate about these issues, particularly one in which governments, industry, and the media really slug out the implications. It is important not to allow digital hagiography or digital phobia to cloud our judgments here. As Usai attests, "the issue cannot be defined either in terms of a blind utopian faith in what the future will bring or in those of a purism so narrow that it rejects outright the intervention of electronics into areas where it has never existed."[111]

At the recent "Future of Screen Heritage in the UK" symposium organized by the Media, Communications and Cultural Studies Association at Roehampton University, at which representatives of the BFI, the British Library, archivists, and academics gathered to discuss these issues, there was a general consensus that whilst digital might be an answer for access, it does not offer any easy answers for the preservation of material originated on film.[112] As Ian Macdonald reports,

> Digital is a fresh set of problems. We don't even know the dimensions of these problems yet, because the technology is still being developed—indeed technology is *always* under development (emphasis original). What is clear is that digital may be an answer to access problems, but it is not an answer to preservation.[113]

But even at a symposium aiming to bring all the UK stakeholders together, it seemed that there was a reluctance to discuss the specific issues: the problem of rapidly changing technologies, built-in obsolescence, the broken chain of (digital) video formats, the tension between lossless and lossy compression, the lack of agreed codecs or compression rates for both online delivery and digital cinema projection, and the vast differences between these two types of digital distribution. Furthermore, there was a lack of specific attention to what digital preservation actually means and

precisely how this differs from the needs of digital access so that, whilst a difference was acknowledged, the details were not elaborated.

CONCLUSIONS

The total shift to digital is coming. It is our responsibility, as academics and archivists, to be at the forefront of these debates, to unpack the various nuances and implications of digital technologies at all levels of the process, and not let the shift be driven solely by corporate technology conglomerates. In his introduction to *Fractal Dreams*, editor Jon Dovey notes how many of the contributors set out to trouble the "utopian rhetoric of technological determinism" manifested in the marketing hype of the manufacturers of new technologies.[114] Dovey suggests that there is a need to

> question the surprisingly persistent myth that technology will set us free. It is a myth driven by relentlessly optimistic media coverage. Each onslaught of hyperactive technobabble becomes more tedious than the last, until at last we become just plain bored by global capitalism's latest manifestation. We should make no mistake that this is indeed what is emerging. The real of digital offers the media/finance/military power bloc an opportunity to reorganise and consolidate its power.[115]

Dovey also points out that the supposedly radical, democratizing potential of new technology is all part of the marketing hype to sell more consumer products. Like Dovey, Brian Winston similarly notes that "new technologies are constrained and diffused only insofar as their potential for radical disruption is contained or suppressed. That is the brake. The technologies are made to 'fit' into society …. This

can therefore be termed 'the suppression of the radical potential.' "[116] For Winston,

> It all depends where you stand. For a technological determinist, whether of conservative or radical bent, the impact of the technology looms large and the changes wrought are great. The potential changes (which are always apparently to occur within the next five years to ten years) are greater yet, quite often wholly transformative [but the benefit of hindsight] will very often reduce the scale of change involved.[117]

In this sense, for Winston, "being digital becomes no big deal."[118] It is just another in a series of technological shifts in the history of the media. Writing about HDTV in 1996, Winston predicted that "our amnesia about the history of technological developments will, however, most likely work as it usually does. When, sometime in the early decades of the next century, a fully compatible HDTV system is finally introduced and begins to be diffused, there will be much talk, as there usually is, of how swiftly this change is come upon us," pointing out that "by that time it will have been more like fifty years" since research into HDTV began.[119] It is interesting to read this in the context of Godfrey Cheshire's article, written at the advent of digital cinema projection in 1999, which begins with the tidal wave of digital technology about to crash down on the unsuspecting bystander. Cheshire predicts a total shift to digital in the next two to ten years. Clive Ogden, interviewed in 2006, predicts another ten to twenty years of life in film stock. Read in the light of Winston's pragmatic, historically situated approach, it might be worth stepping back and asking not when the shift to digital will happen, but why it has not already happened?

However, it does seem that the sheer pace of contemporary technological change is something new and, despite the relatively

slow initial adoption of digital cinema, the rapid reduction in cost in relation to speed of computer processors that, according to Moore's law is doubling every two years, might mean there is a speedup in the adoption of digital technology.[120] If, as I have argued, digital is not currently the answer for film preservation, in the long term, it might have to be. This being the case, there clearly needs to be a joined-up international strategy, at the very highest level, for ensuring that future-proofing, back-compatibility, and format standardization are addressed from the perspective of the conservationist, and that any digitization for purposes of preservation involves no loss of information/compression. There is also a need for foolproof systems for backing up data in order to avoid the potential loss of digital assets. Instead, what we have at the moment is global corporations vying to become the market leaders, and built-in obsolescence creating an enforced culture of consumerism in tandem with the hype around digital fuelling a "prosumer" market hoodwinked by the promise of democratized access. Within all of this, is there also a danger of academia being in the pockets of the corporates?[121] Sony is investing heavily in equipment at a number of educational and research centers, including the University of East London's Matrix East Research Lab and the HD Studio at Bournemouth to name but two.[122] Various other media companies are sponsoring academic conferences and workshops, such as Anglia Ruskin University's Megapixel conference (sponsored by QED Productions and GearBox, assisted by the FDMX [Film and Digital Media Exchange], an HEFCE-funded knowledge exchange partnership) and the University of Westminster's D-Cinema workshops, coordinated by Joost Hunningher, which aim to "test the creative potential of an end-to-end Digital Future," with "support from the main manufacturers developing the technology that could shape our future."[123] Could there be a danger of the Knowledge Transfer Scheme (KTS) or knowledge exchange agenda

interfering with the ability of the academy to reflect critically on these new developments in technology? Richard P. Crudo claims that "the marketing and journalistic coverage of digital technologies has been predominantly fraudulent from the very beginning. … Corporate salesmen—shills and hucksters that they are—can't be blamed for doing their jobs. But judging from the flood of false perceptions and utopian expectations they've managed to etch into stone, they need to be blamed for doing their jobs too well."[124] Not only that, but the media, governments, and the academy also believe and regurgitate the hype. As Crudo argues, "it has become more important than ever for us to ask the hard questions of our digital manufacturers—and to be more demanding of the answers they give us."[125] Digital technology is not the demon here, we are. If we don't say something, it will be too late for film preservation. As Maurice Thornton, retired projectionist, points out, "It's like everything else heritage, if you don't preserve it it's gone and unfortunately it's gone forever because it cannot be recreated, not in the same way. So, that's why I'm a film man. Because I know everything's done digitally now, and I know it's done on video cameras [gesturing towards my HDV camera] and DVD cameras and that, but I don't want to see the old film go."[126]

NOTES

1. Charlotte Crofts, " 'High Definitions': Articulating Media Practice as Research," *Networking Knowledge: Journal of the MeCCSA Postgraduate Network* 1, no. 1 (2007), http://journalhosting.org/meccsa-pgn/index.php/netknow/article/view/1/40 (accessed November 1, 2007).
2. Curzon Community Cinema, Clevedon, UK, http://www.curzon.org.uk (accessed November 1, 2007).

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4. See, for example, any edition of *High Definition Magazine* (http://www.definitionmagazine.com/), Joost Hunningher's D-Cinema project (Joost Hunningher, *Project Report: Exploring D-Cinema, a CILECT Project*, July 2003, http://161.58.124.223/archives/d-cinemarept.htm, accessed November 7, 2007), and the UK screen heritage strategy document (UK Film Heritage Group [BFI], "Strategy for UK Screen Heritage," June 2007, http://www.bfi.org.uk/about/news/pdf/uk-screen-heritage-strategy.pdf).
5. Howard Kiedaisch, "Lifting the Roadblock: The Arts Alliance Media Virtual Print Fee Breakthrough" (presentation by the CEO of the Arts Alliance Media at the Screen International conference, "Digital Cinema 2007: Powering New Formats, Alternative Content, and Fresh Audiences"), September 25, 2007, http://www.digitalcinema2007.co.uk (accessed November 10, 2007); see also Arts Alliance Media, "AAM—Digital Cinema," http://www.artsalliancemedia.com/cinema/ (accessed November 7, 2007).
6. UK Film Council, "Film in the Digital Age: UK Film Council Consultation on Policy and Funding Priorities, April 2007–March 2010," November 2006, http://www.ukfilmcouncil.org.uk/media/pdf/7/r/FilmInTheDigitalAge.pdf (accessed November 7, 2007), 1.
7. Godfrey Cheshire, "The Death of Film/the Decay of Cinema," *New York Press* 12, no. 34 (August 26, 1999), http://www.nypress.com/print.cfm?content_id=243 (accessed November 1, 2007).
8. Brian Winston, *Technologies of Seeing: Photography, Cinematography, and Television* (London: BFI, 1997).

9. Lionel Runkel, interview by author, HDV digital video recording, November 24, 2006, Technicolor Film Services, West Drayton, Middlesex, UK.
10. Jon Dovey, *Fractal Dreams: New Media in Social Context* (London: Lawrence and Wishart, 1996), 134.
11. Clive Ogden, interview by author, HDV digital video recording, September 29, 2006, Kodak, Hemel Hempstead, UK; Kodak, Kodak Theatre Management System, http://motion.kodak.com/US/en/motion/Products/Distribution_And_Exhibition/Kodak_Digital_Cinema/tms.htm (accessed November 8, 2007).
12. Roger Ebert, extract from the introduction to *Roger Ebert's 2007 Video Yearbook*, December 4, 2006, http://rogerebert.suntimes.com/apps/pbcs.dll/article?AID=/20061204/COMMENTARY/61204001 (accessed November 8, 2007).
13. Cheshire, "Death of Film/Decay of Cinema."
14. James Quandt, "Tacita Dean: Schaulager Basel," *ArtForum* (November 2006), http://artforum.com/inprint/id=9720 (accessed November 1, 2007).
15. James Doran, "Kodak Mulls Closing the Shutters on Its Century-Old Film Business," *Times*, February 7, 2007.
16. Ibid. As evidence of this, see the advertising copy for Kodak Theatre Management System on their Web site: "Redundancies Can Be Eliminated," presumably not those of the projectionists.
17. Cheshire, "Death of Film/Decay of Cinema."
18. Ibid.
19. Mia Bays, "Is There a British Film Industry?" memorandum submitted as written evidence to the Select Committee on Culture, Media and Sport, UK Parliament, June 6, 2003, http://www.publications.parliament.uk/pa/cm200203/cmselect/cmcumeds/667/667we52.htm (accessed November 7, 2007).

20. Hasan Bakhshi, *The Theatrical Window: Unchartered Waters?* March 2007, http://www.ukfilmcouncil.org.uk/media/pdf/g/9/Theatrical_window.pdf (accessed June 11, 2008), 12.
21. Ogden, interview. According to Leo Enticknap, the principal research and development of video technology occurred in the 1950s, with the first mass production of video being sold to studios from 1956. See Leo Enticknap, "Television and Video," in *Moving Image Technology: From Zoetrope to Digital* (London: Wallflower Press, 2005), 159–86.
22. Paolo Cherchi Usai, *The Death of Cinema: History, Cultural Memory, and the Digital Dark Age* (London: BFI, 2001), 115.
23. Alvin Toffler and Heidi Toffler, *Revolutionary Wealth* (New York: Knopf, 2006).
24. Ben Kempas, "Give Me an HD Coffee Break," *Dox: Documentary Film Magazine*, no. 66 (September 2006): 17–19.
25. Red Digital Cinema, "Shot on Red," http://www.red.com/shot_on_red (accessed November 7, 2007); Internet Movie Database, http://www.imdb.com (accessed November 7, 2007).
26. Kempas, "Give Me an HD Coffee Break," 19. Incidentally, you can include me in that "prosumer" market, as I am shooting my practice research project on the Sony HDV Z1 camera.
27. Jeff Allen, interview by author, HDV digital video recording, December 8, 2006, Panavision, London. Of course, similar things were said about silent films in the late 1920s and Allen has a vested interest in film, being a camera hire company that deals in both film and HD cameras.
28. Allen, interview.
29. Cheshire, "Death of Film/Decay of Cinema."
30. "Special Report: What If HD Rules?" *Exposure: Fuji Film Magazine*, no. 36 (Autumn 2006): 25.

31. Ibid.
32. Codec stands for compression–decompression.
33. "What If HD Rules?" 25. This is precisely what they have done with DAB radio, which caused a great deal of debate when the bitrates on the Radio 3 signal was halved to make way for the Asian Network. See Digital Radio Tech, http://www.digitalradiotech.co.uk/articles/BBC-Radio-3s-bit-rate-reduced-to-160-kbps-on-DAB.php (accessed June 11, 2008).
34. "What If HD Rules?" 25.
35. Ogden, interview.
36. Runkel, interview.
37. Carolyn Giardina, "F-Stop," *British Cinematographer: Covering International Cinematography*, September 2006, 15.
38. Ibid.
39. Ogden, interview.
40. Ian W. Macdonald, "The Future of Screen Heritage in the UK," report presented at the MeCCSA symposium, September 2007 (final version prepared October 2007), http://www.meccsa.org.uk/pdfs/FutureScreenHeritageUK-Notes.pdf (accessed November 2, 2007).
41. Carolyn Giardina, "Studios Examine Preservation Policies: Universal Fire Prompts More Industrywide Attention," *Hollywood Reporter*, June 5, 2008, http://www.hollywoodreporter.com/hr/content_display/news/e3i5f72d636331a44a7bba6dd4839c3f46a (accessed June 11, 2008).
42. Science and Technology Council of the Academy of Motion Picture Arts and Sciences, *The Digital Dilemma: Strategic Issues in Archiving and Accessing Digital Motion Picture Materials* (2007). Available online (must register) at http://www.oscars.org/council/digital_dilemma/register.php.
43. Carolyn Giardina, "AMPAS: Archive Before It's Too Late," *Hollywood Reporter*, November 5, 2007,

http://www.hollywoodreporter.com/hr/content_display/news/e3i00627c6566fe8f5f10cd\e3b1192389ed (accessed July 25, 2008).

44. Ibid.

45. Giovanna Fossati, "Notes on the 2004 Joint Technical Symposium: Preserving the Audiovisual Heritage—Transition and Access," *Journal of Film Preservation*, no. 68 (December 2004): 25–33.

46. Giardina, "AMPAS: Archive Before It's Too Late."

47. Cheshire, "Death of Film/Decay of Cinema."

48. Of course, the argument against this is that the equipment obsolescence cycle for anything computer based is so short as to negate the absence of environmental damage from photochemical processes. Whilst film generates a great deal of carbon and uses dangerous chemicals in its manufacture and processing, it will last for several centuries. Film projection equipment also has a proven longevity, but digital projectors and/or servers are likely to have to be replaced every two years, and the RAID or MAID array storage of digital data burns kilowatts of power a year.

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49. Jon Webber, interview by author, HDV digital video recording, January 8, 2007, Curzon Community Cinema, Clevedon, UK.

50. Cheshire, "Death of Film/Decay of Cinema."

51. Macdonald, "Future of Screen Heritage in the UK." It is important to point out, however, that digital prints can also be subject to image degradation caused by "lossy compression," which is a form of compression in which information is lost when the data is decompressed; it is generally not advocated by the film preservation community. See Nicola Mazzanti and Paul Read, "Film Archives on the Threshold of a Digital Era: Highlights from the FIRST Project's Final Report," Joint Technical Symposium, Toronto, June 26, 2004, http://www.jts2004.org/english/proceedings/ppts/JTS-Presentation-Mazzanti-Reed.ppt (accessed June 11, 2008).

52. Cheshire, "Death of Film/Decay of Cinema."
53. Runkel, interview.
54. Torkell Saetervadet, ed., *The Advanced Projection Manual* (Brussels: FIAF; Oslo: Norsk Filminstitutt, 2006).
55. DTS, http://www.dtsonline.com/digitalcinema/ (accessed November 8, 2007).
56. Macdonald, "Future of Screen Heritage in the UK."
57. Maurice Thornton, interview by author, HDV digital video recording, December 27, 2006, Nailsea, UK.
58. Runkel, interview. This is something I have directly experienced in my own practice. Shooting my documentary on Sony's HDV Z1, I encountered problems at the editing stage when my version of the digital editing software, Apple's Final Cut Pro, was incompatible with this relatively new medium. The version I was using was misleadingly called Final Cut Pro HD, but did not work with the HDV codec, and I had to upgrade my entire operating system in order to be able to use the latest version of Final Cut Pro at great expense.
59. John Borland, "Digitizing the Multiplex," *CNET News.com*, August 31, 2004, http://www.news.com/Digitizing-the-multiplex/2100-1025_3-5330706.html?part=rss&tag=5330706&subj=news.1025.5 (accessed November 7, 2007).
60. Digital Cinema Initiatives, "Digital Cinema System Specification," version 1.2, March 7, 2008, http://www.dcimovies.com/DCIDigitalCinemaSystemSpecv1_2.pdf (accessed June 11, 2008).
61. Patrick Frater, "India Slams Hollywood's Digital Cinema," *Variety Asia Online*, March 28, 2007, http://www.varietyasiaonline.com/content/view/1071/53/ (accessed June 11, 2008).
62. "Panasonic and Sony Jointly Developed New HD Digital Video Camera Recorder Format for Recording on Disc," press release, May

11, 2006, http://www.sony.net/SonyInfo/News/Press/200605/06-0511E/index.html (accessed November 10, 2007).
63. Digital Cinema Initiatives, "Digital Cinema System Specification."
64. Ogden, interview. Many would argue that it is impossible to meaningfully compare the grain structure of film emulsion with the resolution of a digital image (see Fossati, "Notes on the 2004 Joint Technical Symposium").
65. Digital Cinema Initiatives, "Digital Cinema System Specification."
66. Michael Karagosian, "Is a Digital Cinema Rollout Imminent?" *INS Asia Magazine* (October 2004), http://mkpe.com/publications/d-cinema/insasia/imminent.php (accessed June 11, 2008).
67. UK Film Council, "Digital Screen Network," http://www.ukfilmcouncil.org.uk/cinemagoing/distributionandexhibition/dsn/ (accessed November 7, 2007).
68. Ibid. The Arts Alliance Media won the UK Film Council's tendered consortium bid to outfit 240 cinemas with digital projection "solutions."
69. Jeff Allen, e-mail message to author, March 14, 2008.
70. Webber, interview.
71. Ibid.
72. Claudia Kienzle, "Restoration: Preserving Screen Gems," *Post Magazine* (October 2005), http://www.gammaraydigital.com/about/news/Post1005_Restoration.pdf (accessed November 9, 2007).
73. Usai, *Death of Cinema*, ii.
74. UK Film Council, "Film in the Digital Age," 2.
75. Cheshire, "Death of Film/Decay of Cinema."
76. Ibid.

77. City Screen Picture Houses, "Live in High Definition," http://www.picturehouses.co.uk/metropolitan_opera (accessed November 7, 2007).
78. Peter Grant, "Why Ross Noble's Empire Date Will Be a Real First," October 12, 2007, http://www.liverpool.com/features/why-ross-noble-s-empire-date-will-be-a-real-first.html (accessed November 7, 2007).
79. Julia Chamberlain, "Ross Noble: 'Nobleism' Larger than Live," October 21, 2007, http://www.chortle.co.uk/shows/misc_live_shows/r/15911/ross_noble:_nobleism_larger_than_live/review/ (accessed November 7, 2007).
80. Cheshire, "Death of Film/Decay of Cinema." Cinegames is transmitting multiplayer, live video games in Madrid. See Wheeler Winston Dixon, "Vanishing Point: The Last Days of Film," *Senses of Cinema*, no. 43 (April–June 2007), http://www.sensesofcinema.com/contents/07/43/last-days-film.html#b1 (accessed November 1, 2007).
81. Keith Uhlich, "My Man Godfrey," *Senses of Cinema*, no. 13 (April–May 2001), http://sensesofcinema.com/contents/01/13/godfrey.html (accessed November 1, 2007).
82. Matthew Power, "The Big Squeeze," *MovieMaker* (Fall 2006): 24.
83. Ibid., 26.
84. Ian Gilmour and R. Justin Dávalia, "Lossless Video Compression for Archives: Motion JPEG2k and Other Options," white paper, http://www.media-matters.net/docs/WhitePapers/WPMJ2k.pdf (accessed June 11, 2008).
85. Dixon, "Vanishing Point."
86. Cheshire, "Death of Film/Decay of Cinema."

87. YouTube 1, *Arrival of a Train at La Ciotat* (Lumière Brothers, 1895), http://www.youtube.com/watch?v=1dgLEDdFddk (accessed November 7, 2007); YouTube 2, *Lumière: l'arrivée d'un train à La Ciotat* (1895), http://www.youtube.com/watch?v=2cUEANKv964 (accessed November 7, 2007). Watching both versions side by side, you can clearly see that it is a different platform or train station, and different characters people the platform in each version. In the first (YouTube 1), a signal on the opposite platform is raised. In the second version (YouTube 2), there is a dark structure on the left-hand side of the opposite platform and there are a number of small children dressed in white both boarding and disembarking from the train, which do not appear in the first version.
88. Dixon, "Vanishing Point."
89. Bryant Frazer, "Permanent Ghosts: Cinephilia in the Age of the Internet and Video," *Senses of Cinema*, no. 5 (April 2000), http://www.sensesofcinema.com/contents/00/5/cine5.html (accessed November 1, 2007).
90. See, for example, *Scary Mary Poppins* (Chris Rule, 2006) on iFilm (recently rebranded as Spike.com after its acquisition by Viacom).
91. Cheshire, "Death of Film/Decay of Cinema."
92. Usai, *Death of Cinema*, 123–24.
93. Ibid., 122.
94. Unless of course, the transfer is from a submaster or digital file, in which case, what precisely is being preserved? It is also worth noting that the manufacturers of some scanners claim that continuous motion and an LED (i.e., cold) light source make original element wear so low as to be negligible (such as the Kinetta Archival Scanner).
95. Usai, *Death of Cinema*, ii.
96. National Initiative for a Networked Cultural Heritage (NINCH), "NINCH Guide to Good Practice in the Digital Representation and

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Management of Cultural Heritage Materials," Section VII: Audio/Video Capture and Management, October 2002, http://www.nyu.edu/its/humanities/ninchguide/VII/ (accessed November 8, 2007).
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98. UK Film Heritage Group, "Strategy for UK Screen Heritage."
99. Howard Besser, "Digital Longevity," in *Handbook for Digital Projects: A Management Tool for Preservation and Access*, ed. Maxine Sitts (Andover, Mass.: Northeast Document Conservation Center, 2000), 155–66. Also available online: http://www.gseis.ucla.edu/~howard/Papers/sfs-longevity.html (accessed November 10, 2007).
100. André Bazin, *What Is Cinema?* vol. II (Berkeley: University of California Press, 1971).
101. Malcolm Le Grice, *Experimental Cinema in the Digital Age* (London: BFI, 2001), 302–3.
102. Ibid., 313.
103. Usai, *Death of Cinema*, 123.
104. Hunningher, *Exploring D-Cinema*. Fuji and Kodak are the biggest, but not the only manufacturers of film stock (see OrWo, http://www.orwonet.de).
105. Usai, *Death of Cinema*, 123.
106. Ibid., 119.
107. Others would argue strongly against this, suggesting that the digital to analog conversion process would introduce degradation of the image, advocating "always on" storage facilities such as RAID or MAID or continuous migration to other digital formats, either way preserving the origination data. James Lindner, e-mail to AMIA-L mailing list ("Preserving Digital Video vs. Film"), February 21, 2002, http://palimpsest.stanford.edu/byform/mailing-lists/amia-l/2002/02/msg00209.html (accessed June 11, 2008).
108. Usai, *Death of Cinema*, 121.

109. Ibid., 105.
110. Besser, "Digital Longevity."
111. Usai, *Death of Cinema*, 121.
112. As we have seen, the issue of digital preservation of material that is originated on videotape or "born digital" is, arguably, a completely different kettle of fish.
113. Macdonald, "Future of Screen Heritage in the UK."
114. Dovey, *Fractal Dreams*, xiii.
115. Ibid., xxi.
116. Winston, *Technologies of Seeing*, 7.
117. Ibid.
118. Ibid.
119. Ibid., 107–8.
120. See Leo Enticknap, "New Moving Image Technologies," in *Moving Image Technology*, 202–31.
121. I include myself in this, in terms of the support and access Panavision, Kodak, and Technicolor have given me with my film.
122. University of East London, "Future of Film Brought into Focus with Launch of Matrix East Research Lab at UEL," news release, June 26, 2007, http://www.uel.ac.uk/news/latest_news/stories/matrixeast.htm (accessed November 7, 2007); Bournemouth University, "Sony Delivers First HD Studio to BU," news release, October 31, 2007, http://www.bournemouth.ac.uk/newsandevents/News/2007/october07/sony_delivers_first_hd_studio_to_bu.html (accessed November 7, 2007).
123. "Megapixel: A Conference on the Impact of High Definition Technologies on Screen Arts and Education," conference Web site, http://www.megapixelconference.co.uk/main.html (accessed November 10, 2007); FDMX: The Film and Digital Media Exchange, "About FDMX," http://fdmx.co.uk/aboutus.php (accessed November 10, 2007); Hunningher, *Exploring D-Cinema*; and Joost Hunningher,

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"Exploring D-Cinema 2," *CILECT News*, no. 45 (June 2007). Hunningher lists as partners the DTi, NFT, Panasonic, Panavision, Quantel, Sony, Kodak, FG, Optex, BKSTS, and Arri Media.

124. Richard P. Crudo, "Question Time," *British Cinematographer: Covering International Cinematography* (September 2006): 14.

125. Ibid.

126. Thornton, interview.

Figure 1: Exterior projection booth, Curzon Community Cinema, Clevedon, which claims to be the oldest, continually operating, purpose-built cinema in the world.

Figure 2: The NEC digital projector at the Curzon Community Cinema, Clevedon, screening a remastered print of *Casablanca*.