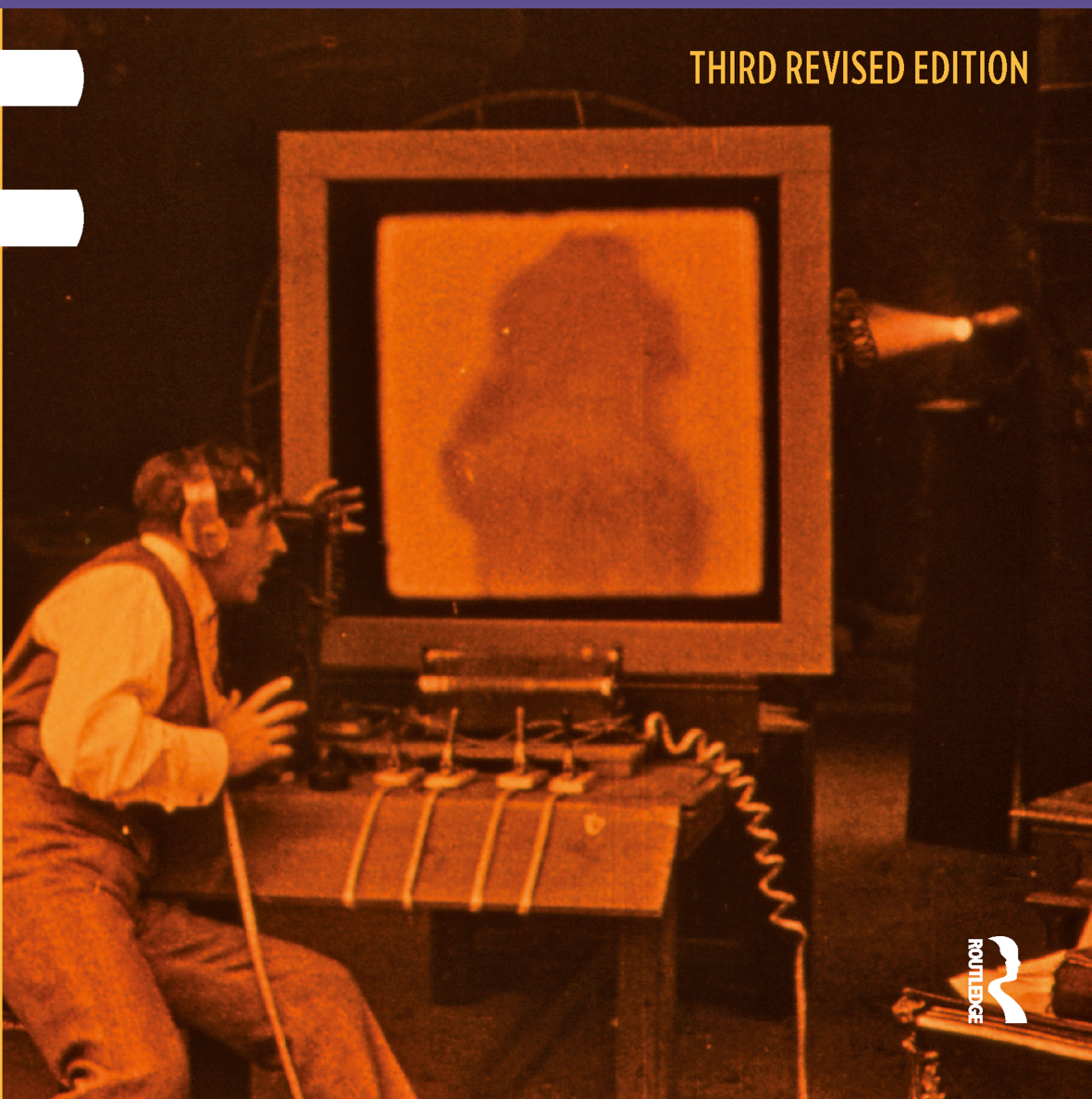
GIOVANNA FOSSATI

FROM GRAIN TO PIXEL

The Archival Life of Film in Transition

THIRD REVISED EDITION



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Routledge
Taylor & Francis Group
LONDON AND NEW YORK

Published by Eye Filmmuseum

First edition 2009
Second edition 2011
Third revised edition 2018

First published in 2009 by Amsterdam University Press Ltd.

Published 2025 by Routledge
4 Park Square, Milton Park, Abingdon, Oxon OX14 4RN
605 Third Avenue, New York, NY 10158

Routledge is an imprint of the Taylor & Francis Group, an informa business

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ISBN: 9789463725002 (pbk)
ISBN: 9781003696148 (ebk)
DOI: 10.5117/9789463725002
NUR 674

Cover illustration: *Amour et science* (H.J. Roche, Éclair, France, 1912 – courtesy of Eye Filmmuseum)

Cover design: Magenta Ontwerpers, Bussum

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ACKNOWLEDGEMENTS

I would first of all like to thank Frank Kessler and Nanna Verhoeff at Utrecht University and William Uricchio at Utrecht University and Massachussetts Institute of Technology who have encouraged and supported this project from the very beginning. Their stimulating input has added greatly to the substance of this work.

This book has also benefited from the advice and the fruitful suggestions by Tom Gunning (University of Chicago) whom I would also like to thank for his support.

The research for this book has been made possible by the support of the Netherlands Organisation for Scientific Research (NWO).

Special thanks also to Eye Filmmuseum (formerly known as the Nederlands Filmmuseum), and in particular to former Director Rien Hagen and current Director Sandra den Hamer, who believed in this project and have made it possible for me to carry it out.

Among the people who have helped me at Eye Filmmuseum, I would like to especially thank Mark-Paul Meyer, not least for all that he has taught me since I started working in the film archive in 1995. His comments on this project have been of great value.

Many thanks also to my colleagues Leontien Bout, Andreas Busche, Catherine Cormon, Guy Edmonds, Anne Gant, Irene Haan, Rixt Jonkman, Nico de Klerk, Annike Kross, Simona Monizza, Ad Pollé, Emjay Rechsteiner, Geke Roelink, Elif Rongen-Kaynakçi, Frank Roumen, Jan Scholten, Dorette Schootemeijer, Walter Swagemakers, Ronny Temme, Frédérique Urlings, Jeannette Verschure, and to my ex colleagues and friends Eef Masson (Utrecht University) and Claudy Op den Kamp (University of Plymouth).

I would also like to thank my colleagues of the MA Programme Preservation and Presentation of the Moving Image (P&P) at the University of Amsterdam, as this course was an important inspiration for my work. In particular, many thanks to Julia Noordegraaf for her support. I also owe a debt to my P&P students who were an important part of this inspiration.

This book would not have been possible without the assistance of the archives and laboratories that were the object of my case studies. My gratitude goes in particular to Grover Crisp and Michael Friend (Sony Pictures Entertainment), Andrew Lampert (Anthology Film Archives), Rani Singh (Harry Smith Archives), and Thomas C. Christensen (Danish Film Institute). Many thanks also to Peter Limburg, Paulo Fonseca, Juan Vrijs, and Tom De Smet for their time and valuable information on the work at Haghefilm, and to Balázs Nyari, Tom Heitman, Simon Lund, Diana Little, Daniel DeVincent, and Seth Berkowitz, for the many productive conversations with regard to the work at Cineric. As regards my analysis of the Digital Film Lab, I would like to thank my friend Paul Read (consultant to the lab) for his invaluable help.

My thanks also go to Amsterdam University Press, in particular to Jeroen Sondervan and Chantal Nicolaes for their enthusiastic and responsive assistance in the editing and publication process.

I am particularly indebted to my dear friend Sabina Gorini for her irreplaceable intellectual and emotional support.

Thank you to my parents Silvia Levis and Marco Fossati for the many ways in which they have made this project possible and for simply being who they are.

This book owes its existence to Andrea Battiston whose continuous feedback throughout the project has greatly contributed to its clarity and final form. Thank you also for being a great life partner and father.

ACKNOWLEDGEMENTS TO THE THIRD REVISED EDITION

This revised edition of From Grain to Pixel would not have been possible without the support and generous sharing of invaluable knowledge of a number of colleagues. I particularly would like to thank: Seth Berkowitz, Daniel DeVincent, Simon Lund, Balázs Nyari, Eric Nyari (Cineric); Ronald Bosdam, Gerard de Haan, Bin Li, Peter Roelofs, Juan Vrijs (Haghefilm Digitaal); Robert Byrne (San Francisco

Silent Film Festival); Thomas Christensen (Danish Film Institute); Grover Crisp (Sony); John Klacsmann (Anthology Film Archives); Heather Linville (Library of Congress); and Michael Pogorzelski (Academy Film Archive).

I am also indebted to a number of colleagues who throughout the years have adopted this book for teaching purposes and have provided precious advice on what to update and improve. I would like to thank, in particular, Michele Canosa (University of Bologna), Barbara Flueckiger (University of Zurich), Jane Gaines (Columbia University), and Dan Streible (New York University).

I want to especially mention the staff and students of the Master Program Preservation & Presentation of the Moving Image (University of Amsterdam) whose continued support and enthusiasm have greatly encouraged me to update this book.

Special thanks to Eef Masson and Christian Olesen (University of Amsterdam) for the inspiring collaboration on the projects Mapping Desmet and the Sensory Moving Image Archive.

I am grateful to Viola ten Hoorn for her impeccable copy-editing work.

For offering me this opportunity to revisit my book, I heartily thank Maryse Elliott and Chantal Nicolaes at Amsterdam University Press who have been immensely supportive of this book as well as the entire Framing Film series.

At Eye Filmmuseum, I want to thank Sandra den Hamer for her continued support and trust; Gerdien Smit for her fantastic work; Anne Gant for her insightful feedback; Leontien Bout, Annike Kross, Jeroen de Mol, Jan Scholten, and Andréa Seligmann Silva for sharing their knowledge and experience; and all my colleagues, past and present, for their passion, creativity, and enthusiasm.

And finally, I thank my family: Silvia Levis and Marco Fossati, my parents, for always being there for me; Gloria and Matilda, my daughters, for making me laugh and keeping me sharp; and Andrea Battiston, my life partner, for his unconditional support and irreplaceable advice.

Introduction to the Third Revised Edition[i]

This book was originally published in 2009 as an attempt to lay the foundations for a new approach to film archival theory and practice. While addressing the questions "what is film?" and, by analogy, "what is film heritage?" in the technological and cultural shift to digital, I moved away from the unproductive opposition analog *versus* digital and proposed to look at film's nature from the perspective of transition. Considering that film as a medium had never existed in one distinctive form, I argued that its transitional character became even more evident because of the digital turn. Film archivists and curators have always made choices about what to preserve, what and how to restore, and what and how to exhibit, based on different interpretations and conceptualizations of film's nature and ways of approaching film archival practices. By analyzing the cultural, aesthetic, economic, and social factors behind these choices, we come to recognize different frameworks that have informed the archival practice (in a more or less conscious way). And by recognizing these frameworks, it is possible to start defining a theory of that practice.

Since its first publication, the book was reprinted with minor adjustments in 2011 and was made available online as an open-access resource.[ii] It has been regularly taught in the MA program *Preservation and Presentation of the Moving Image* at the University of Amsterdam and has been adopted by several academic courses focusing on film archiving and preservation around the world. In many ways, with this book I have accomplished one of the main goals I had set for myself ten years ago: to provide guidance to researchers, professionals, and students alike in the relatively young discipline of film heritage studies.

Despite being a few years further along in the transition from analog to digital, I still consider *From Grain to Pixel* a valuable and topical tool for a number of reasons. Firstly, it still offers an accurate description of the development of film archival practice over the last decades (particularly in Chapter One and in the case studies in Chapter Four). Furthermore, it captures a snapshot of a specific moment

in the transition to digital, namely the decade that saw new digital tools slowly emerge as sporadic experiments at the beginning of the 1990s, and then become regularly adopted, from 2005 onward. The realization that the period 1997-2007 would become so crucial for the transition to digital could not yet be fully grasped when the first two editions came out in 2009 and 2011, as the so-called digital rollout (when the digital infrastructure for film distribution and projection took over the analog one) in the Western world followed right after, in 2011-2012.[iii] In the years that followed the digital rollout, analog production, post-production, distribution, and projection quickly became the exception. The roles had reversed with digital becoming the norm rather than the exception. Both studio and independent productions abandoned analog as a means of distributing films.[iv]

Secondly, the book's stance on the hybrid nature of archival practice is still valid today. After all, film archival and restoration workflows are still often a combination of analog and digital technologies; furthermore, even digital filmmaking and restoration practice cannot help but draw on 120 years of analog tradition. As will be illustrated in the updates to Chapter One, the film archival workflow is, and will remain, hybrid for a long time to come as the greater part of archival holdings yet contain analog films and even the new digital films entering the archive are in many cases hybrid products conceived within a hybrid film culture.

As I foresaw ten years ago, analog filmmaking has become a niche practice.[v] At the same time, a movement of filmmakers and artists has recently emerged that privileges the use of photographic film and advocates keeping its production alive. Filmmaker and artist Tacita Dean was one of the first to plead publicly for the survival of the manufacture and post-production of analog film. Other leading advocates such as Hollywood filmmakers Christopher Nolan and Quentin Tarantino have also pressured studios to make deals with Kodak guaranteeing a minimum amount of film-stock production that would allow directors to shoot on film should they prefer to do so.[vi]

Thirdly, the book still serves its purpose of bridging theory and practice while, hopefully, stimulating interest in film archival practice and theory among media scholars. Although new academic literature has since appeared – Everett (2008); Lipman (2009); Pescetelli (2010); Bursi and Venturini, eds. (2011); Frick (2011); Bordwell (2012); Enticknap (2013); Parth, Hanley and Ballhausen, eds. (2013); Catanese (2014); and Lameris (2017) among others – relatively little has been written about film heritage (practice and theory). Luckily, the communication gap between scholars and archivists so prominent a decade ago is slowly being bridged. In our increasingly digital film culture, a productive dialogue between academia and archivists is certainly becoming more and more relevant.

An additional reason why I believe this book is still relevant today is that its theorization is still applicable to changing practices, in part because these have not radically changed, and in part (and more importantly) because it is a theorization

that transcends specific technological shifts. Being a theory of practice in transition and having defined transition as a perpetually ongoing process in film history and practice, its relevancy, it seems, will not be affected by an increase in the level of digitization in practice.

That said, I do believe that this book has some limitations. Firstly, with a limited focus on sound, the importance and scale of film sound archiving and restoration could not be properly addressed (a short update to Chapter One attempts to partially rectify the omission); and secondly, lacking a broader approach to film heritage, the discussion of ephemeral collections (such as home movies, industrial films, advertisements, etc.) and special collections (such as apparatus, stills, posters, company archives, etc.) has unfortunately been overlooked. This limitation in scope is further discussed in the new Conclusions. Finally, perhaps the book's most glaring limitation is its exclusively Western perspective. In this regard, I am aware that the term "film heritage" should be interpreted critically as it is mainly the product of Western film archival tradition (namely European and North-American).[vii] Remaining critically attuned to such shortcomings, film scholar and archivist Caroline Frick aptly expressed that:

> Greater critique of the cultural heritage rationale, and its accompanying support of a specific mode of historical preservation, should be a component of such discussions as it encourages and even argues for more substantive questioning of standard conservation practice. (2011: 155)

As we move toward a more varied landscape of archival practice in which a plurality of approaches and perspectives coexist, I hope that the growing number of non-Western students graduating from film-archiving programs will soon join the discussion. As for my part, it is one of my future objectives to expand my research to non-Western discourses, practices, and traditions.

For this revised edition of *From Grain to Pixel*, I felt that it was more effective to update rather than rewrite the book as the previous editions still hold up.

In this Introduction, I will address the current trends that I consider particularly important for film heritage studies today and how this field is becoming increasingly more relevant and established within the academic landscape. In the closing paragraph, I will offer a reading guide to this updated volume.

To start with, let me pose a general question: now that digital has become dominant can we still speak of film? Film scholar and founder of the Orphan Film Symposium Dan Streible has argued that talking about "digital film" today is an oxymoron (2013). Indeed, a "film" is a strip of celluloid coated with a layer of emulsion on which a succession of photographic images has been imprinted. As such, film by definition does not come in a "digital" format. Contrarily, I would argue that using the term "film" to also refer to "digital films" is not only legitimate, but

necessary. In order to claim the continuity of 120 years of film history, it is vital that such an analogy will not be dismissed out of hand. It also serves the purpose of stressing the materiality that digital films still share with their analog predecessors, a characteristic of digital film that is too often overlooked. What is so appealingly unique about the word "film" is that it refers to the medium's materiality, which is one of the levels at which the science of film continues to operate in today's "digital film culture," a material level that most people never directly access and thus fail to recognize.

Apart from referring to moving images, the term "film" also refers to a cultural, social, aesthetic, and, I cannot stress this enough, "material" sphere that finds its roots in the experimentation of the late 1800s. It all started with a flexible film of celluloid coated with a layer of silver emulsion. At that time, most people could not access such material layers, much in the same way they do not have direct access today to the binary codes on digital film CARRIERS. However, everybody understands that film necessitates there being "material things" that, in one way or another, support what is seen on the screen. Such awareness has been at the center of the development of film heritage as a science. As Streible points out:

> [It is not] necessarily incorrect to refer to digital or electronic moving images as films. Rather, if we forget to specify what photochemical film was, we stand to lose important historical knowledge and awareness. Important distinctions become lost if we neglect what preservationists, archivists, and technical experts have brought to recent film historiography. (2013: 229)

"Film," as I would like it to be intended, is a broader concept that transcends the technological differences such as that between the analog and the digital. Film heritage includes all the elements that inform and form film culture. And while today's film culture has happened to become increasingly "digital," it is based on more than a century of analog film and analog film culture.

Interestingly, the establishment of the first film-heritage study programs coincided with the discourse on the demise of cinema, which started in the 1980s, under the threat of multiplexes, and resurged with the rise of the home-movie industry and the advent of large-scale digitization. As Marijke de Valck recently pointed out:

> [I]t might very well have been the sense of crisis surrounding cinema and the demise of an intellectual culture of film that fed into simultaneous visions to create programs that would deliver the new generation of archivists, curators and programmers that could save the cinema that was so clearly perceived to be under threat. (De Valck, 2015: 3)

Film heritage comprises the theory and practice of collecting, archiving, preserving, and presenting films. The 1930s saw the first film archives established in the Western world: among them, the film department of the New York Museum of Modern Art, the British Film Institute, the Cinémathèque Française in Paris, and the Reichsfilmarchiv in Germany (Houston, 1994). After World War II, an increasing number of film archives emerged across the world.

While collecting, preserving, and showing national film heritage have been some of their main goals, public non-profit archives also often have a strong focus on international avant-garde films. This can be linked to the solid relationship that was cultivated during the 1920s and 1930s between avant-garde filmmakers and early-film theorists who were establishing film as a form of art. Because film archives subscribed to that idea, it strengthened their very *raison d'être*. Note that until then, films were mainly seen as a form of entertainment and were usually destroyed after commercial release to retrieve the silver in the emulsion.[viii]

With the film archive movement, films began to be considered part of our cultural heritage. In 1938, the International Federation of Film Archives (FIAF) was founded and a number of principles were defined which are still binding today for film archives worldwide. Film archival practice has developed since then; but during the first four decades it remained quite inaccessible and, at times, even secretive, partly due to complex legal issues. Indeed, the copyrights of many films held by archives were in fact owned by commercial companies that could (and at times did) claim their rights on the films. The inaccessibility of film archives was also partly due to a limited interest in archival films by a larger audience and the academic community.

This situation came to an end in the late 1970s. At the 34th Annual Congress of the Federation of Film Archives held in Brighton in 1978, a group of film scholars were invited to view and discuss several hundred early films, approximately dating from the period 1900-1906. This event has been recognized by many as the starting point of a new relationship between the practice of film archiving and academic film studies. Since then, the Brighton Congress has gained an almost mythical status in the field and has inspired a new stream of studies by scholars concerned with film heritage, such as Tom Gunning and André Gaudreault (both of whom participated in the Brighton Congress), Thomas Elsaesser, Jane Gaines, William Uricchio, Frank Kessler, and many more in recent years.

As pointed out by Elsaesser in his "The New Film History" (1986), the 1980s saw the emergence of a wave of historians who initiated a new way of approaching film history. The Brighton Congress has undoubtedly been a turning point in helping film archives open their vaults to film researchers, leading to unprecedented collaborations between scholars and archivists. In Uricchio's words, Brighton "gave novel stimulus to the distribution of archival films, but first of all to its restoration" (2003: 29-30).

In 1984, the first academic master program in film archiving was launched at the University of East Anglia in collaboration with the East Anglian Film Archive in Norwich, England. With this program, the academic history of film heritage officially started. Since then, a number of similar programs have followed suit, including the MA program *Preservation and Presentation of the Moving Image* at the University of Amsterdam, launched in 2003 in collaboration with Eye Filmmuseum, the Netherlands Institute for Sound and Vision, and the Living Media Art Foundation (LIMA). Other programs established around the same time include the Moving Image Archive Studies program at the University of California in Los Angeles; the Moving Image Archiving and Presentation program at the New York University; and the master degree at the University of Rochester, New York, in collaboration with the L. Jeffrey Selznick School of Film Preservation at the George Eastman Museum. More recently, similar academic programs have been introduced worldwide, including those at the universities of Udine, Berlin, and Frankfurt. The proliferation of these academic programs and the establishment of the Chair in Film Heritage and Digital Film Culture at the University of Amsterdam are signs of renewed interest in the field. A recent academic publication that reflects on the institutionalization of moving-image archiving programs approximately two decades after their introduction (Olesen and Keidl, eds., 2018) is yet another testament to their growing popularity.

Due to its relatively young age as an academic discipline, film heritage studies form an unevenly charted territory that has historically grown out of film and media studies. Yet, from its inception, it has always been in dialogue with other disciplines such as heritage and museum studies, art history, digital humanities, and, more recently, computer science. One thing that has become evident in the first two decades since its introduction is the importance of keeping theory and practice in balance through a fertile collaboration and interplay between the leading scholars and archivists in the various fields of education, research, and practice.

Along similar lines, the combination of theory and practice lies at the heart of my own work both as a scholar and museum curator. I have always felt very strongly that bridging theory and practice is essential and especially urgent today because the technology, expertise, and conceptualization of film are changing so rapidly. For the same reason, the *archival life of film* (that is, what happens to the film artifact once it enters the archive) needs to be reopened for discussion, while paying particular attention to new developments in film discourse and new trends within filmmaking and film culture.

A case in point is the development which is taking place in the larger landscape of film and which is affecting the current film-heritage discourse: the so-called "material turn." Representing a renewed longing for the experience of the film medium's materiality, the "material turn" can be found in work by filmmakers and artists alike, including Peter Delpeut, Gustav Deutsch, Bill Morrison, Tacita

Dean, and, more recently, Hollywood filmmakers such as Christopher Nolan, Paul Thomas Anderson, and Quentin Tarantino.

The "material turn" in film could be interpreted as a reaction to the "digital turn," emphasizing the haptic interaction with the material as opposed to the experience of the perceived immateriality of digital access. With regard to film specifically, the renewed interest for analog film could be seen as a counter effect of the digital rollout. Indeed, until recently the focus on film materiality, while present, was quite rare.[ix] Since the digital rollout (approx. 2011-2012), the topic of film materiality has become much more pervasive. I have already mentioned the plea by Tacita Dean for maintaining film-stock production and post-production facilities as a viable option for filmmakers and artists who prefer (the aesthetic characteristics of) analog over digital, and the similar appeal by Hollywood filmmakers of whom Christopher Nolan is probably the most outspoken. Moreover, scholars such as Barbara Flueckiger (2012) and her team at the University of Zurich have made film materiality a central topic of their research (their work in the FilmColors project will be discussed in more detail in Chapter One). Even a cultural theorist such as Giuliana Bruno focuses specifically on materiality in her book *Surface: Matters of Aesthetics, Materiality, and Media* (2014), in which she addresses the question of the place of materiality in this time of rapidly changing materials and media by looking at recent work by media artists, filmmakers, and architects.[x] In line with these developments in filmmaking and academic research, the film archival field is also exploring the topic with a number of film archiving programs focusing on the study of the material aspects of the film medium (Campanini et al., 2017). Despite, or perhaps more accurately because of, the digitization of most movie theaters, there has been a revival of interest in the medium of film by cinema audiences. Today's filmgoer seems particularly keen on watching rare projections of film reels in *cinémathèques*, especially 70mm screenings of restored and new titles, as discussed in Chapter One in relation to the 70mm release of *The Hateful Eight* (Quentin Tarantino, USA, 2015). Furthermore, the proliferation of art houses dedicated to the screening of celluloid prints clearly demonstrates the rising popularity of analog film.[xi] In fact, experiencing a traditional film projection has become an "event" not to be missed, not unlike what scholar Erika Balsom discussed in relation to the hype around the installation of *The Clock* (Christian Marclay, 2010) or the launch of a new iPhone (2013). Hype or not, the interest for analog film screenings is ubiquitous and with film archival festivals such as the George Eastman Museum's Nitrate Picture Show screening vintage nitrate film prints, now returning for its fourth year, it seems it will remain so for some time yet.[xii]

While the "material turn" is intrinsically related to the "digital turn," it is not, in my view, in opposition to it. Instead, it would be more accurate to refer to it as its companion. In fact, I would argue that there is no such thing as immaterial digital film. A digital film is as material as any other object; it is stored on a material

CARRIER, projected through a material digital projector, and screened on a material screen or viewed through a device (computer, tablet, or smartphone). And, like its predecessor, it is immersed in a material cultural environment consisting of its makers, users, and caretakers. In this line of reasoning, digital films are the result of a century-long tradition of analog films and, as such, they bear the same material and cultural traces.[xiii]

In this revised volume, the text of the first 2009 edition (including minor adjustments made in 2011 for the second edition) has been left fundamentally intact, with the exception of a few corrections, updates of institutional names, and minor revisions in the body of the text and in the footnotes. The stylistic layout of the updated texts (approx. 100 pages) notably differs from the original text; along with a new general Introduction and Conclusion, updates are included per chapter.

In Chapter One, after a brief introduction of the most important changes in the practice, each theme/section of the original text is followed by an update that gives an overview of the changes in the last ten years and the current state of affairs (2017-2018). The discussion on the changes in film production and post-production practices (in 1.1) aims to highlight some of the ramifications for today's archival practice (in 1.2).

In Chapter Two, in addition to a new introduction, the update on this chapter about the theorization of archival practice includes a new theoretical framework. The "film as performance" framework is described here as a means to capture the performative dimension of film. It will be argued that this framework is particularly relevant for the restoration and presentation of early cinema and experimental films, and that it could shift the discussion around film archival practice further away from film as an artifact.

In Chapter Three, the new introduction is followed by brief updates to the sections describing the four archives and three laboratories discussed in the 2009 edition. Updated interviews have been conducted with the same people that were interviewed ten years ago or with the persons who have replaced them since.

In Chapter Four, a new introduction on the relevancy of past and present case studies is followed by a newly added case study, focusing on the restoration of *We Can't Go Home Again* (Nicholas Ray, USA, 1973). Discussed in relation to the new "film as performance" framework, introduced in the update to Chapter Two, and the well-established remediation concept, this case study provides a detailed examination (illustrated by newly added color images) of some of the intricacies of such a restoration project.

In the new Conclusion, I will mainly address new directions for research in the field and touch upon a number of relevant recent projects.

Finally, the glossary of technical terms, the bibliography, the filmography, and index of names have been updated to include the newly added entries.

Framing Film (in Transition): an Introduction

Film is in a state of rapid change, a transition where analog (photochemical) film is being gradually replaced by digital film. Most think that digital projection will substitute traditional film projection already within a few years. This transition, evident across media in both the commercial and the cultural fields, profoundly affects not only the practice of filmmaking and distribution, but also the practice of film archiving, and the theoretical conceptualization of the medium.

Past instances of technological transitions within film have succeeded one another throughout the nineteenth and the twentieth century, from a variety of pre-cinema technologies and practices to a number of moving image technologies; early moving image technologies were sometimes accompanied by experimental sound systems, experiments that continued throughout the first part of the twentieth century until a standard was established in the early 1930s; and in the 1950s, the moving image was again transformed with the introduction of television, within a technological frenzy that involved both the newly born television medium and the film medium, for the first time put under pressure by competition. All these moments of transition have worked as a catalyst for a process that has never found rest: the continuous transformation of audiovisual media or, maybe even more aptly, as this work intends to demonstrate, their inherently transitional nature.[1]

Grown inured to the profound changes film has undergone in the past, many argue that with the digital turn a transformation of a different kind is occurring, and that with the digital, along with a technological transition, also an ontological change is taking place. To address this line of thought it is necessary to consider and discuss the very nature of film.

The current technological transition from analog to digital cuts across all modern media from print to sound, from photography to video and film.

Film, the central focus of this study, is witnessing a time of unprecedented change. Existing logics of production, distribution, and exhibition are challenged, and many different and competing standards are being introduced. The turmoil around this ongoing change has spread from the film industry to its audiences, from academia to cultural institutions.

Early appearances of digital technology in film can be traced back to the late 1970s with the first attempts to create digital special effects and, later, in the 1980s, when the anticipation of an imminent digital turn in film production grew more pronounced. At that time Francis Ford Coppola envisioned the arrival of DIGITAL CINEMA, and, even more insistently, George Lucas began his long-standing militancy for the all-digital film. Nevertheless, thirty years later we are still witnessing a progressive hybridization of technologies where analog and digital coexist in many segments of the production chain. Indeed, both old and new technologies keep changing in ways that are not converging. While editing, for instance, has indisputably become an all digital affair, projection is still almost all analog and, similarly, films shot using exclusively digital cameras are still a minority. However, although analog and digital technologies at this point complement each other in a hybrid form, digital technology is still expected to take over film and other media altogether. As I write, the digital has shown only the tip of its potential: Moore's law remains valid and we continue to see dramatic increases in processing power, storage capacity and transmission speed.[2] We are clearly at a transitional moment and, as William Uricchio put it, we "have a sense of what is looming in the distance, but its magnitude is not yet visible or even imaginable" (2007: 19). Indeed, in the middle of the technological transition, with a sense of the direction (towards the digital) but with no real sense of the destination, we have a unique (and uniquely limited) point of view. To use Tom Gunning's words, the still unexplored potential of the digital holds an uncanny fascination for us who are witnessing its emergence:

> Every new technology has a utopian dimension that imagines a future radically transformed by the implications of the device or practice. The sinking of technology into a reified second nature indicates the relative failure of this transformation, its fitting back into the established grooves of power and exploitation. Herein lays the importance of the cultural archaeology of technology, the grasping again of the newness of old technologies. (2003a: 56)

The current technological transition comes with promises of a revolutionized medium and the utopian dimension has not yet surrendered to the routine of a reified technology and practice. If this ongoing transition can, according to

Gunning, offer useful tools for grasping the newness of old technology, similarly, technological transition from the past can help us in the investigation of the current transition.

From this perspective, this work addresses the question of whether the ongoing transition in film technology and practice is introducing a fundamental change in the nature of film, and specifically focuses on how it could affect the present and the future role of film archives. I will critically assess theoretical work on film and new media and repurpose it, seeking a new theorization of film archival practice in this transitional moment. I will investigate how film archives, by looking at film from the perspective of film and new media theory, could re-position film as a full participant within the new media environment, and how film archivists could re-think their profession and their relationship with the media environment.

Film archival practice is changing very rapidly and, with it, the way we look at the preservation of our film heritage. New forms of (digital) archives are being developed via the Internet that make use of participatory media to provide a significantly wider and more open form of access than any traditional archive has ever offered before. As a consequence, film archives and film museums are struggling with questions about their role. As a response, they could either close their doors to new media, or accept them and challenge some of their views and assumptions about the film medium. Whatever the choice, it will determine their future.

At this crucial moment of changing technologies and concepts there is insufficient dialogue between film archives and academia. Caught up in everyday practicalities, film archivists rarely have time to reflect on the nature of film and on the consequences deriving from new technologies on the viability of film as a medium. On the other hand, researchers investigating the ontology of the medium theorize future scenarios at a much faster pace than practice can keep up with, often without considering the material and institutional realities underlying the medium. This situation is leading to an increasing estrangement between theory and practice.

A constructive dialogue is needed along the lines of the International Federation of Film Archives Congress held in Brighton in 1978, which brought film historians and film archivists together to re-assess early film history, sparking something of a Renaissance in film studies and archival practice. If the Brighton Congress led film archives to open their doors to film historians, and, consequently, to a renewed academic interest for early films, this work strives to stimulate a closer relationship between film theory and film archives, by bridging the archival field, based on practical experience, and the academic field, open and free to elaborate on the nature and the consequences of changing media.

In this moment of transition from analog to digital, theorizing archival practice is not only urgent for film archives but also for media scholars. The kind of theorization proposed in this study aims at providing a common ground for a renewed dialogue between film archives and media studies. Such a dialogue will have a direct influence in determining how we understand, preserve and access our film heritage. As film undergoes its most recent, and perhaps most profound transformation, it is urgent that a theory of practice is developed today, while this transition is ongoing.

This work originates in particular from the need for a pragmatic approach, but is based on a sound theoretical reflection, as a response to the uncertainty that is strongly felt in the film archival field in this moment. Indeed, David Thorburn and Henry Jenkins point out:

> In our current moment of conceptual uncertainty and technological transition, there is an urgent need for a pragmatic, historically informed perspective that maps a sensible middle ground between the euphoria and the panic surrounding new media, a perspective that aims to understand the place of economic, political, legal, social and cultural institutions in mediating and partly shaping technological change. (Thorburn and Jenkins, 2003: 2)

In line with the above, the "conceptual uncertainty and technological transition" should be seen not only as the object of this research but also as the motive behind it, and the "pragmatic, historically informed perspective" is the one intended to be taken here.

Current debates on the impact of technological change for the medium have produced a broad spectrum of reactions stretching between two perspectives: one that identifies the advent of digital technology as a radical change in the nature of the medium (Rodowick, 2007; Cherchi Usai, 2005; Virilio, 1998; Baudrillard, 1995; Mitchell, 1982, among others), and the other that inscribes digital technology in a broader media landscape where film is one of the participants (Kessler, 2009; Gunning, 2004 and 2007a; Uricchio, 1997, 2003 and 2004; Thorburn and Jenkins, 2003; Bolter and Grusin, 1999; Manovich, 2001 and 2002; Elsaesser, 1998, among others). These two perspectives foster opposite interpretations with regard to the role film archives and museums should play in the future.

In the past decade, the archival community has often embraced the first perspective, tracing it back to Bazin's reflection on the photographic image's unique power of transferring the "reality from the thing to its reproduction" (1967: 14), a thesis dear to many film archivists. Taken to the extreme this approach fuels the idea that "digital film" is not film anymore, and that it there-

fore represents the end of film as we know it. Accordingly, digitization would mark the beginning of the end of film archives and museums, as they would stop collecting new material once analog photographic film disappeared.

On the other hand, according to theories embracing the second perspective, the advent of digital technology does not mark the end of film and, therefore, film archives should continue collecting, preserving and presenting moving images on whatever medium, including the digital one. From this perspective transition is in itself much more complex and in a way integral to the panorama of the media.

As this work intends to show, archival practices are changing with the new digital tools, and these changes apply also to those archives that may decide not to follow film after its turn into digits. For instance, the relationship with the audience is changing radically, as I will discuss later, and the film spectators that film archives have known are changing into users who expect to participate actively and have open access to archival collections. The question of whether film will disappear or not is at this transitional moment less urgent and relevant than the question of what impact the digital is having on film and on the work of film archives today.

What will become of film archives is a question that should be answered together by theorists and archivists. Only a dialogue between theory and practice can give form to a renewed archival theory that will make of future archives mirrors of a living media culture rather than repositories of dead media. This work aims at such a theorization using film restoration as its main focus.

The definitions of analog and digital are crucial for this work to identify the changes occurring in the technology and the practice, and how they impact on the current transition in film and archival practice. Discussing them is necessary as the terms are often confused and are used to categorize media in an inappropriate way. To start with, the definitions of analog and digital are complex by themselves. To avoid complicating the discussion beyond the aims of this work, I will have to limit my investigation of analog and digital with regard to technology.[3]

If we look at the dictionary, *analog* is defined as "of, relating to, or being a mechanism in which data is represented by continuously variable physical quantities." Whereas *digital* is "of, relating to, or using calculation by numerical methods or by discrete units."[4] Based on these definitions, analog's main feature is that of being "continuous," whereas digital's main feature is that of being "discrete."

This is further stressed and aptly exemplified by William J. Mitchell:

> The basic technical distinction between analog (continuous) and digital (discrete) representations is crucial here. Rolling down a ramp is con-

> tinuous motion, but walking down stairs is a sequence of discrete steps – so you can count the number of steps, but not the number of levels in a ramp. (1982: 4)

Note, however, that the definition of discrete may collapse into the definition of continuum, e.g. in the case of a staircase with infinitely small and adjoining (and therefore infinite) steps. If, according to Mitchell, analog and digital images are both "representations," Rodowick introduces a further differentiation when arguing that while an analog (photography) "transcribes before it represents" (2007: 78), a digital system in the first place "transcodes" (Rodowick, 2007 after Lev Manovich, 2001). Indeed, a digital system makes use of a numeric code (discrete elements, such as the steps in a staircase), for transcoding sound and light waves.

The distinction between analog/representing and digital/transcoding is further problematized by the concept of isomorphism.[5] As used by Rodowick (2007: 9), isomorphism for a representation medium implies the absence of a transcoding process (e.g. from waves into discrete numbers). But one may consider isomorphism in a different way and relate it to the observer. From this perspective also analog sound waves (or the analog video images) transcribed onto a magnetic tape would not be isomorphic, as the magnetic signal cannot be directly interpreted as sound or moving images by our senses. Also in this case a sort of transcoding process has occurred, even though within the "continuous" physical domain. Magnetic tapes, but also analog television, may well be considered part of a non-isomorphic representation process, even though they provide analog (continuous) representations.

Considering the above, the concepts of analog and digital do not help in distinguishing between those media that are intelligible for us and those that need transcoding to allow intelligibility. Analog photography and film, in the end, are a technological singularity since they are the only representation systems that are fully transcoding-free and isomorphic with the originating image, as photographic images are transcribed and stored in a way that is intelligible for us without any kind of transcoding process.[6] This is true unless we consider the chemical development of the latent image of a photograph as a transcoding process in itself.[7]

The idea that analog photography and film due to their singular full isomorphism are different from all the other media, puts the question of whether the advent of digital implies the beginning of an irreversible change in film in another perspective, as it suggests that the beginning of the change in film started already decennia ago with the affirmation of the (analog) television as a mass medium. This is also in line with the fact that broadcast archives are reacting very differently than film archives to the introduction of digital

media. In this perspective the very debate analog versus digital and the related ontological question should be rephrased in a debate whether intelligible media (and in particular analog photography and photographic film) are ontologically different from the rest of audiovisual media that need transcoding.

In any way we may look at it, the debate is ongoing, and focusing only on the poles of the discussions (analog vs. digital, or isomorphic vs. non-isomorphic) is, in fact, less interesting and less productive than focusing on the middle ground. It is in the middle ground that things acquire their real dimension, namely in the very place of transition. The search for a "sensible middle ground" will be guiding this work in line with the idea, expressed by Rodowick in his *The Virtual Life of Film*, that digital film, even though other than analog film, is still profoundly related to it:

> As film disappears into digital movies, then, a new medium may be created, not in the substitution of one form or substance for another, but rather through a staggered displacement of elements. The electronic image has not come into being *ex nihilo* from the invention of digital information processing, but through a series of displacements in the relationship between the formative and constitutive of moving-image media: how an image is formed, preserved, placed into movement, expresses time, and is presented on detached displays. We may be confident in our ordinary sense that film, analogical video and digital video are relatively distinct media, without assuming that a medium is defined essentially by substantial self-similarity. Every medium consists of a variable combination of elements. In this respect, moving-image media are related more by a logic of Wittgensteinian family resemblances than by clear and essential differences. (Rodowick, 2007: 86)

In this view, even establishing an ontological difference between analog film and digital "film," would not necessarily lead to the conclusion that we are dealing with two different media forms. This is one of the aspects I will address in this work. I intend to problematize the discourse on film and media ontology and to discuss it in relation with the idea of transition, which is at the same time the object and the framing of this work.[8]

Whether the digital turn will ever be completed and the transition will end up in a fully digital environment, is to be doubted. Based at least on previous experience, old media never disappear completely. Accordingly, analog media will most probably not disappear altogether and will still have a place within the digital panorama. On the other hand, there is no doubt that digital technology is here to stay and to become more and more intertwined with our daily life. What is still open to discussion is what media will look

like at the end of this transition and, again, if (this) transition will ever know an end.

If we consider transition as an inherent property of media, technological hybridism is its necessary characteristic. As a consequence, the very idea of the purity of a medium (the analog vs. the digital) should be reconsidered and, eventually, abandoned:

> To comprehend the aesthetics of transition, we must resist notions of media purity, recognizing that each medium is touched by and in turn touches its neighbors and rivals. And we must also reject static definitions of media, resisting the idea that a communications system may adhere to a definitive form once the initial process of experimentation and innovation yields to institutionalization and standardization. (Thorburn and Jenkins, 2003: 11)

In this perspective, if, as I think, transition is the most appropriate and productive term to define the process that film is undergoing at the moment, it seems also important to point out why it is useful and urgent to discuss this transition while it is happening.[9] There are at least two good reasons. The first one concerns the value of a historical record of events still taking place. The second resides in the possibility of exercising some kind of influence on the direction events are taking in the practice, in this case the practice of film archiving and film preservation.

Historical records of events taken *in medias res* benefit from a privileged point of view, that of those who do not know yet how the dice will roll in the end, where the ongoing developments will lead to and with which consequences. Although lacking the historical distance to put events in perspective, such a record would have had the advantage of not filtering its account either through a technological determinism *a posteriori* or by a teleological approach. Of course history is a discourse and not a mere series of facts and, therefore, recording the facts while they are happening is not interesting unless such a record is framed in a critical discussion.

To the question of whether it makes sense to theorize a still changing present, Lev Manovich answers in his seminal book on the language of new media that:

> [...] even if the language of computer media develops in a different direction than the one suggested by the present analysis, this book will become a record of possibilities heretherefore unrealized, of a horizon visible to us today but later unimaginable. (Manovich, 2001: 7)

Like Manovich's, the research presented here is placed at the turn of the 21st century, at a juncture where technology is changing rapidly and media are transitioning into new forms. Differently from Manovich, who looks at the language of new media in terms of emergence of a new medium (Manovich, 2001: 6), I propose to look at it in terms of transition. Of course, making sense of this transitional phase is not an attempt to read the future, for we cannot possibly know what is yet to come.

As mentioned earlier, a second reason why it is important to discuss transition *in medias res* is the chance it also brings along to influence the course of the events in the practice. It is not indifferent in this regard that the researcher of this work embodies two roles, that of the scholar, who addresses the ongoing transition, and that of the curator, who looks for answers to shape the future practice of film archives. It is from both roles that I aim to formulate an archival theory that may be a useful reference, a point of departure for those film archive professionals who are disoriented in this technological transition.

In this work, the historical, social and cultural framing accompanying changes in technology and practices will be taken into account. In particular, the discussion within and about the field and its dynamics will be central. With this respect, Uricchio's view will be embraced:

> [...] new technological capacities achieve (new) media status through a series of struggles over identity, representational capacity, business model, mode of production, regulatory frameworks, and so on. Historically, such struggles have been profoundly social, resulting in cultural and institutional consensus around a particular set of constructions, the new medium of the moment, effectively marginalizing many viable alternatives. (Uricchio, 2002b: 220)

It is the aim of this work to look at these struggles and to take a snapshot of a field in transition at a moment when the future of film is being profoundly reshaped, from production to preservation and exhibition.

Although in agreement with Manovich that cinema is going to be replaced by digital media (2001), this work challenges his teleological approach to technology in accordance with Frank Kessler, who points out that Manovich's approach leads to the conclusion that:

> Film history is in a certain way part of the pre-history of new digital media. The new medium causes a shift of perspective on the history of the old medium. The latter acquires now, as it were, a new *telos*. (2002: 14-15 – my translation, emphasis in the original)

This study will focus mainly on the transitional aspect of the technology, the practices and the field. Also, it will be looking at the changes in both new and old technologies and the way their transition reflects upon the film archival field. This approach is in line with the idea, put forward by Jay David Bolter and Richard Grusin, that new media "emerge from within cultural contexts, and they refashion other media, which are embedded in the same or similar contexts" (Bolter and Grusin, 2000: 19). In this technological transition it is the field of film archives and that of film studies that are being reshaped and archivists and scholars are also agents of the reshaping process.

The investigation of such changes, which are social, technological and cultural at the same time, needs a suitable research method. In the second part of this book, in order to investigate both the field and the changes in technology and practice as interrelated processes, I have looked at approaches offered by social studies and, in particular, those studies focusing on the social construction of technologies. This branch of academic work stems from a reaction to the technological deterministic approaches of the 1980s. There are several theoretical approaches that arise from here and they all ask related questions, as, for instance, the Social Construction of Technology (SCOT).[10]

The SCOT theory, in particular, which has previously inspired, among other scholars, Karel Dibbets, with his work on the introduction of sound film in the Netherlands (1993), has been used in the second part of this study as a reference theoretical tool to analyze a number of recent and innovative film restoration projects and a selection of the major players in the film archival field. Since SCOT focuses on the interrelation between social players, or "relevant social groups," and artifacts, it aptly applies to my case where archival institutions interrelate with the artifact film, facilitating its transition from analog to digital.[11] SCOT is a suitable instrument for studying a transitional process at the same time influenced by and influencing a large number of players and cutting across various layers (technological, economical, social, cultural, etc.). Another reason why I find SCOT particularly apt is its focus on collective agency, such as institutions and organizations, rather than individual agency (Bijker, 1995: 192). Indeed, I will focus mainly on institutions and organizations such as film archives, film laboratories, professional associations, international projects, rather than on individual film curators, restorers or inventors of specific film restoration tools. However, the role of individual actors is acknowledged by SCOT as well, and actors will be taken into consideration in this work, in particular in their role of promoters of knowledge exchange between different professional groups and institutions. In addition, in this work I also embrace SCOT's rejection of a deterministic approach to technology.[12] Differently from SCOT, though, this work focuses on the artifact (i.e. archival film) and on the social groups and the practices around it, while

the artifact is in transition. This introduces differences with the typical SCOT case study, which looks mainly at past transitions. Also the point of view of this work is different from SCOT's, as it is situated within that very transition it intends to discuss.

There are many social groups relevant to this work, from filmmakers to film restorers, from film production companies to film archives, from film laboratories to film exhibitors, from manufacturers of film and film equipment to providers of hardware and software, from funding entities to professional organizations. They are all influenced by the current transition of archival film and, in turn, they all contribute to it. Although I will touch upon many of these groups, especially in the larger snapshot of the technological transition in Chapter One, I will mainly focus on those that are closer to the artifact archival film and that have a more direct influence on its very life. What I call the *archival life of film* indicates the life of film once it has entered the archive, from selection to preservation, from restoration to exhibition and digitization. The social groups that have a direct and material influence on the *archival life of film* are those of film archives and film laboratories. Archives in particular belong to the group that has to respond in the first place to issues concerning preservation, restoration and access of film heritage.

Since the term film archive, as I use it in this work, indicates different kinds of cultural institutions (e.g. film and audiovisual archives, film museums and *cinémathèques*), I think it is useful to take a brief look at the differences between these institutions. The relevance of this closer examination bears also on the question of whether they should adopt different approaches with respect to, and as a result of the transition to digital.[13]

The main difference between archives, museums and *cinémathèques* is in the way they exhibit their films, in accordance with their mission statement. Differences in the nature of the collection, on the other hand, are rather scattered and elude the designations above.[14]

Most film museums and *cinémathèques* are usually characterized by an active exhibition policy. This is typically realized in one or more public screening theaters run by the institution itself; here films from the collection are shown regularly, alongside films from other archives and contemporary distribution titles. In some cases, together with the film screenings, these institutions also display (part of) their film-related collection in an exhibition space.[15] Film archives, on the other hand, usually do not take upon themselves the exhibition of their collection to the public in a theater. For instance, the CNC (Centre national du cinéma et de l'image animée) does not have a theater to show its collection, as exhibition is not part of its mission.[16] However, even in such a case, promotion and distribution are realized as the collection is shown at festivals and in movie theaters.

This distinction between museums and *cinémathèques*, on one side, and archives on the other, however, is losing relevancy as digital technologies offer today many more means of exhibition than traditional film projection alone. In this respect, a distinction on the basis of theatrical exhibition of films can be easily disputed. In this work the changing practice of accessing film archives will be discussed in relation to new possibilities offered by digital technologies. I divide here access practices into three categories: access by the broader public via video or digital reproductions, cinema distribution to audiences outside the archive, and cinema exhibition to audiences inside the archive.[17]

In addition to the difference in their accessing policies, film institutions of course vary greatly in their origin, scale, structure and funding, as pointed out by Penelope Houston (1994: 5) with regard to the institutions affiliated to the International Federation of Film Archives (FIAF).[18] Film institutions can be entirely public (e.g. regional or national film archives such as Centre national du cinéma et de l'image animée – CNC, Library of Congress – LoC, Danish Film Institute – DFI, and many more) or private (such as Hollywood studios' archives or private collections like the French Lobster Films), or partly subsidized with public money (such as Eye Filmmuseum and the Fondazione Cineteca Italiana). As a consequence, their policies for collecting preserving and exhibiting can differ greatly. For instance, most archives limit their scope to national productions, whereas Hollywood studios' archives and, in general, private archives deal only with films for which they hold the copyrights, regardless of their origin. For example, Sony Picture Entertainment recently restored Michelangelo Antonioni's *Professione: Reporter* (also known as *The Passenger*, IT, 1975), even though it is mainly an Italian production, and Lobster Films does not limit its collection to French films.[19] Eye Filmmuseum, on the other hand, besides its "archival function," which is limited only to national film productions, also collects, restores and exhibits non-Dutch films, on a selective basis.[20]

However different, most film institutions collect and preserve films (and often film-related artifacts such as cameras, projectors, posters, stills and filmmakers' paper archives) according to their specific policies and in proportion to their financial means. All members of FIAF are non-profit institutions and follow the Federation's code of ethics, which sets general rules regarding preservation and exhibition of films.[21] In general, for-profit archives also follow most of the rules set by the FIAF.[22] Despite the generalizations above, the way film institutions respond to the transition to digital should be considered for each single case, based not just on their designation but on their mission statement, their objectives and, of course, the origin of their funding. Note that film archives, museums and (most) *cinémathèques* are all concerned with collecting, preserving and promoting films.[23]

It should also be pointed out that, besides FIAF, there are a number of professional organizations that have an important role in coordinating and circulating debates within the archival field, especially in this time of transition. Some of the more relevant organizations will be touched upon in this work. They include AMIA (Association of Moving Image Archivists), ACE (Association of European Film Archives and Cinémathèques), SEAPAVAA (South East Asia Pacific Audio Visual Archive Association), FIAT/IFTA (International Federation of Television Archives), SMPTE (Society of Motion Picture and Television Engineers), EBU (European Broadcasters Union).

In this sketch of the archival field I need also to clarify my own personal position as a film archivist and, therefore, as a player within the very field I am researching. Rodowick recalls that in the 1970s "film history was a pursuit based on scarcity" and "the only way to see a film was to see it projected," and that after 1989 "only a few short years marked the transition from scarcity to an embarrassment of riches, though at a price: *film had become video*" (2007: 26 – emphasis in the original). My own personal experience has been quite different. In 1989 I started studying film and only then non-contemporary film became something other than televisually broadcast movies or rented video cassettes. Seeing (non-contemporary) film projected on a screen was, after 1989, an eye-opener in terms of visual pleasure and, more specifically, photographic quality, as these were incommensurably better (and other) than what I had experienced before on television. On the other hand, film prints available in the late 1980s and early 1990s were almost as scarce as those available to Rodowick in the 1970s (and probably often the same ones). Available prints were most of the time in bad shape, bearing the signs of a long life of projections. During those years, film restoration took its first steps as a self-conscious discipline, and a few film archives and specialized film festivals (such as Le Giornate del Cinema Muto and Il Cinema Ritrovato in Italy, and Cinémemoire in France) spread the message that films needed active restoration in order to be properly experienced.[24] Although preservation and philological reconstruction of incomplete films was already an existing archival practice, the emphasis on restoring the pristine photographic quality of archival films started to be consciously addressed only in those years. Along with it the archival community started shifting from an idea of "original" focusing on philological integrity (in other words, the reconstruction of the complete narrative of a film), to an idea of "original" that foregrounded the material integrity (reconstructing the narrative by recurring to the most original material artifacts available). My initial interest and passion for film started in this environment, quite different from Rodowick's. The ideal of restoring the "original" beauty of films as seen in projection led me to this profession. The advent of the digital was almost synchronic with my first year

working in a film archive (1996-1997), since in 1997 one of the first full digital restorations, *The Matinee Idol* (USA, 1928), was carried out.

My positions as film archivist and as researcher will at times overlap, as this study is also based on my professional experience and on a broad range of contacts and collaborations. Conversations with leading figures in the field, from film archives, research institutes, film laboratories and funding entities, have been used to support the analysis of the research. Also, the discursive range this work draws from includes academic assessments, professional journals, papers from media-analysts, as well as from motion picture engineers, and, of course, personal opinions expressed by filmmakers and by film archivists. Throughout these pages I intend to keep my position as researcher as distinct as possible from that of film archivist.

In this work I investigate the interplay between film and media theory and film archival practice in this time of transition from analog to digital and, based upon this investigation, I propose a new theorization of archival practice. I aim to demonstrate that practice is in a constant state of transition, characterized by a growing hybridization between analog and digital technology, and that an appropriate theorization of archival practice is not only relevant and necessary, but urgent for such a transitional practice, producing ever changing film (archival) artifacts. Therefore, I invoke a renewed mindset for both film archivists and film scholars and a renewed dialogue among them.

The first part of this research addresses the transition film is now undergoing, from both the perspective of the practice, in film production and film archiving, and the theoretical perspective, in film and new media studies. I have divided this first part of the study in two chapters, the first focusing on the practice and the second on the theoretical discussion. In the second chapter I also elaborate a new theorization of archival practice inspired by both theory and my own practical experience. Since I invoke a dialogue between film archivists and film scholars, I have chosen to speak to both of them in this work.

In Chapter One I investigate how new technological changes are influencing the practice of film production and of film archiving. Since my focus is on film archiving, the discussion on changes in film production due to the digital is limited to a number of areas that clearly have a bearing on film archival practices. This chapter is first of all an effort to create a detailed snapshot of a practice in transition that I feel is still missing in the literature. Whereas a number of reference publications exist with regard to traditional photochemical film restoration (e.g. Read and Meyer, 2000), a detailed technical description of the available tools and the viable practices for digital restoration of archival films is not yet available at the time of writing.[25] Furthermore, a close snapshot of the current practices and a detailed description of the technical

possibilities available in the period 1997-2007 is a necessary reference for the discussion of the film restoration case studies analyzed in this work. In Chapter Two I look at how theoretical debates address the transition to digital, with particular attention to the most relevant recent developments in media studies and to the discussion on film ontology. The question is addressed whether film's ontology changes with the transition to digital, and a number of approaches are discussed that more clearly bear on the conceptualization of archival films. I also propose a number of frameworks and concepts as a basis for a new and digitally informed theory of film archival practice, which is suited for the transitional character of film. I would like to point out that my use of frameworks and concepts, derived from film and new media studies, is pragmatic and instrumental for my new theorization of film archival practice. My theorization intends to comprise the different conceptions of the nature of (archival) film already existing in the field. However, I also propose a new way to look at film's nature, from the perspective of transition. I will argue that such an approach can be productive for understanding the current transition from analog to digital.

The second part of this study puts the proposed theorization to the test with a number of relevant social groups from the film archival field and film restoration case studies. In Chapter Three I investigate the different approaches to film archival practice, in particular those of film archives, laboratories and funding entities, in relation to the proposed frameworks and concepts. In Chapter Four I critically examine how this new theorization bears on current archival practice by discussing a number of relevant and innovative film restoration case studies, carried out by the entities discussed in Chapter Three, that have been realized right in the middle of the technological transition from analog to digital (1997-2007). The case studies I have examined include both restorations carried out by me or under my supervision (Fossati, 2006), such as *Zeemansvrouwen* (NL, 1930) and *Beyond the Rocks* (USA, 1922), and restorations from other leading archives, such as *The Matinee Idol*, (USA, 1928, by Sony) and *Mahagonny* (USA, 1970-1980, by the Harry Smith Archives and Anthology Film Archives).

In this second part I turn to some of the analytical tools offered by the SCOT theory as they provide an appropriate and productive reference for organizing my cases and relevant social groups, and for explaining the dynamics that are taking place. The comparative analysis of specific restoration case studies, social groups and relevant theoretical discourse will reveal the interplay between theory and practice. In particular, the discussion of case studies will focus on all the decisions and their consequences, which are, consciously or not, related to questions regarding film ontology. Each selected case provides an opportunity to discuss and to test the earlier proposed frameworks

and concepts in relation to the issues, such as the extent of the restoration interventions, the respect of the original artifact, and the transparency and reversibility of the choices made.

Like any study, this one also has limits. I would like to mention three of them in particular. First of all, I am not addressing broadcast archives, and I mention television only incidentally. The second limitation is geo-cultural, as this study focuses mainly on Western realities, including Europe and North America. The third one regards home-movies, amateur cinema and films produced within film schools' programs, all of which have been increasingly produced with digital means in the last decade, but could not be treated in this study. These have been painful but necessary exclusions.

For ease of reference, I have added a concise technical glossary to this book. All terms included in the glossary are highlighted in SMALL CAPITALS throughout the text.

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PART 1

PRACTICE AND THEORY OF (ARCHIVAL) FILM

In the first part of this book I discuss the transition from analog to digital technology, firstly from the perspective of film (archival) practice and, secondly, from that of film and new media theory. Here I also introduce a new theorization of archival practice.

In Chapter One I provide a snapshot of some of the most relevant changes in film production and film archival practice that are occurring at this time of transition from analog to digital technology. Such a snapshot will show how the combination of the new digital tools and the well-established analog ones has led to a high level of hybridization in technology and practices, both in film production and in film archiving. In this chapter some of the tensions and questions regarding the nature of film will start to take shape through the debates around the new technology, the new tools and, especially, their application in everyday practice.

In Chapter Two I focus on the debates around the nature of film by looking at how film and new media theories are reflecting on this transitional moment and, in particular, how theoretical studies are addressing the question around film ontology in view of the digital. Here I identify relevant frameworks and concepts as a basis for a new theorization of film archival practice. Such frameworks and concepts can serve as tools to analyze the transition from analog to digital in current film archival practice. This analysis will be carried out in the second part of this work where the interplay between practice and theory will be further developed.

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CHAPTER ONE

Film Practice in Transition

This chapter focuses on the transition and changes in the practice of film production and film archiving. For the updates to this chapter, which are added to the earlier edition following each topic, I chose to be brief and concise in highlighting the changes that have most impacted current practices. In the first part, focusing on the consequences of digitization in current film production and distribution, I look at the main changes and new trends, addressing in particular those aspects that have directly influenced film archiving. In the second part, I offer a detailed recount of how archival practice has changed in the past ten years, partly as a consequence of the changes in production and distribution, and partly due to the mastering of practices and improvement of techniques that were still somewhat experimental a decade ago.

As argued in the earlier edition, the interplay between film production and archival practice is still paramount — not only for restoration and exhibition practices but also, and even more so, for all born-digital films which are made following the new technological and infrastructural practices and preserved by film archives.

Ten years ago, I pointed out the high degree of hybridity in technology and practice. But can we still talk of a vastly hybrid practice today? I think we can. While some changes have been quite dramatic, in particular in digital cinematography and digital distribution and exhibition, and have greatly reduced the use of analog film in today's practice, I argue that the practice is still hybrid as it relies on a long tradition and expertise in analog filmmaking. Indeed, even for those new films or film restorations in which the entire workflow from shooting (in the case of new films) and digitization (in the case of archival films) to exhibition is fully digital, the entire workflow still relies on tools and expertise that were typical of the analog film past.

As mentioned in the new introduction to this revised volume, I maintain that the dynamics illustrated in the snapshot taken a decade ago for the first edition of this book are still at work in current practice and are still shaping the workflows

which are being adopted by filmmakers, producers, post-production technicians, and distributors as well as by film archivists, restorers, and laboratories specialized in film restoration today. For this reason, the earlier edition's detailed description of that practice is still relevant and useful. The snapshot covered the salient period in the transition to digital, roughly framed between 1997 and 2007, when new tools and practices were introduced and experimented with, and most of the current trends were set in motion which still form the basis of today's archival practice.

The past decade has also seen the publication of several important contributions, both academic and professional, on film archival practices. Alongside a number of reference publications still relevant today, which mainly focus on analog archival practices (e.g. Read and Meyer, 2000 and Venturini, ed., 2006), a number of important academic studies have since appeared reflecting on film archival practices (e.g. Pescetelli, 2010; Frick, 2011; Jones, 2012; Parth et al. eds., 2013) as well as more practical discussions of the available tools and viable practices (e.g. Enticknap, 2013; Newnham, 2015; Edmondson, 2016; and, in Italian, Catanese, 2013 and Dagna, 2014).[xiv]

Three of the most dramatic changes impacting film archival practices in the last decade have been the so-called digital rollout, which has replaced analog film by digital film in the distribution and cinema exhibition in most Western countries; the disappearance of film manufacturing as an industrial practice and the consequent closure of many film laboratories; and the rapid growth of digital archives that are being built for the long-term preservation of digitized and born-digital films. These changes will be briefly discussed directly below and in more detail in the following pages while updating the various practices related to film production and film archiving.

In the first decade of the new millennium, film distribution and projection was still mainly analog. Most films, including those that were digitally post-produced, were printed on film rolls and shipped to movie theaters for projection. It is in the second decade of the current millennium that the digital rollout was truly set in motion in most Western countries. Facilitated by state interventions and following a strategy promoted by the studios in the United States and by the European Community in Europe, distribution and projection networks have rapidly shifted to a fully digital chain.[xv] Presently, in most cases, a complete switchover has been realized: commercial cinemas and art houses have replaced film projectors with digital projectors, often thanks to favorable national incentives as in the Dutch case discussed below. At the same time, many filmmakers have diverted to digital shooting, due to the improvement in digital cinematography, as discussed further on. These two changes — the incremental use of digital cameras for shooting film and the shift to digital projection in cinemas — have led to a complete digital workflow in film production and distribution with far-reaching consequences for the entire film industry and film archives.

The consequences of the digital rollout have been multiple. The production of film stock has rapidly decreased, leading to the downsizing of film manufacturing, the disappearance of many traditional kinds of film stock, and the closure of many film laboratories.[xvi] All of a sudden, a whole branch of the film business revolving around the post-production of film strips, including activities spanning from film processing to negative cutting and film printing, and all related expertise, quickly became obsolete.

There was a rising concern that practices, tools, and expertise related to traditional film post-production would disappear within the archival community. Thus, a number of initiatives were launched to keep laboratory equipment and expertise in existence, for they were still deemed necessary for archival purposes (e.g. for film restoration and exhibition practices) and they were seen as an integral part of film heritage from a historical perspective. Three such initiatives are the Future of Film Archiving (FOFA), which was initiated by the British Film Institute; the Film Advocacy Task Force (FATF), which in turn is part of the Association of Moving Image Archivists; and the Charter of Cinematographic Projection in the 21st Century, which unites several hundred organizations and individuals worldwide committed to traditional film projection through the platform filmprojection21.org.[xvii]

With the disappearance of a variety of film stock and the closure of film laboratories, film archival practice also started diverting more and more to digital alternatives. Alongside digital restoration and access, digital tools and media had to be adopted as a means to preserve the film archives' rapidly growing collection of digitized film-born films and new born-digital titles. Both the digital as well as the analog collections need to be preserved for the distant future.

The long-term preservation of data has become a global concern, as most activities from banking and healthcare to national and domestic administration, have become mainly digital and need to be properly stored in a sustainable fashion. From the perspective of film archiving, the sudden shift to a mainly digital production and distribution chain has led to a rapid growth of the number of digital films to be archived. Despite the awareness of the challenges posed by digital storage (e.g. the rapid obsolescence of hardware, software, and formats and the high costs related to daily maintenance and regular MIGRATION to newer formats), new important efforts have been made to improve the technology and to design the best practice that will allow for better long-term preservation of data. Most of the bigger film archives, especially studio archives and public archives in the Western world, are being equipped with a digital storage strategy of some kind that will allow for the long-term preservation of new born-digital films and digitized film-born titles.

A new phenomenon that has emerged in the last decade, which is deeply related to the transition to digital and is certainly worth highlighting here, is what I referred to as the "material turn" in the new Introduction to this edition. Within

filmmaking and film archiving, the material turn indicates the renewed interest in traditional film.

While the film industry workflow from production to distribution and projection has rapidly shifted to digital, a niche movement of filmmakers and artists has emerged that privileges the use of photographic film and advocates keeping its production alive. One of the first to voice this trend publicly was Tacita Dean in her plea "Save Celluloid, for Art's Sake," published by the British newspaper *The Guardian* on February 22, 2011; an article she wrote in response to the decision by Soho Images, the last laboratory in the United Kingdom that was still offering such services, to stop processing 16mm film. Dean vehemently argues that film is still the core of her art as well as that of many more like-minded artists and independent and experimental filmmakers. Forcing the demise of the analog tradition (by dismissing a service like 16mm film processing) is, in her view, ill-advised, as she states that the CEO of Deluxe, owner of Soho Images in London, "might not have understood the devastating impact this presumably financially negligible decision might have on a growing group of contemporary artists, the galleries and museums that show them and the national collections that own their work."[xviii] This kind of plea for maintaining traditional film industry as a specific means for artistic and creative productions was shared by many filmmakers, artists, and archivists alike.[xix]

More recently, a similar plea came from a number of Hollywood filmmakers who still want to have the option of working with traditional film. Like Tacita Dean, they believe that both analog and digital tools should coexist, as they together offer more creative choices to filmmakers. Christopher Nolan, Quentin Tarantino, and J.J. Abrams are among the well-known film directors who have joined forces to promote an agreement between Hollywood studios and Kodak to ensure traditional film production.[xx] In 2015, Kodak finalized the agreement, guaranteeing for the time being that filmmakers can continue to shoot on analog film. It should be noted, however, that the production of film stock has been drastically downscaled both in terms of format choice, emulsions, and quantity and is wholly dependent on the management decisions of manufacturers like Kodak. In the updates to this chapter, the film manufacturers and film stocks available today will be discussed in more detail.

The discussion on the digital turn among filmmakers and archivists is still quite polarized, as was recently recorded on (digital) film in the documentary *Side by Side* (USA, 2012) and in various interviews.[xxi] Another interesting consequence of the recent interest in traditional film has been the renewed synergy between film archivists and artists. This is visible, for instance, in collaborations between film technicians and artists within film laboratories: film technicians working in archives or in film laboratories specialized in film restoration occasionally support artists running do-it-yourself laboratories; similarly, film archives equipped with an internal film laboratory occasionally offer services to artists who want to process and edit their analog films.[xxii]

All things considered, it is quite evident that, a few years after the turn to digital for mainstream cinema, we can still talk of a hybrid film archival practice, as will be discussed topic by topic in the following pages. Additionally, in the updates to this chapter (film production and film archival practice) and Chapter Three (archives and laboratories), we will see that the dynamics at play a decade ago and highlighted in the earlier edition of this book are still valid today, even though new developments have occurred and are being applied in everyday practice to an even greater degree.

In this chapter I will describe and discuss the main changes that are taking place in film archival practices today, from preservation to exhibition and access, as a result of the introduction of digital technology. While doing so, I will introduce links with the changes in theoretical approaches within current film and new media theory, which, in turn, will be central in the following chapter.

The objective of the following pages is to provide a snapshot of the current practices in film archiving, focusing, in particular, on the changes brought about by the introduction of digital tools. A detailed snapshot of archival practice in transition is necessary at this point since it is missing in the literature at the time of writing, and it is meant to serve as a reference for those who are not familiar with the techniques involved in preservation, restoration, and exhibition of archival films as carried out today. Within this work it also serves as a technical reference for the case studies discussed.

Furthermore, a snapshot of the technology available and the practices adopted by film archives today is instrumental in placing this work within the very transition it discusses. Archival practice is in many ways connected to film production practice. The most evident connection between archives and the film industry is that they make use of the same service providers (e.g. the same film manufacturers and laboratories) and of the same equipment for exhibition (e.g. projectors and sound systems). As a consequence, archivists need to know the technology used to make films today in order to be able to best preserve and restore these films tomorrow. Being familiar with current changes in film production practices is also necessary for film archivists in order to understand where changes in archival practices originate from and where they might be headed. Understanding the transition in the film medium is, indeed, the very first step for rethinking film museums of the future.
With the above in mind, in the first part of this chapter, I will discuss a number of areas of contemporary filmmaking where the use of digital tools can clearly be held responsible for significant changes in the film production workflow.

I will mainly focus on the areas of audio, editing, special effects, film duplication process, and shooting and projection. These are the areas that most significantly influence the changes in film archival work in general, and in film restoration practice in particular, as it will be discussed in the second part of this chapter.

Since in this chapter I will be looking at transition, in the first place, from the perspective of practice, I will make extensive use of current professional sources, like trade journals and hand books, both from the filmmaking and the film archival field. Since professionals are expected to comment on the actuality and to provide other professionals with suitable tools for everyday practice, these sources give voice to the practice in this transitional phase. In this perspective they can be considered an integral part of the snapshot I am drawing of this technological transition.

1.1 FILM PRODUCTION

As discussed in the earlier edition, the transition from analog to digital in filmmaking was already announced in the late 1970s and led to an increasingly hybrid film production practice throughout the following three decades. From the start of this millennium up until its turning point in 2012, digitization of mainstream film production has rapidly progressed. However, despite a drastic change in balance between analog and digital – with digital being the new standard in film production, distribution, and exhibition and becoming predominant in film restoration and overall archival practices – analog film tradition is still very much alive. Indeed, it still serves as the basis of film practice and is essential for understanding, restoring, and preserving film history.

The turning point in the transition to digital has been triggered by a number of factors discussed in the updates to this chapter, including the lowered costs of digital equipment (projectors, data servers, data storage means, etc.) and various financial mechanisms designed to support movie theaters, in particular for purchasing digital film projection equipment. Furthermore, the sudden expansion of digital projection in film theaters coincided with a number of successful film releases relying heavily on digital 3D technology. The year 2012 marked the pivotal moment at which digital distribution and exhibition outmatched the traditional analog workflow. For the first time, more film theaters were equipped with digital than analog projectors, and more films were distributed as DCPs rather than reels.[xxiii]

Ostensibly, the most significant title that can be associated with the shift to digital is James Cameron's *Avatar* (USA, 2009). Distributed at a time when a large majority of movie theaters were still projecting film reels, *Avatar* was mainly shown

as a film reel projection. However, its enormous success helped convince many distributors and theater owners of the potential of (3D) digital projection. In the earlier edition of this book, I wrote "Whether digital 3D will be more commercially successful than other 3D formats already introduced throughout film history remains to be seen" (below, p. 81). A decade later, digital 3D is still around and is considered one of the factors that contributed to the accelerated shift to digital. As pointed out by Ian Christie:

> Not until the extraordinary success of AVATAR in 2009-2010, which demonstrated the immersive appeal of digital 3D, did there appear to be compelling commercial reasons for a majority of exhibitors to invest in digital projection, charging premium prices for 3D in order to help amortize their costs, together with elaborate distributor-led schemes such as the "virtual print fee." (2016: 261)

Alongside 3D, the last decade has seen a few other developments related to the new possibilities of digital means, such as HIGH FRAME RATE, HIGH DYNAMIC RANGE, and 3D sound systems, which have had an important impact on film production workflows, image and sound aesthetics, and film preservation practices.

Additionally, in recent years the difference between video and film (post-) production have become increasingly blurred. From a technical perspective, with the advent of 2K and 4K television and high-definition online services (Netflix, YouTube, Vimeo, Amazon Prime, etc.), the traditional difference between the two media have all but disappeared in terms of hardware, software, and technical processes. Indeed, the majority of the technical tools used for video and film are one and the same, as will become clear in some of the following updates.

In terms of production and sheer scale of output, the Netflix phenomenon (with its straight-to-video films and "cinematographic" series) is also assimilating theatrical and "television" films to such an extent that the Cannes Film Festival has now introduced a new rule that requires films in competition to have had a theatrical release in order to be admitted.[xxiv]

> Also, I had come to the conclusion in the last days of Apocalypse Now [1979] that the cinema was about to go through an extraordinary change in that it was able to become electronic. I was sure that movies were going to be shot and edited digitally, and were going to be able to make use of the many facilities of an electronic medium.[26]

Francis Ford Coppola was not the only one to foresee that cinema would become digital. From the late 1970s onwards there have been many enthu-

siastic prophets of the new DIGITAL CINEMA, as well as prophets of the end of film caused by the arrival of the digital. Almost thirty years later, what Thomas Elsaesser noted in 1998, is still partially valid:

> We know that the revolution announced by Francis Ford Coppola in the late 1970s, which he hoped to implement with his Zoetrope Studio all-digital filmmaking, has so far not materialized, while another guru of digital cinema, the inventor and owner of 'Industrial Light & Magic' George Lucas has voiced, as recently as 1997, a certain skepticism, and this not after a commercial failure, as Coppola's ONE FROM THE HEART proved to be, but flushed with success after the tremendously lucrative re-launch of the first part of his STAR WARS trilogy, and his digital empire, working to full capacity, evidently also having 'the Force' on its side. (Elsaesser, 1998: 204)

The climate of digital expectation has had its ups and downs in the past three decades while the actual technological transition is taking much longer than was expected by many. As pointed out earlier, in the following pages I will look at the changes from the perspective of the practice. I will point out first some of the most relevant changes in film production in the last thirty years with respect to the transition from the analog to the digital technology, and I will relate these changes to those taking place in the film archival practice. Later, I will discuss in detail how new digital media are transforming film archival practice.

The introduction of digital technology has had a major impact on various aspects of filmmaking, such as audio, editing and special effects. In the last ten years a new process, in particular, has been introduced in the post-production practice that has led to the full digitization of film during post-production, the so-called DIGITAL INTERMEDIATE process. However, even though at one step the whole film is digitized, the rest of the workflow, from its very beginning (shooting) to the end (distribution and exhibition), is today still predominantly analog. Most commercial films are still shot using polyester photosensitive film, and projection prints are still shipped to cinemas all over the world to be screened using old-fashioned film projectors. This does not mean, however, that things are not changing. In the last few years more and more filmmakers, with different backgrounds, from the mainly Scandinavian Dogme 95 movement to mainstream Hollywood filmmakers, are turning to digital for shooting their films, and it is expected that in a few years digital distribution and projection will become the norm. At that point the whole film production chain could eventually become celluloid-free. And film will be changed, at least as a material artifact.

The technologies and practices related to these changes will be discussed

in this chapter, focusing on how these are reshaping the practice of filmmaking on the one hand, and of film archiving on the other.

Digital Audio

While discussing the introduction of digital technology in film sound, it is worth taking a look at the music industry, which adopted digital tools two decades earlier than the film industry. The introduction of digital technology in the music industries dates back to the 1970s when companies such as BBC and Decca started to use digital recording tools. Only at the end of the decade, and especially during the following one, digital audio started to be employed for popular music on a larger scale. The successful Compact Disc, for instance, was developed jointly by Philips and Sony and was put on the market in the early 1980s. Along the way an animated debate between supporters of analog or digital audio took place from concert halls to living rooms. Today, almost everybody listens to music that has been produced using both digital and analog technologies at some point of the production chain. Nevertheless, there are still musicians who find it important to declare that their music has been produced in a digital-free environment.[27]

Looking at the difference between analog and digital audio, it can be stated in the first place that audio is an analog phenomenon. Analog audio records waves, whereas digital audio translates these waves via encoding into binary numbers. The audio waves, produced for example by an actor, a singer or an instrument, are converted into digits and stored on a CARRIER, e.g. a Compact Disc or a hard disk, via an encoded digital format, e.g. PCM, WAV, MP3. At the end of the chain a decoder will convert the encoded digits back into a(n analog) sound wave.

Digital audio entered filmmaking when the technology became competitive with the existing magnetic tape recorders (usually referred to with their brand name NAGRA, as the standard in motion picture and television recording from the 1960s). Only in the 1990s did digital technology slowly start to take over part of the motion picture sound reproduction process. Magnetic tape recorders started to be replaced by digital recording devices making use of Digital Audio Tapes (DAT), launched by Sony in 1987. DAT is still a standard in the professional circuits today. Only recently have devices that record uncompressed audio directly onto hard disks been gradually introduced.[28]

Digital tools have been introduced in the practice of mixing film audio but, until this day, they have often coexisted with analog steps in the chain. In practice, the process of producing sound for film has not changed much since the introduction of digital recording devices. As noted by Sean Cubitt:

> Sound effects are still largely produced by the established analogue means of Foley editing, although there are specific examples in which the effect is dependent on digital equipment. (Cubitt, 2002: 18)[29]

With respect to the reproduction of sound in cinemas, the conversion to digital started in 1992, with the introduction of Dolby Digital. *Batman Returns* (USA, 1992) is considered to be the first film to make use of a Dolby Digital soundtrack.[30] In Dolby Digital the space between the perforations of a film projection print hosts the digital sound information; a decoder built in the film projector reads the information while the film is shown and a digital processor converts it back into sound. A similar system was more recently developed by Sony, the Sony Dynamic Digital Sound (SDDS), where the sound data are inscribed on the outside edge of the projection film print.

A slightly different system, the Digital Theater System (DTS), was used for a limited number of films, the first of which was *Jurassic Park* (USA, 1993). DTS uses a separate Compact Disc that provides digital sound in synchronization with the film print thanks to an optical time code printed on the film. The film print carries a redundant analog soundtrack for cinemas without DTS or as a backup in case the Compact Disc should fail. This system is reminiscent of early sound systems developed in the late 1920s, such as Vitaphone or Movietone, where a sound recording would be played in synchronization with a mute film print.[31]

Also in film exhibition analog and digital sound technologies coexist. A good example of this coexistence is that of a typical projection print provided with Dolby Digital audio or SDDS. On such a film print two types of soundtracks are present, namely, a digital track between, and an analog track along the perforations. The presence of two tracks allows the film audio to be played also in theaters that are equipped with an analog sound system only, and it offers an alternative in case of technical breakdown. These are two issues quite strongly related to the economical aspects involved in technological change as they guarantee compatibility with different kinds of equipment (analog and digital) and back-up in case of technical failure.[32] It should also be noted that the digital soundtrack is photochemically printed on the projection print, which means that it has to rely on the traditional analog reading head placed in the film projector.[33]

Although the high quality of recent cinema sound systems is often attributed to digital technology, this is not always the case. Trademarks such as THX, for example, are not digital recording technologies, but a quality certification for playback systems for cinemas, home cinemas and even for car sound systems.[34] THX sets standards for the type, number and location of speakers and other spatial aspects for the cinemas or other environments

where the sound is played back. Both digital and analog formats can be heard in THX-labeled cinemas.

We can conclude that the introduction of digital in film audio at this point has only partially changed the practice and, as Cubitt points out:

> [...] digital sound as a whole is still dependent on analogue and imitates it even more closely than visual effects. Thus there are no plans in hand for digitally synthesized voices, even though synthespians, virtual actors existing only in computer, are being developed as a commercial proposition. (Cubitt, 2002: 18)

On the other hand, it should be pointed out that in a larger context the audiocultural perception has indeed changed and our ears have been retrained by this pervasively digital audio environment (e.g. CD, MP3 and DVD). So, even if digitally synthesized voices are not commercially developed and digital sound for film imitates analog sound, as argued by Cubitt, it cannot be denied that digital quality has become part of today's sound in a broader sense, certainly in users' everyday experience.

Also, this brief overview of the introduction of digital technology in film audio shows quite clearly that, at this point, everyday practice deals with a hybrid technology where analog and digital tools coexist at every step of the production chain, from production to exhibition. The situation is similar with respect to film restoration practice.

The impact of digital audio on film restoration has been larger than one would think based only on the limited reflection that this technological change has produced.[35] Film audio, indeed, is a field that has been significantly less addressed than other aspects of film, in particular the image. And this remains true also with regard to the transition to digital. This could be surprising as almost all films produced over the last fifteen years, and also many film restorations of archival films, have gone through digital. One reason for this lack of reflection could be the fact that sound in film has never been intelligible without a transcoding step (in other words, sound in film is not isomorphic), not even when it was completely analog, and, therefore, it is harder to grasp. In this respect the shift to digital in sound is significantly less dramatic than in image. Even if audio is not the object of this research, the kind of theorization I propose in this work may be useful for further reflection on it.

DIGITAL AUDIO – UPDATE

Digital tools for film sound recording, editing, and reproduction were developed much earlier than those for the image. Digital sound had by and large replaced analog sound by the 1990s; however, at that time, most soundtracks were still transferred back from the digital domain onto film prints for projection. With the shift to digital of film distribution and exhibition, most of today's workflow regarding film soundtracks has also become fully digital. Nowadays, encoded film soundtracks are included on the DIGITAL CINEMA PACKAGE or DCP and decoded directly from the digital domain during projection.

With respect to film sound post-production and restoration, a couple of important changes have occurred. The first is the integration of a large variety of plug-ins into audio software that allows film sound editors and restorers to carry out multiple tasks from a single workstation within the same software platform. The second is related to the above-mentioned shift to digital projection and comes with the introduction of the DCPs. DIGITAL CINEMA PACKAGES allow for greater flexibility and lower costs also due to less stringent standardization and quality control requirements. When encoding soundtracks for DCPs, sound editors and restorers are not necessarily bound to the ever-dominant sound systems adopted by movie theaters, such as the Dolby encoding system.[xxv]

With the digital rollout and the shift to digital distribution worldwide through DCPs, things have changed. Audio professionals working for lower budget productions as well as film (sound) restorers are no longer restricted to using a Dolby encoding system (unless specifically required by film festivals or theaters) as any sound source can be recorded on a DCP.

It should be pointed out that, despite the flexibility of new workflows, the same high level of quality control the industry had been used to in the recent past is no longer warranted. In fact, audio quality from DCPs can vary significantly. Another limitation of the current workflow is that DCPs have been standardized so that they can only accommodate sound as Surround, typically known as 5.1. This indicates that five channels plus one (Left, Right, Center channels, Left and Right Surround channels, plus a channel for low-frequency sounds) are used to create the surround sound effect. Various kinds of soundtracks using less than six channels (e.g. Mono and Stereo soundtracks) can be accommodated on a DCP by creating silent tracks.

Similar to the developments regarding the projection technology of film, digital audio technology has proceeded with the search of a more realistic "3D" experience by the spectators. This has led to new sound systems such as Dolby Atmos, Auro 3D, and DTS:X, also referred to as "Immersive Sound Systems." These systems mark a new step in the surround sound film technology as they add more channels of sound reproduction that literally "surround" the audience in the

theater creating a multi-dimensional lifelike sound; hence, 3D.[xxvi] Moreover, as it introduces new features and tools, film editors can now divide the sound in up to 128 different tracks (as in the case of Dolby Atmos) which can be played back by the multiple speakers certified theaters are equipped with today.[xxvii]

As we will see in the update on Sound Restoration in the second part of this chapter, recent developments in audio editing and reproduction pose new challenges for film archives in terms of acquisition, preservation, and, eventually, restoration. In addition, the past decade has also seen interesting developments in film sound research, archiving, and restoration. Archivists and scholars are becoming increasingly aware of this too often neglected aspect of film archival practice. Going forward, they need to face the challenges and expand the boundaries of restoration in this new direction.

Digital Editing

With the introduction of DIGITAL EDITING, the craft of film editors has changed radically. They have abandoned viewing tables, film splicers and piles of film trims, and have started working with computer suites. In this way films can be edited at a much higher speed, and, most importantly, random access to any given frame at any given time is possible. Because of immediate random access, opposed to linear access (e.g. from begin to end), DIGITAL EDITING is often referred to as non-linear editing, whereas traditional editing is considered linear. The turning point for the introduction of digital in the editing practice was in the 1990s. As film editor Walter Murch states, "1995 was the last time the number of mechanically edited films equaled the number of digital" (Murch, 2001: xi).[36]

DIGITAL EDITING has certainly sped up the post-production process. However, it is important to point out that, even though it is a precious instrument for the editor, it does not substitute traditional film editing and, in that sense, it operates alongside the photochemical process of film from camera to screen. Monica Mak, filmmaker and editor herself, while discussing theoretical misconceptions about non-linear editing's effect on thematic coherence, film aesthetic and narrative chronology, argued that DIGITAL EDITING is not more non-linear than traditional film editing (Mak, 2003: 39). In particular she points out that:

> Although it would require extra time and labour, an editor nonetheless could still accomplish the same process on a traditional film editing machine, such as a Steenbeck flatbed. For instance, if an editor work-

> ing on a Steenbeck wanted to insert sequence C in between juxtaposed sequences A and B, he/she would have to untape the two spliced negatives of sequences A and B, and retape them with sequence C in the middle. What makes this process faster on a digital editing platform is that the digital editor could, in less than a minute, acquire the same results, with a few clicks on a mouse. (Mak, 2003: 47, fn. 20)

In practice, DIGITAL EDITING is a way to speed up the cutting and splicing process that (until recently in most cases) still takes place on the actual celluloid film, namely, the camera negative.[37] The film negative is digitized at lower RESOLUTION and imported in an editing suite, such as Avid Media Composer, Apple Final Cut, Adobe Premiere, to name the most used in professional filmmaking. Once the final editing is accepted, a so-called Editing Decision List (EDL) is produced, which instructs the "negative cutter" on how to edit the actual negative film, using edge codes (serial numbers to be found along the side of the film) as references.[38] Only when the negative is edited following the EDL instructions, is a film ready to be duplicated to produce intermediate copies and, finally, projection prints.

DIGITAL EDITING never had a significant role in film archival and restoration practices. Editing, within a restoration process, is often referred to as "reconstruction" and it is usually done by comparing all existing sources.[39] There are at least two reasons why DIGITAL EDITING has not changed the film restoration workflow as much as it has film post-production. On the one hand, transferring an archival film to video or digitizing it to a low RESOLUTION format for editing brings with it extra costs that most archives cannot cover. On the other hand, reconstruction of an existing film is a different craft than editing a new one since a reference for the sequence of the scenes already exists, i.e. existing prints. For those cases where the reconstruction of the restoration version is particularly complex, an EDL is created to help the editing process throughout the workflow and as a documentation of the choices made by the restorer with regard to the editing of the restored version and the sources used to reconstruct it. A well-described example of this process is offered by the restoration of *Menschen am Sonntag* (DE, 1920), carried out by film restorer and current Curator at the Deutsche Kinemathek, Martin Koerber (2000).

In the case of DIGITAL EDITING, film restoration has deviated from conventional post-production practices for contemporary film production for the reasons just mentioned. However, in the last few years a new duplication workflow has been more frequently adopted by the industry, which is also gradually being adopted by film restorers. The so-called DIGITAL INTERMEDIATE process radically changes the meaning of DIGITAL EDITING as, in this case, the physical cutting of the film negative is no longer necessary. Instead a new complete

edited negative is produced digitally. This process will be discussed in detail later as one of the most significant technological changes in relation to the reshaping of filmmaking and film archival practice. First, two other practices should be discussed, which are profoundly intertwined with the introduction of digital technology in film production.

DIGITAL EDITING – UPDATE

The past decade has been marked by a significant decrease in the use of film stock in the production and distribution chain, which has accelerated dramatically since the digital rollout in 2012.

By the 1990s, editing had become a mainly digital practice while the rest of the film production workflow remained predominantly analog. Since the late 1990s, with the introduction of the DIGITAL INTERMEDIATE process, the physical cutting and assembling of a film negative gradually became redundant as this process allowed for the direct re-recording of a new complete negative from the edited film data. The increased use of digital cameras in the last decade (see the update on digital cinematography below) and the widespread digitization of film distribution and exhibition from 2012 onward have made the use of film stock a rare exception. Consequently, film editing in the analog domain has essentially disappeared from laboratory services.

However, there are still independent, experimental, but also mainstream filmmakers who prefer to shoot (parts or entire films) on analog film. As discussed in the new introduction of this chapter, there is a renewed interest in the aesthetic characteristics of analog film by artists as well as a handful of filmmakers. A case in point is *Dunkirk* (NL/UK/FR/USA, 2017) for which director Christopher Nolan chose to work exclusively with 70mm film, from shooting to editing and printing. Although the film was also digitized for digital distribution, its production chain had been 100 percent analog.[xxviii] The consequence for film archives, as we will see in the second part of this chapter, is that they have to remain flexible in order to acquire, preserve, and restore all kinds of films using the best possible (digital and analog) means. It should also be noted that the use of analog film for film production and film archival workflows has become increasingly expensive as the costs of both raw film stock and laboratory services have risen significantly since the 2012 digital rollout.

With regard to the increasingly blurred line between film and video software and its use by professionals and amateurs alike, it comes as no surprise that film and video editors often use the same editing suites (e.g. Blackmagic DaVinci Resolve, Adobe Premiere Pro, etc.). These kinds of suites are becoming more affordable,

more user-friendly, and fully mobile as they can be used on any kind of computer (data are often stored online so that more people can work on these simultaneously from different locations).

Also, video editing suites are integrating more and more applications (e.g. color correction, audio editing, retouching, stabilization, grain and noise control, etc.) that used to require separate software tools. The good news for professionals and amateurs is that, besides the diverse array of features software packages offer today, the difference among them in terms of performance and price is negligible.

With the advent of born-digital film, film archives have started resorting more frequently to (digital) editing for their collection. Editing is often part of the acquisition phase as new films nowadays are regularly delivered to archives as digital files which need to be reassembled before being ingested in the digital preservation workflow. This is expected to change in the near future as archives are setting up guidelines regarding the format in which films can be submitted for preservation.[xxix]

In addition, film digitization and digital restorations are being carried out more extensively than in the past. Film restorers use editing tools on a more regular basis, for instance to reassemble films after digitization and restoration when different elements have been used as source material. Editing has also become a more commonly used tool, for example in providing access to digitized archives now that more and more alternative ways of presentation are being employed on-site but also online. We will discuss this in the second part of this chapter in the update to Distribution, Access, and Exhibition.

Computer-Generated Imagery and Digital Compositing

Differently from DIGITAL EDITING, the change brought about by digital special effects or COMPUTER-GENERATED IMAGERY (CGI) is an intrinsic part of the post-production process as it modifies the image within the frames. A variety of hand-made tricks (e.g. make-up, mechanical robots, and miniature reconstructions) and photo-optical effects (e.g. multiple superimpositions, back-projections, animation techniques) require evermore computer expertise. CGI is indeed the process by which scenes are, partially or entirely, generated in the digital domain via dedicated 3D computer graphics. Characters can be added to a scene, as for instance in all the scenes where Frodo is talking with the "synthespian" Gollum in *The Lord of the Rings* trilogy (NZ, 2001, 2002, and 2003).[40] Or live actors can be placed in front of virtual backgrounds as in *Sky Captain and the World of Tomorrow* (USA, 2004) or *300* (USA, 2007); or a complete scene can be computer generated and animated as in *Spider-Man* (USA, 2002, 2004, and 2007) where the super-hero, abandoning Tobey Maguire's body, becomes

a digitally-generated character jumping around in a virtual urban landscape. Scenes where everything is digitally generated are, in effect, not different from COMPUTER-GENERATED ANIMATION (CGA), i.e. animation created with 2D or 3D computer graphics. The introduction of CGA has had an even bigger impact on the practice of animation films than CGI on that of live action film. CGA has replaced the photographic image entirely, and the craftsmanship related to traditional CEL ANIMATION (i.e. hand-drawn) or STOP MOTION animation films has been replaced by new forms of digital expertise. Note, anyhow, that also for CGA films (both 2D and 3D) storyboards are still produced using pencils on paper. Also, there are still many recent examples of films that use traditional techniques such as cels (e.g. *Les Triplettes de Belleville*, FR, 2003 and *Spirited Away/ Sen to Chihiro no kamikakushi*, JP, 2001) and STOP MOTION (think of films by Aardman Studios). However, it is a fact that since Pixar's *Toy Story* (USA, 1995), most Western animation films are computer-generated.

For CGI, as we have seen for film audio, the relation with the traditional hand-made analog practice is stronger than one might think. Even if digital enhancement is very often applied, the use of actual make-up or miniature reconstructions and model work are, in most cases, still at the base of the special effect. As Cubitt writes:

> Some fields of visual effects are likewise still very close to their analogue counterparts. Stunts, while often enhanced digitally, are pretty much analogue phenomena. The same is true for pyrotechnics and demolition, including miniature pyrotechnics and model work. Prosthetics and make-up [...] are done using time-honored techniques. New technologies of latex and other modeling materials have changed the craft of make-up, but the fundamentals still apply, and the impact of digital technologies has been minimal. (Cubitt, 2002: 18)

It is even argued by some that today's CGI are not essentially different from traditional optical effects, not only within film tradition but within the whole visual tradition:

> The special effects of contemporary cinema are thus only a more recent manifestation of optical, spectacular technologies that created immersive, overwhelming and apparently immediate sensory experiences, such as "Renaissance" and elevated perspectives, panoramas, landscape paintings, kaleidoscopes, dioramas, and cinema – a cinema, to borrow Eisenstein's phrase, of *attractions*. (Bukatman, 1999: 254 – emphasis in the original)

CGI can be seen as a simulation of what had already been achieved in analog photographic film in the past. CGI and digital special effects in particular have, in other words, simulated and improved already existing film techniques. Or, taking things a little further with Lev Manovich:

> What computer graphics have (almost) achieved is not realism, but rather only photorealism – the ability to fake not our perceptual and bodily experience of reality but only its photographic image. (2001: 200-201)

The idea of using digital means to simulate pre-existing analog techniques, and in particular photographic images, plays a very important role in the discourse about film archiving and restoration. If restoration is also simulation, as I will argue later, the simulation potential typical of new digital media (Manovich, 2001 and Rodowick, 2007) offers a productive concept for a theorization of film archival practice in the transition to the digital. This matter will be addressed more extensively later, and, in particular, in Chapter Two.

It is the practice of digital COMPOSITING, i.e. "the marrying of digital effects and live-action footage into a single frame" (Cubitt, 2002: 24), that best covers the partial introduction of digital tools in the realm of film special effects. COMPOSITING implies the superimposition of extraneous elements, e.g. an actor in the foreground and a landscape in the background, photographed in different locations and at different times. The elements may be computer-generated as well. Whereas an entirely digitally-generated composition falls into the category of COMPUTER-GENERATED ANIMATION (CGA), as mentioned earlier, COMPOSITING in itself is a practice rooted in analog filmmaking, in particular in the use of multiple printing and optical effects, and in the use of BLUESCREEN (also known as CHROMA KEY), a practice that predates digital technology and finds its root in television practice. A well-known example of the use of BLUESCREEN is that of the weatherman standing in front of an empty blue background: at the control desk the background is substituted by the weather map for the final broadcast image. Once more, we encounter a hybrid practice where digitization has made existing tools more efficient.

A different kind of digital COMPOSITING is that of digital effacing. This is a technique that does not really have an equivalent in photochemical filmmaking. With digital effacing, undesired elements are digitally removed from the image. These can be wires used to hold objects (e.g. miniature airplanes or "flying" actors), or objects that accidentally appear in an image where they do not belong (e.g. cables or other tools needed by the filming crew).[41] This technique is also often applied for erasing damage produced on the original camera negative during production or post-production (e.g. a scratch occurred during shooting or printing). Because re-shooting a scene might end up being

more expensive than "restoring" the film digitally, the latter is often chosen. As will be discussed later, some of the digital tools that are used today for film restoration were originally developed for similar tasks.

The main issue in digital COMPOSITING seems to be the reconciliation between what is produced photographically and what is generated digitally. With respect to this, Mike Allen writes that:

> In this sense, digital imaging technologies and techniques are striving to replicate what already exists: the photographic representation of reality. The success or failure of any digital image lies in the degree to which it persuades its spectator that it is not digital, but *is* photographic. The difference between the two, as has been widely analyzed, is that whereas the photographic record automatically assumes a referent, an original object whose image has been captured by light passing through a camera lens and altering the chemical make-up of a strip of celluloid, a digital image need have no such referent. This difference, seemingly impossible to reconcile, lies at the heart of the matter in hand: how to combine photographic and digital imaging to create a coherent and seamless filmic world. (Allen, 2002: 110)

Film's post-production aims at such reconciliation, which is once again a hybrid practice where analog and digital serve the common task of creating a "photographic representation of reality." The task in itself is not a new one when we think, for instance, of the practice of photographic retouching; what is new is the use of digital tools.

At first, when the digital elements to be introduced in a photographic image were minimal, e.g. the robot's point of view in *Westworld* (USA, 1973) or the Bit character in *Tron* (USA, 1982), scenes containing digital special effects were produced separately and were added to the rest of the analog film during editing. This was an awkward and inefficient route, as each scene of a film had to be treated separately. In the beginning this procedure was hardly competitive compared to the traditional optical method, as Douglas Bankston points out:

> During that era, computers and their encompassing "digital" aspects became the basis of experiments within the usually time-consuming realm of optical printing. Over 17 years, Barry Nolan and Frank Van Der Veer (of Van Der Veer Photo) built a hybrid electronic printer that, in 1979, composited six two-element scenes in the campy sci-fi classic *Flash Gordon.* Using both analog video and digital signal, the printer output a color frame in 9 seconds at 3,300 lines of resolution. If optical printing seemed time-

> consuming, the new methods weren't exactly lightning-fast, either, and the look couldn't yet compete with the traditional methods. (2005: 78)

This practice certainly contributed in defining the aesthetic of blockbuster movies, where special-effects sequences seem to interrupt the narrative flow as instances of pure spectacles. In Allen's words:

> In using and manipulating the formal parameters of mainstream film-making in this way, CGI sequences construct themselves as simultaneously ordinary *and* extraordinary, as photo-realistic elements of transparent film-making and as non-real, spectacular images designed to be noticed, to be separated from the flow of the rest of the film's images, and appreciated for their non-photographic visual qualities. The tension between these two states, between these two kinds of film form, has come to typify the experience of watching any film with a significant degree of CGI in it. (Allen, 2002: 117-18 – emphasis in the original)

If this effect is rooted in the post-production practice of CGI where scenes with special effects are edited in or inserted in footage without special effects, recent changes in post-production are leading to a very different practice. Now digitizing the entire footage (and not only the scenes to be provided with special effects) has become a viable practice. This practice is known as the DIGITAL INTERMEDIATE process and will be discussed in detail in the next section.

Obviously, CGI and digital COMPOSITING could play an important role in film restoration, and in particular in the reconstruction of images or parts of images that have been erased by mechanical damage or chemical deterioration. As discussed later, when a part of the image has been damaged, nothing can be done with photochemical tools. As will be shown in the case of *Visage d'Enfant* (FR, 1925), for example, it is only thanks to digital COMPOSITING that it has been possible to rescue a heavily deteriorated shot. This has been achieved by digitally combining elements of the image rescued from a few frames that were not damaged. Although this matter will be further described and discussed in the second part of this chapter, I would like to point out that the adoption of post-production practices by film restorers is nothing new, as the technology, service providers and technical staff involved are in most cases the same. On the other hand, in this transition, film archives, for the first time, have the chance to bend the technology for their needs while it is being developed, whereas, in the past, they typically had to use tools developed solely for film post-production.

COMPUTER-GENERATED IMAGERY AND DIGITAL COMPOSITING – UPDATE

As discussed, COMPUTER-GENERATED IMAGERY (CGI) is particularly relevant for fully animated films. Until a few years ago, one of the industry's leaders in the field Disney Studio was still partially relying on 2D animation with titles such as *The Princess and the Frog* (USA, 2009) and *Winnie the Pooh* (USA, 2011); however, in 2013 they announced they no longer had plans to release more 2D animation movies.[xxx] At the same time, other animation companies continue to successfully produce 2D animation and, more specifically, hand-drawn CEL ANIMATION for both short and long features, including the Japanese Studio Ghibli, whose most recent success *The Red Turtle* (FR/BE/JP, 2016) by Dutch animator Michael Dudok de Wit is a mix of 2D CEL ANIMATION and 3D digital modeling. Likewise, several other independent animation films are still being hand-drawn or make partial use of hand-drawn CEL ANIMATION.

This phenomenon of combining fully digital techniques with traditional analog techniques resembles what has been discussed earlier about filmmakers reverting to analog film stock. More generally, this signifies a "material turn" as a reaction (or, more accurately, as a complementary phenomenon) to the "digital turn."

Transition and hybridization of technologies create a breeding ground for new film archival researches and practices. In the field of CEL ANIMATION, a couple of very promising research projects are worth mentioning, namely the collaborative project run by the Walt Disney Animation Research Library and the Getty Conservation Institute, and the Dutch-funded project *Materials in Motion*, both focusing on CEL ANIMATION techniques and aiming at defining the best practices for preservation and restoration.[xxxi]

In live action films, CGI still represents the main source of special effects, as it did ten years ago. Here, the main new developments are in the improvement of dedicated software and in the increased popularity of digital 3D which has characterized the period since the digital rollout in 2012. In general, there has been an increased use of CGI, replacing the practice of using real objects in front of the camera to support early CGI technology (such as miniature models or animatronics in science fiction films or films like the *Jurassic Park* series). Reviewers have at times been critical about this drastic shift to all-digital effects as they fear it might lead to an overall lowered quality.[xxxii]

A recent film that greatly relies on 3D CGI and is particularly relevant when discussing recent film productions in relation to film archiving is Martin Scorsese's *Hugo* (USA, 2011). As film historian Colin Williamson points out, two aspects are central to this film: "the relevance of early film trickery to historicizing the wonders of DIGITAL CINEMA, and the potential for CGI to make early cinema wonderful for contemporary audiences" (2016: 175).

Indeed, *Hugo* addresses contemporary 3D and CGI technology (as well as digital color GRADING) as part of the same filmic tradition as the kind of visual tricks Georges Méliès used more than a century ago. At the same time, the film adds contemporary digital "tricks" to the original archival footage that is shown in the film by, for instance, making it 3D. According to film historian Ian Christie, this use of 3D CGI for archival footage "creates the kind of impact that Méliès films had for early spectators [and] allows a wider audience to see them afresh benefiting from the novelty of 3D and from what digital techniques have brought to film restoration" (2012: 39).

Although the discussion is beyond the scope of this update, I would like to underline that *Hugo* has been emblematic of the productive relation between the shift to digital in film production and the growing interest in archival films, film restoration, and research into obsolete film technologies.[xxxiii]

In terms of changes that have affected film restoration practice, the most fertile source has been that of digital COMPOSITING. As we will see in the second part of this chapter, film restoration tools have improved considerably in the past decade. They have become more precise and offer a richer tool kit, incorporating some of the possibilities which have also been used by digital COMPOSITING artists working on new films. In the second part of the book, when the newly added film restoration case study *We Can't Go Home Again* will be discussed, an example of digital COMPOSITING applied to film restoration will be illustrated in detail.

Digital Intermediate Process and Digital Color Grading

The recent introduction of the DIGITAL INTERMEDIATE (DI) has turned film production into a truly hybrid analog-digital process. In the DI process the whole film is digitized, including the scenes where no digital effects need to be added, so that the workflow, including editing, special effects, COMPOSITING and color GRADING takes place entirely in the digital environment. Only when the DI is completed with the definitive editing, the added special effects, the required COMPOSITING scenes, and the desired color GRADING, is the film printed back onto one or more un-spliced film negatives. Without any splice (physical joints between cuts) the negative is sturdier and is at less risk of damage when handled or used to produce further duplications in a printer.

The DI process allows a significantly better integration of CGI and digital COMPOSITING effects. The new negative is sturdier as an object and it allows for the creation of a smoother narrative line because special effects are evenly spread along the film and are less conspicuous than before, when CGI-loaded scenes and narrative flow were literally alternating with one another. As dis-

cussed below, since the introduction of the DI process the use of digital effects is in general much better integrated in the film. This is also true for digitally-corrected colors.

The film-to-digital-to-film workflow via the DI process is becoming common practice today, even for films without special effects or COMPOSITING scenes.[42] The main reason for its success is that it satisfies the needs of all the players in the film production chain, from the creators of special effects to the post-production technicians, from the people responsible for the film's color character to the directors of photography. As Douglas Bankston points out in a special issue of the *American Cinematographer* dedicated to digital film GRADING:

> The DI process was born out of a rather recent marriage between visual effects and motion-picture film scanner- and telecine-based color grading. (Bankston, 2005: 77-78)

Color GRADING is the practice that has been affected the most by the introduction of the DI process. Traditional analog GRADING requires that before a film negative is duplicated into a projection print (or any other intermediate film element), certain color values are defined for each scene in the film. This process is carried out by a grader, usually in the presence of the filmmaker or the cinematographer, on a viewing table equipped with a video camera (a so-called Color Analyzer) that shows a video image of the film negative to be graded. The grader defines a value for each color component (red, green and blue) according to the filmmaker's wishes with respect to the overall light and color temperature. These values are then applied to the colored lamps used in the film printer. While duplicating the film, the printer will adjust the color balance for every single scene according to the values established during GRADING. Other elements, besides the intensity of the color lamps, influence the final color character of the graded film print, namely, the type of film stock and the way the film is chemically processed. Quite interesting techniques have been applied in order to modify the color appearance of films and not only by experimental filmmakers. An example is the relatively recent *Three Kings* (USA, 1999), for which Director of Photography, Newton Thomas Sigel, used a film stock originally developed for still slides and had it processed with a so-called "bleach bypass" where the film skips one bleach bath, in order to leave a layer of silver in the emulsion and obtain a higher contrast and de-saturated colors.[43]

It should be noted that in a photochemical process it is practically impossible to match perfectly the appearance on a Color Analyzer with that on the final film. As Paul Read points out: "the grader has no accurate method of demonstrating to the client what a print will look like before it is made" (2006:

114). On the contrary, with a digital workflow, matching of the appearance during GRADING to that of the final product is theoretically possible.

Undisputedly, the DI process allows a greater control of the GRADING of the colors. Differently than in traditional analog GRADING, digital GRADING allows the altering of each color component (red, green and blue, as well as their complementary colors, yellow, cyan and magenta) independently from each other. In addition, only in the digital domain is it possible to selectively change the color of a single element in a frame. In most cases, digital GRADING allows the printing of all subsequent elements (e.g. intermediate positives, duplicate negatives and projection prints) with one light, that is to say, without any additional GRADING adjustments as is the case with photochemical GRADING processes where the original negative does not reflect the final color and lighting character that is meant for the projection prints. This is obviously a great advantage for future archivists, who will be able to determine a film's look from a negative even when no reference print is available. For these reasons, as will be discussed in the second part of this chapter, digital GRADING offers a solution for the restoration of color faded films that could not have been attained with photochemical tools.

Two early examples of the use of the DI process and its greater power in obtaining color effects are *Pleasantville* (USA, 1998), the first Hollywood film to make use of it, and *O Brother Where art Thou?* (USA, 2000). In both cases the complete negative was digitized and the desired color character of the film was achieved in the digital domain. The choice for this process was dictated by the desire to obtain a particular color character that was difficult to realize through traditional photochemical processes. While in *O Brother...* digital color GRADING is merely functional for obtaining an overall color effect that would not be possible in the analog domain, in the case of *Pleasantville* a gradual switch from black-and-white to color makes color GRADING an essential aspect of the film aesthetics and narrative. In a way, the use of color in *Pleasantville* becomes a (digital) effect in itself. As Scott Higgins points out:

> Where *Pleasantville* brashly displays digital manipulation *O Brother* consciously strives to assimilate the technology into reigning norms. (Higgins, 2003: 68)

The choice of Martin Scorsese, "an older advocate of pure celluloid" in his own words, to use the DI process for *The Aviator* (USA, 2005) was done with a different objective.[44] Scorsese wanted to achieve a particular color for his Howard Hughes' biopic to emulate the look of two- and three-strips Technicolor for the 1920s and the 1930s, respectively.

In an interview to the professional magazine *The American Cinematographer*, Director of Photography Robert Richardson reveals:

> Prior to my involvement, Marty designed a color timeline that influenced every creative department. He wanted the progression from a two-color palette to a three-strip palette to approximate the technological advances of the film industry at that time, but more importantly, he felt it would mirror the characters' emotional evolution. The first act, which covers Hughes's early career in Hollywood, was supposed to have Technicolor's two-color look. With the second act, which begins after Hughes sets a speed record flying across the continental United States [in 1937] and goes with Katharine Hepburn to Connecticut, we transition to that vibrant, three-strip look that most of us associate with the glorious Technicolor years. Then, when Hughes almost dies crashing the XF-11, we were going to cut into a more contemporary look without either Technicolor process applied. (Pavlus, 2005: 3)

The film's Head of Special Effects, Rob Legato, and Director of Photography, Robert Richardson, were helped by Joshua Pines and Stephen Nakamura, Vice President of imaging research and development and Senior Colorist at Technicolor Digital Intermediates, to create the necessary software to obtain this effect. The final result won *The Aviator*, among others, the Oscar for Best Cinematography.

Scott Higgins, interestingly, compares the introduction of digital color GRADING with that of the three-strip (i.e. three colors) Technicolor system itself:

> This inauguration of new color technology strongly recalls Technicolor's introduction of three-color in the 1930s. In that case, a single corporation courted the film industry by offering a strongly defined aesthetic for binding color to classical norms. Early Technicolor features, particularly *Becky Sharp* (Mamoulian, Sherman, 1935), *Trail of the Lonesome Pine* (Hathaway, 1936), and *A Star is Born* (1937), served as aesthetic prototypes, promoting the new technology and testing options for integrating color as an attraction and as a narrative tool. Color consciousness was the way of thinking about color with an eye toward creating a stable place for the technology in the industry. The formal changes wrought by digital color, in particular the process of functionalizing this new technology, can be put in perspective by recalling the strategies worked out in Hollywood's first contact with full color-reproduction. Technicolor's historical precedent casts some light on the current approaches to digital color. (Higgins 2003: 61)

As will be discussed in the second part of this chapter, the DI process and the work of digital colorists are becoming of crucial importance in the practice of film restoration. Especially the high flexibility offered by digital GRADING and its predisposition to simulate other color techniques make this process extremely effective and suitable for film restorers. Once again, the simulation potential of the digital makes it particularly apt for the tasks of film restorers. On the other hand, for some these advantages come at a high price, namely that of interfering with the indexical nature of analog photographic film (i.e. its physical bond with the reality it represents). This conflict will be central to the theoretical discussion in Chapter Two.

Also, a new set of problems would come into play with the introduction of such a process for restoration, e.g. the calibration of all the different components, photochemical as well as digital, throughout the complete film production workflow. In fact, proper calibration is necessary to guarantee the integrity of colors from the beginning to the end. As Douglas Bankston puts it:

> Maintaining image integrity in a hybrid workflow — in other words, preserving the intended look — is the digital nirvana that cinematographers seek. [...] Film and its photochemical processes have their own tendencies. Over time and through technical development, the closed-loop system of film became manageable and consistent, with repeatable results. However, the introduction of digital bits has thrown the traditional methods of image control into flux: no two facilities are alike, no two processes are alike, and no two workflows are alike [...]. (Bankston, 2005: 77)

The DI process and digital color GRADING have been timidly adopted by film restorers in the last few years for a few restoration projects where the financial means have allowed it. Examples of film restorations making use of the DI process, such as *The Matinee Idol* (USA, 1928) and *Beyond the Rocks* (USA, 1922), are analyzed in Chapter Four as case studies. The DI workflow for film restoration is further discussed in the second part of this chapter.

DIGITAL INTERMEDIATE PROCESS AND DIGITAL COLOR GRADING – UPDATE

With the digitization of the entire (post-)production chain, shooting and distribution included, the hybrid film-to-digital-to-film workflow, which was typical of the DIGITAL INTERMEDIATE (DI) process and widely adopted around 2005, has become less common. However, there are still a significant number of films, either entirely

or partially shot on film, which are digitized for post-production. In these cases, we can still talk of a hybrid workflow. Regardless, most of these films will only be digitally distributed and projected. Note that today, the term DI is still occasionally used for digital post-production (editing, CGI, color GRADING, etc.) even if there is no analog film involved.

Furthermore, in film archival practice, the DI process has become commonplace. Film restorers ever more frequently prefer digital tools for film restorations, and, as we will see in the second part of this chapter, many digitally restored films are no longer recorded back to film. Film restorers generally use the same equipment (hardware and software) as used by post-production and restoration laboratories. Color GRADING suites such as Nucoda, Lustre, Baselight, and DaVinci Resolve are perhaps the most commonly used platforms for both new productions and restorations although other ones are available. The basic functions of software-based color GRADING suites have not changed over the last decade. While new tools have been added to facilitate work regarding 3D films and HIGH DYNAMIC RANGE imaging, these new options are not usually applied in restoration projects.[xxxiv]

Ostensibly, the most important reason for many filmmakers to opt for a digital workflow has been digital color GRADING with its greatly enhanced flexibility in correcting and manipulating the look of the image during post-production. Despite having been around since the late 1990s, digital color GRADING has not changed much in the last decade. A fundamental step in film production for two decades, it has now also become central to the (digital) restoration practice.

One notable change with regard to color GRADING for both the industry (film and video) and the film archival community has been the introduction of a new standard: the Academy Color Encoding System (ACES).[xxxv] The ACES is the result of the collaborative work of professionals and manufacturers, who have worked under the auspices of the Academy of Motion Picture Arts and Sciences since 2004 to find a solution for the lack of standardization brought about by the digitization of color workflows, from input (e.g. image capturing by digital cameras and film scanning) to output (e.g. online, DVDs, digital projection). Previous color encoding systems and workflows were based on the analog film color space, which is much more limited than its digital counterpart and more uniformly adopted by the industry at large. Indeed, with analog color GRADING colors could not be independently controlled nor different areas of the image graded separately. Thus, due to these limitations, in the analog domain there was less room for an (erroneous) interpretation of how colors should be reproduced.

The first version of ACES was released in 2012 and was widely adopted by the industry. A highly complex color encoding system, ACES encompasses multiple color spaces allowing professionals to precisely define the color characteristics of their work from capture to reproduction in a standardized fashion.[xxxvi] Another important feature of ACES is its flexibility as it is based on a free open-source

system and is compatible with any device or software. Equally important, ACES was specifically developed to meet long-term archiving and restoration needs.[xxxvii]

ACES includes standards for HIGH DYNAMIC RANGE (HDR) imaging, a technique that is quickly on the rise in television and film production. With HDR, it is possible to reproduce a range of luminance (the luminous intensity emitted by a light source) that is similar to the one registered by the human eye and wider than that of traditional photographic reproduction. In simple terms, without HDR many details that are visible to the human eye in the lightest and darkest areas of the image are typically lost during image capturing and, therefore, cannot be retrieved in GRADING and reproduction. Even though HDR GRADING is not relevant for the restoration of films that were not originally made with HDR imaging, film archivists need to be familiar with HDR's features to be able to properly archive new HDR films and restore them in the future. It should be mentioned that HDR remastering has also been carried out on some high-profile Hollywood titles for Blu-Ray releases.[xxxviii]

Digital Cinematography

The term digital cinematography usually refers to the practice of using a digital camera, rather than an analog film camera, for shooting films. In this transitional moment (anno 2009), cinematography is very much a hybrid matter, as films are shot with both film and digital cameras, and, often, even combining the two. However, here I will focus on the influence of the digital in cinematography.

It should be pointed out that the current terminology can be confusing and, sometimes, is used in a contradictory way. For example, DIGITAL VIDEO (DV) is often used as a comprehensive term similar to digital cinematography as defined above, but it is also used to indicate home movies, typically shot with consumers' cameras. Similarly, the term HIGH DEFINITION (HD) has somewhat flexible meanings in this time of technological transition. The term finds its origin in television but is also often used, in opposition to DV, to indicate films shot with a professional digital camera, as pointed out by Stephen Keane:

> [...] in terms of Hollywood fighting back against the use of digital video by independent filmmakers, high-definition is the generic name for professional-standard cameras that take advantage of the versatility of digital film but enable a resolution and depth of field similar to 35mm. (2007: 46)

Such cameras, which can have a RESOLUTION of 1,920 horizontal pixels by 1,080 vertical pixels, are used both for digital television as for films that are released theatrically. Whereas in digital television the RESOLUTION of cameras and displays is given by the amount of pixels expressed in number of horizontal lines (e.g. 1080 lines) or in total amount of pixels (e.g. 2 million/M pixels), in DIGITAL CINEMA the amount of pixels is expressed in pixel per line (2 or 4 thousand/K pixels). As of 2008, digital cameras can have a RESOLUTION up to 4K. RESOLUTION is one of the central issues in the transition from grain to pixel and it will be discussed at length in the second part of this chapter. Note that every photographic image can have a different number of grains in its emulsion. As a consequence, in contrast to digital imaging, where pixels can be counted, RESOLUTION in photochemical film does not translate into defined numbers. This brings us back to the discussion on analog/continuous and digital/discrete. Whereas the elements composing a digital image, the pixels, are identical and their number is pre-defined, the elements in a photochemical image, the grains, vary in size and number. Still, a digital representational system with a sufficient number of pixels could reproduce in appearance even the grain of a photochemical image. From this perspective, the discussion on analog and digital appears once again too complex to be approached as an opposition between two technologies, the analog/grain vs. the digital/pixel.

The fact that more and more films are made through the DIGITAL INTERMEDIATE (DI) process, as discussed above, suggests to some that the days of (acetate and polyester) film are numbered. Even though this may turn out to be true, at the moment filmmakers choosing digital cinematography are still a minority. Similarly, cinemas equipped for digital projection are still an exception. As Bakston notes:

> Despite decades of Paul Revere-like cries of "Film is dead!", celluloid is still the dominant recording and presentation medium. Digital, for reasons mentioned earlier, is fast becoming the dominant intermediate medium. Thus, the typical analog-digital-analog hybrid workflow comprises shooting on film, manipulating the images in the digital realm, and then recording back to film for display and archiving purposes. (Bankston, 2005: 80)

When in the late 1980s, director Peter del Monte and Director of Photography, Giuseppe Rotunno, shot *Giulia e Giulia* (IT, 1987) with a HD camera and transferred it to 35mm film for theatrical exhibition, expectations were high that digital cinematography would soon replace traditional (photographic) cinematography. Twenty years later such a practice is still limited to restricted circuits, some of which will be touched upon further.

Let us first look at some of the reasons why shooting is still mainly done on film. Film is undoubtedly difficult to handle as film strips are heavy and long, must be protected from light at all times until after development, and require the use of a large variety of toxic chemicals and large dedicated equipment. However, many different reasons can be found in the professional journals why analog photographic film is still the preferred medium for shooting. These are of a technological, economical and aesthetic nature and are very much entangled with each other. First of all, digital cameras cannot yet deliver the same image quality offered by analog photographic film, with respect to RESOLUTION and COLOR DEPTH. These two features indicate the capacity of a medium to describe an image both in terms of details and colors. For example, the higher the RESOLUTION the better a photograph can reproduce different particles of sand on a beach; the greater the COLOR DEPTH the better it can reproduce different hues of blue in the sky above. These limitations of digital cameras, which are mainly related to storage and processing speed issues, might be overcome in the future. However, these are factors that, today, still make film a more suitable medium for those filmmakers who look for fine image details. RESOLUTION and COLOR DEPTH will be discussed further and more extensively in relation to film preservation and, in particular, to digitization of film-born images, as these two aspects are considered by the field as the most critical parameters when transforming an image from grain to pixel.

Secondly, since digital camera technology is in rapid development, the risk of investing in something that will soon be obsolete is considerable. This is obviously a reason for concern in this transitional moment, especially because with the digital technology, obsolescence occurs within years rather than decades. In this regard, film and music video-maker, Michel Gondry, warns:

> Something that looks really on the edge now, in five years is going to look very dated because the technology is evolving. (Stuart, 2007)

Indeed, many filmmakers and directors of photography still prefer to work with film. For instance, director of photography Ellen Kuras, who has worked both on film and on digital with directors Spike Lee and Michel Gondry, says that:

> Personally, I still prefer to shoot with film negative. I can see with digital now, it's being made to respond to certain concerns of cinematographers, in particular about the latitude and the ratio of light and what it's able to handle, and how we're able to use it as a tool. (Stuart, 2007)

There are filmmakers who, unlike Kuras, choose digital cinematography. These filmmakers operate in different contexts, from Scandinavia to Hollywood, and have very different backgrounds and budgets. For instance, filmmakers affiliated to the Dogme 95 movement chose digital above film shooting in the late 1990s:

> [...] the Denmark-based Dogme 95 saw itself as strictly avant-garde, redirecting the technological democratization of cinema through the strength of the group. [...] The advantages of DV, the format of choice for the Dogme film-makers who quickly ignored their own 35mm rule [which instructs to use 35mm film], relate to production and effect. Where mainstream cinema is said to take full advantage of digital's ability to fake and manipulate the perceived reality of the photographic image, DV brings immediacy and authenticity back into the process. Location shooting releases Dogme films from the restrictions of the custom-built studio and the handheld nature of the cameras means that they can be anywhere, at any distance and often in multiple locations. (Keane, 2007: 43-44)

The choice of digital cinematography allows in this case a greater impression of immediacy and authenticity, both expressions of proximity to the filmed action and refusal of manipulation, and more flexibility for hand-held shots, all main aspects of Dogme 95. If the digital offers Dogme 95 filmmakers the tool for achieving a realistic look, mainstream films usually employ digital tools for manipulating photographed reality.

The motivations that made George Lucas choose digital over film cinematography for his second *Star Wars* trilogy are indeed quite the opposite. In an interview for the *American Cinematographer*, Lucas argues that:

> Before [digital], once you photographed something, you were pretty much stuck with it. Now, it's more like painting. You can have complete control over it just like an artist does, and that to me is the way it should be. It's so much more liberating in terms of changing things in the frame. It's not just moving frames around; you can actually change each frame to give it more unity, more clarity, and more symmetry. (Magid, 1997a: 49)

Lucas' ambition of making his trilogy completely filmless was in the end impossible to realize, and a mix of analog film and digital images were captured. The post-production, however, was completely digital and passed through the DI process. In addition, Lucas systematically applied digital COMPOSITING, CGI and CGA. For the exhibition, though, he had to surrender to ana-

log cinema projection, since only a few hundred cinemas around the globe could show a digital projection of his *Star Wars* films.

Another example of digital cinematography, similar to Dogme 95, is Richard Linklater's *Tape* (USA, 2001), which was shot with consumer DV cameras to take advantage of their great mobility, as the director points out:

> I was thinking in terms of DV cameras, these small, little consumer model DV cameras we shot it on – and how to use those to the best of their ability. And put those in all of those places you couldn't normally put a regular 35 mm camera. It was attacking the digital medium pretty viscerally.[45]

Tape is an American independent film, a category that is traditionally open to experimentation with style and technology. Even Martin Scorsese, one of the founding fathers of American independent cinema, admits:

> [...] if I was starting to make movies now, as a young person, if I could get my hands on a DV camera, I probably would have started that way. We even thought of making *Taxi Driver* in black-and-white video because [initially] we weren't able to get the money to do it as a [filmed] feature.[46]

Although Scorsese's argument focuses on the economical factor, namely DV is cheaper than film, it should be noted that aesthetic motivations are very much intertwined with practical ones. From this perspective, the choice of digital made today by Dogme 95 filmmakers and Linklater are not very different from the choice made by Nouvelle Vague filmmakers or by exponents of the so-called New American Cinema like Scorsese in the 1970s. In both cases, cheaper and more flexible equipment was adopted for making films outside mainstream practice.

If the choice of digital by Dogme 95 is related to realism, in the case of Danny Boyle's *28 Days Later* (UK, 2002), an early example of the contemporary use of both digital and film cinematography with a conscious aesthetic intention, digital film represents "a world divorced from our own," a world taken over by zombies, while film, both 35mm and Super8, is used for "moments of comfort," when the narrative is back to a familiar situation (Keane, 2007: 51-53).

More recently, Michael Mann chose digital cinematography for *Collateral* (USA, 2004), a film where the use of digital effects (CGI) is not evident and which is the first Hollywood mainstream production shot almost entirely in HD. Only interior scenes were shot on film, whereas most of the film consists of night-exterior scenes.[47]

Finally, a brief look at avant-garde, where digital technology has been

adopted by quite a number of filmmakers. As filmmaker and essayist, Yann Beauvais, points out, avant-garde filmmaking is realized today by a combination of film, video and digital means:

> Writing about experimental film today implies recognizing that this cinematographic practice is often estranged from its original medium: the silver based film. Film production is not any longer limited to that medium, but it is realized by means of a combination of media, from video to film passing through the digital in many different forms. (Beauvais, 2005 – my translation)

Although experimentation and hybridization are traditional characteristics of avant-garde, in the past decade the debate on film versus digital has at times reached extremes among avant-garde filmmakers. On the other hand, it should not come as a surprise that those who have often literally molded celluloid to achieve their objectives again re-interpret technological change. Filmmakers who have used film strips as canvases to paint on, like Jürgen Reble and Peter Kubelka, obviously cannot passively observe this technological transition without reflecting on the nature of their own work. Interestingly, some opinions within the avant-garde are similar to those of film archivists, or are even overlapping (as in the case of avant-garde filmmaker and former Curator of the Austrian Film Museum, Peter Kubelka). In both cases there have been examples of fierce debates opposing celluloid purists to digital enthusiasts. As if those who have handled the film-artifacts most closely, by creating them, in the case of experimental filmmakers, or by preserving them, in the case of film archivists, share the same kind of attachment to the artifacts and, consequently, to the technology that produced them. Such an attachment clearly also has an emotional component.

It should be noted that all the films mentioned so far with respect to digital cinematography have been released, distributed and shown mainly on 35mm film prints. Indeed, the majority of cinemas still project film. This brings us to the following topic, digital projection.

DIGITAL CINEMATOGRAPHY – UPDATE

Shortly before the 2012 digital rollout and Kodak's bankruptcy, another equally important change occurred in the film production industry. In October 2011, the three major manufacturers of film cameras (ARRI, Panasonic, and Aaton) announced that, from that moment on, they would exclusively focus on digital cameras.[xxxix]

When an industry shifts to a new technology and diverts funding in a new direction, it generally stops researching and developing the old one and, consequently, this marks the end of its history as a living technology. Nevertheless, we should not forget that film cameras are regularly used even today. The nature of film cameras is such that, as long as film stock is available, they can still be used to make new films. Their mechanical and photographic parts are less complex and easier to repair than their digital counterparts, and the lenses they use are the same. It is worth noting that, in 2016, after its restart, Kodak introduced its new Super8 film camera in the context of what its marketing department labeled as an "analog renaissance." The move was in response to the earlier mentioned appeals from the film industry and directors such as Christopher Nolan and Quentin Tarantino to keep analog film technology alive.[xl]

It is undisputable that digital cameras have evolved a great deal in the last decade and that increasingly more filmmakers have chosen to shoot their films, partly or entirely, by digital means. While in 2009 professional digital cameras had a 2K RESOLUTION, today's camera can capture up to a RESOLUTION of 8K (i.e. approximately 8,000 x 4,000 pixels, almost three times the number of pixels of a 4K image), as in the case of the RED camera, a newcomer in camera manufacturing which has been embraced by many filmmakers including Peter Jackson, Steven Soderbergh, and David Fincher since its introduction on the market in 2007. In terms of RESOLUTION and overall look, however, some directors still prefer the large formats of traditional analog and thus prefer shooting with 70mm cameras, like Christopher Nolan for *Dunkirk* (NL/UK/FR/USA, 2017) or Ultra Panavision 70, like Quentin Tarantino for *The Hateful Eight* (USA, 2015).

As mentioned earlier, the discussion among filmmakers still seems polarized and motivated by aesthetic (e.g. the specific film look resulting from its organic grain structure versus the potential for HDR imaging and other lighting or color effects) or practical reasons (e.g. the higher cost and the required discipline that come with shooting on film knowing that post-production corrections are limited versus the greater flexibility offered by digital means).[xli]

All professional digital cameras (ARRI, Sony, RED, etc.) can capture in HDR, a technique that is becoming ever more popular in recent television and film productions. Moreover, digital cameras can capture at HIGH FRAME RATE (HFR), an operating mode used, for example, by Peter Jackson for his *Hobbit* trilogy (USA/NZ, 2012-2014) but has not spread much further in the industry thus far.

The consequences of digital cinematography for archival practices and, in particular, for long-term digital preservation are manifold and quite extensive. They will be addressed in the second part of this chapter. It is worth mentioning here that, with the emergence of new born-digital films and the use of new digital cameras, film archives are flooded with data which pose new technical problems, including "dead and defective pixels," which are DIGITAL ARTIFACTS in the digitally

captured image that film restorers did not encounter with analog film nor with the DI workflow when shooting was still done on film.[xlii]

Another challenge introduced by digital cinematography is the preservation of digital cameras and its related apparatus, which is an integral part of the history of film technology and essential in understanding how films are made. As mentioned earlier, while analog film cameras are relatively easier to preserve and repair and film archives have a long tradition doing that, digital cameras and apparatus, in general, are much more complicated and require highly specialized expertise that is not usually on hand in the film archival field.

Digital Cinema

DIGITAL CINEMA, also known as D-Cinema, is the general term used in professional literature to indicate the practices of distribution and exhibition of films via digital means. Although digital projectors today can approach film projection quality, there are still large differences in the representation of color as the COLOR DEPTH per pixel is still inferior to that of film projection. Comparing film and digital projection is relevant from the archival perspective, as there the aim is to recreate the look of film-born films when digitized and digitally projected. On the other hand, for films made today and shown in digital projection, the comparison with film projection is not relevant.

The term DIGITAL CINEMA is quite recent but the technology that supports it has already been around for a couple of decades. Apart from early technologies for projecting television images on a large screen, such as the Scophony (developed in 1938) and the Eidophor (1943), followed by Cathode Ray Tube (CRT) projectors in the 1970s, the first projectors that could be fed directly from a computer were produced in the early 1990s.[48] Liquid Crystal Display (LCD) projectors were suitable only for low RESOLUTION and small size projections, while the more recent Digital Light Processing (DLP) technology developed in the early 2000s can provide a projected image comparable to that of a film projection.[49] At the core of DLP projectors are microscopic mirrors, the so-called Digital Micromirror Device chip, patented by Texas Instruments:

> This chip is covered with a number of moving mirrors that correspond to the number of pixels being projected. [...] The DLP projector has revolutionised the projector industry as the system offers vast light output (using standard cinema light sources like xenon lamps for the bigger models), high contrast ratios (1800:1 and better) and high resolution (currently up to 2K for D-Cinema purposes). The high-end version of DLP

technology is the major technology endorsed by Hollywood studios for D-Cinema presentations. (Sætervadet, 2005: 253-254)

More recently, an elaboration on LCD technology has led to the development of the Sony Silicon Xtal Reflective Display (SXRD) projector, which, with its **4K RESOLUTION**, is considered one of the most powerful projectors on the market today.

As with digital cinematography, where the use of traditional film cameras is still predominant, the distribution and projection of films are also still mainly an analog business. This can be surprising, since a film produced via the **DI** process could easily be distributed and projected digitally and one may wonder why the data should still be printed back onto a 35mm film print for projection. Printing thousands of film reels (as in the case of a blockbuster) and shipping them around the world is expensive. Sending a hard disk or a digital tape, or just the data, directly to cinemas and starting each new screening by simply pushing a button is definitely a cheaper alternative.

So, why are most screenings still carried out via traditional film projections? In 2007, of a total of more than 90,000 screens worldwide, only approximately 5,800 were equipped with a digital projector. The number of digital projectors installed was indeed more than three times as many than one year earlier, but still a clear minority (less than 7% of the total).[50] On top of that, many of these screens still have a traditional film projector installed alongside the digital one. The reason is that the number of films that are distributed digitally is not enough to keep the programming on one screen throughout the year. It should also be noted that more than a third of the digital projectors were at a lower **RESOLUTION** than **2K**, namely 1.3K, which by many parties is not considered comparable to film (see the discussion on **RESOLUTION** in the second part of this chapter with relation to digital restoration).

This situation could change in the near future. Exhibitors could rapidly shift to digital projection if and when distribution should become mainly digital. Indeed, distribution and exhibition practices are tightly linked and this leads to a power struggle.[51] Whatever will happen a few years from now, it is relevant for this work to point out that from within this transitional phase the digital turn prophesized by Lucas, among others, in 1997 with his first "digital" *Star Wars*, is still very much ongoing ten years later. A sign, once again, that hybridization is the most evident characteristic of this particular transition where the coexistence of analog and digital in the film production chain is more common than any real form of technological convergence.

In practice, digital projection today is possible at a very high quality, at least comparable to that of most film projections. However, it is still very expensive in terms of fixed and variable costs: a digital projector can cost up to

four times that of a film projector, it does not last as long, and it needs more expensive maintenance. Also,

> compression is needed to reduce the data transfer rate [...] to a size that can be projected at real time. [...] In this respect analogue film projection presents information to the screen at significantly higher data rate equivalents than current, or proposed, digital projection. (Read, 2006: 109-110)

Furthermore, digital projection, as all novel technologies, is unstable and standards have not yet been chosen. As a consequence, the market, in particular cinema owners, is not ready to invest massively in it yet. In Keane's words:

> Striving to balance initial costs with long-term savings, the transition from analogue to digital exhibition is caught between various proposed projection and delivery systems on the one hand and reluctance to implement a single, totalizing system on the other. (Keane, 2007: 140)

It is indeed a matter of economic structure, as pointed out by Leo Enticknap (2005: 226-227), as the distribution and exhibition network is not ready to invest in a rapidly changing technology to substitute something that has been there for over a century. This is again a similar situation, in terms of economics, to that of the early 1930s with the transition to sound.[52]

Although the situation is similar everywhere, there are important differences between Europe and the US in the approach to DIGITAL CINEMA. While the American film industry relies mainly on the Hollywood studio system, the European film industry is heavily subsidized by public funds. As a consequence, in Europe it is the influence of policy makers that is leading how films are produced and distributed.

The European Commission long ago recognized that digital media and, in particular, digital distribution and projection, offered a new chance for European films to reach a larger audience. As Anna Herold points out:

> The growing interest in digital cinema can only be understood in the context of the EU audiovisual industry's general situation. It is well known that European cinema in particular, and the whole audiovisual sector in general, suffers from structural weaknesses and is dominated by non-European work, mainly from the USA. The numbers speak for themselves: according to the European Audiovisual Observatory, the USA films' share of the EU market in 2002 (calculated on the basis of the cinema admissions) reached 71.2 percent. In view of both the cultural and economic importance of the sector, it is no wonder that the issue has

> attracted a great deal of attention at the EU level, resulting in the birth of a so-called audiovisual policy. Since the early 1980s, within the framework of this policy, the EU has seen the audiovisual sector as a means for creating a new space of identity that should coincide with the political and economic space of the Union. [...] Digital technology is a focal point in the conception of the EU audiovisual policy around which many hopes are evolving. [...] In this context it [the European Commission] has also taken a number of initiatives, launching pilot projects in the field of e-cinema and supporting the European Digital Cinema Forum.[53] (Herold, 2003: 100-101)

The motivations of the European Commission for stimulating the growth of a European DIGITAL CINEMA is in line with its ambition to make the audiovisual sector a "space of identity" for European countries as opposed to that offered by mainstream cinemas, which are dominated by American imports. From this perspective, a DIGITAL CINEMA "made in Europe" should be competitive both culturally and economically. In order to realize such goals, the EU has funded many projects in the last decade aimed at stimulating the development of digital audiovisual media, a number of which are related to the digitization and digital restoration of archival films and will be discussed in detail in Chapter Three. Some specific projects have also been co-financed by the EU to encourage the conversion to digital projection in European cinemas, as in the case of CinemaNet Europe, which is an exemplary initiative for the European approach to DIGITAL CINEMA. The project CinemaNet Europe is a distribution network co-financed by the EU Media Programme in the framework of the Pilot Projects.[54] Active in the Netherlands, Austria, Germany, UK, Slovakia, France and Spain since November 2004, CinemaNet Europe was at first meant for distributing and showing European documentary films via digital means. Art houses taking part in the CinemaNet Europe network are provided with a digital projector. At first the distribution of digital content was intended to be via satellite but it ended up being via hard disks.[55] In Great Britain, a similar initiative has been launched at national level by the UK Film Council – the Digital Screen Network, with the aim of broadening the range of films available to audiences throughout the UK and, in particular, of non-mainstream films.[56]

The policy of the Hollywood studios, on the other hand, is much more cautious. If DIGITAL CINEMA represents a way of saving a lot of money (through cheaper production and distribution), it also presents some challenges: first of all, the "bigger than life" experience audiences are used to with traditional film projection should be preserved; secondly, the distribution and exhibition systems need to remain compatible; third, distribution should be as piracy-

proof as possible. All these aspects have been tackled by the DIGITAL CINEMA INITIATIVES (DCI), an organ formed by Disney, Twentieth Century Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. In 2005, DCI produced a joint document where specifications for the DIGITAL CINEMA are defined.[57] The first objective, as mentioned in the document, is quite interestingly to improve the quality of the film experience:

> The Digital Cinema system shall have the capability to present a theatrical experience that is better than what one could achieve now with a traditional 35mm Answer Print.[58]

The DCI document, updated and revised in April 2007, represents for many the turning point for Hollywood studios in the direction of digital conversion for film distribution and projection.

The DCI specifications apply to mastering, distributing and projecting of DIGITAL CINEMA content. In particular, a so-called DIGITAL CINEMA DISTRIBUTION MASTER (DCDM) defines the requirements for uncompressed and unencrypted digital images, audio and subtitles. The compression standard for distribution is JPEG 2000, while the requirements for packaging of image, audio and subtitle prescribe the use of MXF (MATERIAL EXCHANGE FORMAT) specifications. Finally, a so-called DIGITAL CINEMA PACKAGE (DCP) is the encrypted result that will be sent to cinemas.[59] Distribution can be carried out by physical media, virtual private networks or satellite communications. The DCI document also describes the requirements for all equipment necessary for playback in a cinema, e.g. digital projectors, data storage systems, sound systems. Requirements for mastering and projection are further described with respect to consistency of image quality. And, of course, a strict security procedure is set to protect content and rights throughout the distribution chain:

> Protection of intellectual property is a critical aspect of the design of the system. This security system should be designed using a single common encryption format along with keys to decrypt the content. The method should provide a means to keep the content encrypted from the time it is encoded in post-production until it is projected on a theater screen. Only trusted entities, deployed in secure environments or implementing physical protection, will be given access to the decrypted content. Content will be decrypted contingent upon usage rules agreed on by content owners, Distributors and Exhibitors. The system should also be renewable in case of a breach of security in any part of the system, and include forensic Marking of the content for providing traceable forensic evidence in the case of a theft of the content.[60]

Clearly, the target of the DCI specifications is contemporary mainstream productions. They do not take into account the digital distribution and exhibition of film content such as digitized archival films, whose standards are very different from those adopted in contemporary productions. For instance, the only projection speed taken into consideration by the DCI document is that of 24 frames per second (the standard speed for sound films) while the projection speed of silent films can be anything from 16 to 24 (and sometimes even more) frames per second.[61] Also, the ASPECT RATIOS considered by the DCI document are those of modern wide screen formats (i.e. 2.39:1 and 1.85:1), while most archival films have other ratios, such as the very common Academy ratio (1.37:1). If the DCI requirements were adopted as standards, manufacturers of, for instance, DIGITAL CINEMA projectors would probably neglect standards of archival films. As a consequence, film archives would have to figure out by themselves how to project digitally their obsolete formats at the right speed and with the right ASPECT RATIO. This is quite a real possibility as the work of DCI, whose members are all Hollywood studios, is influencing standardization organs such as the Society of Motion Picture and Television Engineers (SMPTE) to a great extent. This is quite evident in the following statement:

> Their working members as a team have become an integral part of the digital cinema standard-forming process, as well as for the Recommended Practices and Engineering Guideline supporting documents. (Silva, 2006: 148)

This has provoked the concern of the archival community, as attested by an open letter recently sent by the members of the Technical Commission (TC) of the International Federation of Film Archives (FIAF) to the commission in charge for DIGITAL CINEMA standards at the SMPTE:

> FIAF TC expects the archives to generate their own system if one does not become available which is flexible enough to meet the needs for digital projection of archival movies. The DCI proposal has many merits in terms of the file format and its processing, and greater flexibility would avoid a lot of additional effort, and, many observers believe, a need to change it to suit changing needs, very soon.[62]

On the other hand, as Enticknap rightly points out:

> Although political and regulatory influences have played a part (e.g. in determining technical standards), the invention and development of all

> the technologies used to record moving images have been commercial ventures. (Enticknap, 2005: 187)

Discussions are going on among all players, from policy makers to standards makers, from filmmakers to cinema producers, distributors and exhibitors, and of course also within film and television archives. Many compromises will be made but it is highly probable that, in the end, film projectors will be replaced by digital projectors with defined standards, at least in most commercial cinemas. Film projection will then have to continue in film museums, as we will discuss later in this chapter.

Let us close the topic of DIGITAL CINEMA with a glance at the near future, and, in particular, of 3D digital projection:

> The spectacular potential of digital cinema also looks likely to be joined by the introduction of digital 3D. Disney's *Chicken Little* (2005) was the first film to be released in digital 3D in a handful of compatible cinemas. Having already worked on the 3D IMAX documentaries, *Ghosts of the Abyss* (2003) and *Aliens of the Deep* (2004), James Cameron's first directorial feature films after *Titanic* will be the digital 3D *Avatar* (2007) and *Battle Angel* (2008). Where Cameron expects a thousand digital 3D cinemas to be ready for the former, the reception of the first film will determine not only the success of the second but also the digital 3D format in general. (Keane, 2007: 141)

Whether digital 3D will be more commercially successful than other 3D formats already introduced throughout film history remains to be seen. As its analog antecedents, digital 3D is introduced in commercial films at a moment where transition in media poses questions on the future of cinema as a profitable *dispositif* for media consumption.[63] Indeed 3D films, examples of which exist throughout film history since its early days, had their golden era in the 1950s. The great number of 3D films in this period can be put in relation with the emergence of television as a way to confirm cinema's "bigger than life" supremacy on the emerging new medium. In the transition to digital a renewed interest for 3D seems to confirm that, in Bruce Sterling's words, "the future is just a kind of past that hasn't happened yet" (2003: 11).

From sound to special effects, from editing to post-production, from shooting to projection, a general picture of technological transition arises in contemporary film production where, at all levels, analog and digital are profoundly intertwined. Even though the transition to digital is taking longer than many

predicted years ago, the process is undoubtedly underway, and is bringing with it a high degree of technological hybridization.

Many different social groups have a role in this transition and the various dynamics among such groups, which are economic as well as cultural, are influencing the manner and the time scale in which this transition is taking place. Interestingly, relevant groups from very different interests and backgrounds (from Dogme 95 to Hollywood, from avant-garde to the European Commission), can share an interest in digital technology, although, in most cases, their interpretation of what the digital can do for them is quite different, namely, a cheap means for realism to Dogme filmmakers, a means of manipulation for Hollywood blockbuster films, a tool for experimentation for the avant-garde, and a means for stimulating a European audiovisual culture for the European Commission. These complex dynamics are, in part, responsible for the stretching of the time scale in which this transition is taking place, which is becoming much longer than many, like George Lucas, predicted more than a decade ago.

It is evident that commercial film production has a determining role in the transition to digital technology, as film stock manufacturers and all other film-related businesses completely depend on commercial film distribution. Indeed, film stock would become a niche product in a future when film distribution and exhibition would become fully digital. These and other developments occur in most cases outside the sphere of influence of film archives. Archives, therefore, can only try to anticipate commercially driven developments, contribute to technological innovation where possible, and adopt new strategies accordingly.

This is not only the picture of a film market that dictates what heritage institutions would or would not be able to do in the future. It is also, more importantly, the picture of film practice facing the most pervasive transition in its history, in terms of tools, practices and stimulus to reflection. Therefore, this is the occasion to address, *in medias res*, questions about what film is becoming, and about how film archives can redefine their role, and their practices, in view of a transition that is already fully unfolding.

If the transition to digital in film production has led to a diffused hybridization, how is this reflected in the practice of film archives? How are archives adapting to new digital tools for preservation, restoration, access and exhibition? How are they coping with new films entering the archives in the form of DIGITAL INTERMEDIATES? What are the new functions of the archive enabled by the digital? I will address these questions in the second part of this chapter.

DIGITAL CINEMA – UPDATE

For most Western countries, 2012 marked the moment when the number of digital projectors surpassed that of (analog) film projectors in movie theaters. [xliii] Currently, almost all European cinemas exclusively show digital projections. There are approximately 38,000 digitally equipped screens in Europe, accounting for 97 percent of the total number of digital screens (Bosma, ed., 2017: 7). The few exceptions are film archives and museums and a number of art houses and alternative venues that deliberately chose to keep traditional film projectors.[xliv]

An example of how suddenly and pervasively the 2012 digital rollout took place is that of the Dutch initiative Cinema Digitaal, a non-profit organization created by the Dutch Exhibitors Association and the Netherlands Association of Film Distributors under the auspices of Eye Filmmuseum. The goal of the initiative was to promote the digitization of Dutch movie theaters, especially of smaller art houses, by helping them purchase digital projection equipment and provide the expertise needed to operate it. Cinema Digitaal was partly funded by the Dutch government through a grant by the Netherlands Film Fund. Based on a recoupment scheme which depended on the number of digital films shown by film theaters, Cinema Digitaal funded upfront the purchase of digital projectors by theaters, an investment that would be repaid by theaters over time. The operation started in July 2011 and by September 2012 almost 500 screens (of the total 800 Dutch screens operating in 2012) were equipped with digital projection.[xlv] Other European countries have dealt with the digital rollout through different means but the result was similar: in 2012, Europe was ready for the screening of films distributed as DIGITAL CINEMA PACKAGES (DCP). Today, analog film projection has become a rare experience solely offered by film museums and a few art houses.

In terms of workflow and technology, things have not changed significantly in the last decade. The specifications established by the DIGITAL CINEMA INITIATIVES (DCI) in 2005 and reviewed in 2007 have remained substantially the same with regard to the mastering, distribution of DCPs, and the technical requirements for projection (contemplating 2K and 4K projection).[xlvi] Between 2012 and 2015, DCI has included additional frame rates (60, 96, 120) for HFR projection.[xlvii] As yet, there are no specifications for lower frame rates, an omission that still jeopardizes the digital projection of silent films which should typically be projected at a frame rate lower than 24 (the minimum contemplated by DCI specifications).[xlviii]

Similarly, the technology of digital projectors has not changed considerably in the last decade. The two leading technologies for DIGITAL CINEMA are still DLP and SXRD.[xlix] Only seven digital projector manufacturers comply with DCI specifications (including Barco, Christie, Sony, Samsung, and NEC) and provide 2K and 4K projectors worldwide.[l]

A similarly small number of manufacturers produce DCI compliant cinema servers (i.e. dedicated computers) which are used in combination with digital projectors to decode DCPs, create playing lists, and, in general, manage the files to be sent to the projector or sound system in theaters.[li] New technological trends in digital projection technology include laser projectors and LED displays replacing screens. Both have been introduced recently in the market and present advantages over the existing technologies. It remains to be seen whether they will eventually replace DLP; the current leading screening technology.[lii]

As discussed earlier, the renewed interest in 3D technology, sparked by *Avatar* in 2009 has contributed to the acceleration of digitized film distribution and exhibition: digital 3D technology has become widespread. For example, in 2016, approximately 50 percent of digital screens had 3D capabilities (Bosma, ed., 2017: 46-47). It should be noted that, with a few exceptions among European *auteur* films such as Wim Wenders's *Pina* (DE/FR/UK, 2011) and Werner Herzog's *Cave of Forgotten Dreams* (CA/USA/FR/DE/UK, 2010), most 3D films are blockbuster productions. Also, after several years of growing enthusiasm for 3D films, the number of 3D film releases has not increased as rapidly in the last couple of years as might have been anticipated. Moreover, there is a significant decrease in the number of newly acquired 3D screens while box office revenues for 3D films are declining as well.[liii]

Finally, as we will discuss in some depth in the updates to the second part of this chapter, following the completion of the digital rollout, a renewed interest in film projection has surfaced and is directly related to the "material turn." An example of this renewed interest for analog projection and historical film formats is the successful screening of 70mm versions of films such as *The Hateful Eight* (USA, 2015) which has been viewed by a record number of spectators for a single 70mm print at Eye Filmmuseum, selling 36,000 tickets in 4 months' time.[liv]

1.2 FILM ARCHIVING

As the following updates will illustrate, a lot has changed in archival practice in the last decade. However, in most cases, these changes have not been dramatic and have been the result of incremental modifications and improvements, as in the case of digital and hybrid workflows, digital restoration tools, and metadata management. In the first decade of this century, new digital practices were still in an experimental phase and film archives were still busy acquiring and developing expertise to master them. Today, many larger Western archives have reached a sufficiently high competence level and are already actively integrating the new practices in their policies and workflows. The most profound change in archival

practice has undoubtedly been the establishment and ongoing development of digital preservation strategies for born-digital films and digitized film-born films. From acquisition to storage and retrieval, new workflows were first developed by television archives and later adopted by a number of film archives after applying some modifications. Triggered by the 2012 digital rollout, this change led not only to a sudden rise of the number of born-digital films entering the archive but also to the steady rise of data generated by the digitization of the collections at large and the need of a more integrated approach to manage data and information, as will be addressed in the update on Long-Term Preservation.

While we are clearly a step further in the transition to digital and have moved well beyond the experimental phase in most of its practices (with the exception of digital preservation), I believe we can still state, as I wrote in 2009, that "analog technology (applied to film and film archiving) is not yet obsolete" (p. 87).

This is supported by a number of observations. Firstly, after the digital rollout led to the closure of many film laboratories, archives have in some instances hired the laboratory technicians who had lost their jobs. This has increased the technical film expertise within the archives, thus improving the integration of specialized laboratory skills in archival practice.[lv]

Secondly, for many films a hybrid or even fully analog workflow is suitable for restorations and routinely adopted by film archives. While the recording back to film is much less common than it used to be, it is still applied selectively for either creating analog preservation elements or producing analog projection prints for those films that require to be shown in their original format for film historical and aesthetic reasons. As will be discussed in the update on Distribution, Access, and Exhibition, recording back on film is usually applied for experimental films in which the specific analog film characteristics are inherent in the work and for silent films that need to be shown at a lower frame rate. For these cases, many archives are still reserving budget for film-to-film and film-to-digital-to-film preservation.

Equally important, as discussed earlier with reference to the "material turn," is the growing number of filmmakers and artists who choose to keep working with analog film. These new analog films are shown almost exclusively by film archives and art houses, as they operate the only theaters still equipped with analog film projectors.

The hybrid workflow has been extensively addressed in the earlier edition. The updates to this second part of Chapter One will mainly focus on what has changed in the last decade. With respect to film sound restoration, a topic that was not covered in the last edition, I cannot fully repair the omission, but I will at least mention some of the tools currently available and illustrate how this field is gradually becoming an integral part of film archival work.

> The question now comes – who knows how long motion picture film will last? How long can film records of great events be preserved? As is probably known to all members of this Society, there is no definite answer to this question. The motion picture is still so young that there has not been opportunity to test whether a film will maintain its properties for even a half century. But we do know that some of the earliest motion picture films have been preserved for thirty years or more, and we know that "still" negatives made on film have existed for even a longer period. (Fred W. Perkins, "Preservation of Historical Films." *Transactions of the Society of Motion Picture Engineers*, No. 27, October 1926. Reprinted through courtesy SMPTE in http://members.tripod.com/~cinefan/pres_histfilm_SMPE.htm)

Eighty years after the statement above it is proven that film, when stored at adequate temperature and humidity, can last for more than one hundred years. The *Journal of the Society of Motion Picture and Television Engineers* still exists and in its pages today, as in many forums, the same question is raised, but now on the life expectancy of digital film. This issue is obviously of particular concern for film archives.

Film archives today have a long and proven experience in collecting and preserving (nitrate, acetate and polyester) films. Since films decay in many different physical and chemical ways, resulting in shrinkage, color fading, tears and scratches, restoration often becomes part of the preservation process. While original film elements are preserved for the long term in the climatized vaults of the archives, new restored projection prints are kept under less stringent conditions and are regularly shown.

Larger film archives, in particular national ones such as Library of Congress, CNC, British Film Institute (BFI), Bundesarchiv and Eye Filmmuseum hold film cans by the millions in their climate-controlled vaults. If one considers that it takes about two and a half kilometers of film (four large cans) for one 90-minute 35mm film, one hundred years of filmmaking, even though a great deal of films have been lost along the way, makes for a fantastic length of film strip. Recently, a survey carried out by the European project TAPE has collected data from some 370 archives in Europe holding film in various formats including 35mm, 16mm and 8mm for a total of above 890,000 hours, in length equal to *circa* fifty times the earth's equatorial circumference.[64]

Although there are countless differences in the technical aspects of films made throughout history (different width, base, color system, etc.), all films consist of successive photographic images on a (relatively large) CARRIER, the celluloid or polyester filmstrip. With the introduction of digital technology, film archives are for the first time confronted with a new kind of CARRIER,

which needs neither to be held in cans nor to be counted by the meter, and which "carries" images in the form of data (strictly speaking, data need not even to be "carried" on a specific CARRIER) not directly visible or intelligible by the human eye.

Along with the change of CARRIER, the introduction of digital technology in modern filmmaking, in laboratory, as well as in access practices, is changing the way film archives operate. Digital tools have already been partially introduced in film archives' everyday practices related to access and restoration. However, while digital technology, as we have discussed earlier in this chapter, has become a part of the film production and digital is gradually but surely integrating with traditional analog technologies in all types of audiovisual media, film archivists, because of their background and know-how, continue often to think in terms of analog vs. digital.

This attitude is rapidly changing, though, especially in those archives where the necessity of making the collection accessible via digital means is most urgent and where new born-digital films are becoming a significantly growing part of the collection. Given that in the last years, more and more films have been made through digital technologies at one stage or the other, especially since the recent introduction of the DIGITAL INTERMEDIATE process, film archives are confronted with the need of accepting "digital elements" as the "original" masters of new film productions.

The spread of the digital is also accompanied by an increase in archives' capabilities. Specific digital tools for film restoration are improving by the day and many archivists are changing their views on the digital based on the results of recent digital restorations. For those who accept digital technology as a useful means for restoring archival films, learning how to apply digital tools to film restorations is as important as keeping up with the most advanced photochemical techniques for film duplication. This is also true in the field of access. Digitizing film collections for access purposes is becoming today as urgent as preserving our film originals in the best possible and most sustainable way. Indeed, both users and funding entities expect archives to make use of the possibilities offered by the digital in terms of accessibility. Broadcast archives are especially active in this direction and MIGRATION of video originals to digital media is becoming a common practice in most video archives, even on a massive scale.[65]

On the other hand, and on an equally important level, analog technology (applied to film and film archiving) is not yet obsolete. On the contrary, alongside the new digital tools, analog technology shows a good spirit of adaptation and re-affirms its strength in the daily practice. This is true in the field of film production as well as in film restoration. Most importantly, film is still considered the best option with respect to long-term preservation.

Although data in theory could be constantly migrated, in practice they must be stored on some kind of digital CARRIER. Such CARRIERS encounter the same problems of conservation as traditional analog ones. The problems of instability of cinematographic film, from cellulose nitrate to polyester, are well known, studied and documented.[66] They are problems of a mechanical and chemical nature linked to the thermodynamic instability (perishability) of the film base and of the emulsion. The question of the stability of the CARRIERS is a crucial one from the film archive's point of view. Furthermore, any damage to digital data is not directly visible, unlike the decay of a traditional cinematographic film. At any rate, from the point of view of content safety and possibility of recovery, traditional photochemical technology is considered today to be more reliable than its digital counterpart. This is mainly due to quick obsolescence of hardware and software and to the lack of digital infrastructure. In addition, as we mentioned earlier, film archives do not have the know-how and experience yet to work with digital formats. Archivists have a profound knowledge of film formats and photochemical practices but are not familiar with the digital. Being formed typically in Film Studies, Humanities and Arts, their (practical) technical knowledge has often been developed in the field and they often lack a proper technical background. Only in the last few years, MA programs such as the one at the University of East Anglia (UEA), University of Amsterdam (UvA), New York University (NYU), University of California, Los Angeles (UCLA) and intensive practical courses such as the L. Jeffrey Selznick School of Film Preservation at the George Eastman Museum in Rochester, NY, have added some basics of digital restorations and digital access to their course, as well as specific courses on the preservation of digital art. The fact that film archives and related programs of study are only recently shaping new strategies for coping with a fast changing profession is, once again, a sign that we are still right in the middle of this transition. Below, I will give an overview of the new practices introduced in film archival work with the digital technology.

Long-Term Preservation

Recent studies promoted by the archival community (film archives as well as broadcast archives), such as the European projects FIRST (Film Restoration and Conservation Strategies) and PrestoSpace, both examined in Chapter Three, have concluded that digital technology, while suitable for the long-term preservation of video content, is not yet a reliable alternative for film-born content. Different factors like, for example, lack of standardization, rapid obsolescence of hardware and software, lack of knowledge and experi-

ence with the digital within film archives, and, not less important, the current high costs of digitization and data storage mean that digital is not yet sustainable for the high quality preservation of (large) film collections.

Nevertheless, a time will most probably come when film will not be manufactured anymore, or only in much more limited quantities and varieties than we are used to nowadays.[67] Film will then become more expensive, less versatile and, in the end, less suitable for preservation purposes. As noted by Richard Wright:

> [...] the non-digital 'film as film' route for preservation of film collections is only viable so long as new blank film stock is being produced (which could be as little as another decade, with many types of film stock already out of production). (Wright, 2007: 14)

Film archives will then have no choice but to resort to alternative CARRIERS for long-term preservation of their decaying film originals. Hopefully digital technology will then be sufficiently reliable (with respect to quality and stability) and economically advantageous to become a good alternative to film, even for long-term preservation.

If film archives, on the one hand, should strive to provide the best possible storage condition for their film artifacts, they should also foresee that the choice of integrating digital technologies for low RESOLUTION access, high RESOLUTION restoration and the acquisition of new born-digital films, will inevitably lead to the creation of a (new) digital archive, to be preserved along with the historical film collections. What are the problems posed today by digital storage and long-term preservation of data and what are the solutions already available?

The first aspect to consider is that of the reliability of the digitization process, discussed below with respect to scanning and digitization for digital restoration. Loss of information during digitization can be minimized, but an accurate scan is still a very expensive procedure. Even though state-of-the-art scanners are able to digitize all the information from a 35mm film, the data storage needed for such information is still too large to be managed cost-effectively. Note that, as will be discussed later in detail, a 35mm film with a running time of 90 minutes, once digitized, can reach 1.5 to 6 Terabytes and more of data, depending on the scanning RESOLUTION. The cost of digital storage might not be a problem anymore in a few years from now, but today it is still a major obstacle for film digitization on a large scale.

A second aspect is that of the stability of the digital CARRIERS currently employed. I consider part of stability not only life expectancy, but also obsolescence and (degree of) standardization. Most claims by manufacturers on

life expectancy of digital CARRIERS, from Digital Versatile Disc (DVD) to digital tape, are based on accelerated ageing experiments done in the laboratory. Real life experience with these CARRIERS is still too limited to draw accurate and reliable conclusions in the long term. Therefore, no manufacturer today can really guarantee a precise life expectancy for its products. The situation is very much comparable to the one described for film in the 1926 article from the *Journal of the Society of Motion Picture Engineers* for film, quoted earlier. The difference is that life expectancy for current digital CARRIERS is expected to be significantly shorter than one century. On top of short life expectancy there is the problem of obsolescence of hardware, software and data formats, as upgraded products are regularly put on the market. As Moore foresaw in 1965, the processing power of microchips is doubled roughly every eighteen months and this steady growth has a direct impact on the development of digital components.[68] The result is that older versions of hardware and software are supported for only a few years and then abandoned. At the same time, new standards are continuously introduced. As Paul Read states:

> *Analogue film images are very stable*. One might not think this from concerns over nitrate inflammability, nitrate and acetate base decay, or film dye fading, but by comparison with most digital media this is so, and low temperatures may in future retain film images already in the process of decay for many years yet. *Digital records are, at present, considered very "unstable",* principally due to the fleeting nature and lack of standards of play-out equipment and formats, but most, probably all current data storage media suffer from serious mechanical, chemical and physical limitations. (Read, 2002: 161 – emphasis in the original)

The same concept has been underlined more recently by the European Broadcasters Union (EBU):

> [...] it must be noted that the life expectancy of film, even very old film, that is properly stored in the right climatic conditions far exceeds that of any current video, data or digital format. (EBU, 2004: 3)

One of the solutions applied most frequently today to cope with the instability of digital supports is data MIGRATION. Data MIGRATION consists of cyclically transferring all data onto a new CARRIER (typically, once every two to five years). This can also offer a solution to the problem of changing standards as data can be converted into a new format during the MIGRATION process. Nevertheless, data MIGRATIONS are very costly processes as they require, depending on the volume of data to be migrated, a large storage facility. In addition, stor-

age space should be sufficient for at least two copies of the same data, possibly kept in two different physical locations, placed apart from each other, in order to prevent total loss in case of calamity. Indeed the same should be done with film collections where two elements of the same film are stored in different vaults placed in different locations. Nowadays data storages are usually a mixture of digital tapes and hard disks where the former are used for high RESOLUTION data and back-up and are not readily accessible, whereas the latter are used for lower RESOLUTION copies of the same data to be accessed in real-time. This kind of data storage uses expensive state-of-the-art equipment that relies on robotization to move digital tapes from the actual storage to the recorder-player machines to import (or ingest) and export data: a mechanical arm, electronically guided, that moves tapes from one slot to another along a corridor of cabinets where hard disks, digital tapes and I/O equipment (that is "In and Out" for importing and exporting data, such as a player/recorder of digital tapes) is used. The storage room needs to be cooled as these machines produce a lot of heat, making environment control rather expensive. Furthermore, the costs of digital storage are still much higher than those of film storage. A recent study carried out by the Science and Technology Council of the Academy of Motion Picture Arts and Sciences (AMPAS) shows that the cost of long-term storage of DIGITAL CINEMA data is today between five and eleven times higher, depending on the image RESOLUTION, than the cost of storing the same information on film (AMPAS, 2007: 40-44 and 67-68).

As new kinds of digital tapes are adopted to replace older versions, parts of the equipment need to be replaced as well. The MIGRATION process itself requires an automated monitoring system that keeps track of any loss or degradation of data. Some kind of human supervision is also needed. On top of all this, and most importantly, data MIGRATION is a never-ending process. As Richard Wright puts it:

> All forms of digital data have digital preservation issues. For audiovisual materials that have been digitized, digital preservation is just another aspect of the *maintenance* that is essential for the survival of any audiovisual item. [...] Use of the term *maintenance* is an attempt to stress that archives should expect, indeed demand, funding for *maintaining the viability* of archive content – and that the funding should be part of every annual budget, not just something special for performing a rescue operation when matters have reached a crisis. (Wright, 2007: 5 – emphasis in the original)[69]

For a film archive, building a data archive means adding completely new tasks and costs to its traditional ones. The question many archives are dealing with now is whether they should archive data in house or outsource this service to existing providers with specific knowledge in the field. Both options have serious consequences: while the former requires large investments in space, equipment and for training personnel, the latter implies transferring part of the collection (the data archive) to be stored and managed by an external party. This would be quite a drastic change for institutions whose main task has traditionally been that of taking care personally of their film artifacts. And, in the long run, it may even turn out to be more expensive than the in-house solution. In Chapters Three and Four, a number of cases from the field will be discussed showing how know-how and specialization with regard to new digital tools are growing both in the film archives as in the facilities of the service provider.

Some broadcast archives, as mentioned earlier, are building a digital storage system, adopting cyclical MIGRATION as a preservation strategy to cope with a technology that is still unstable in terms of standards and obsolescence of hardware and software. Archives such the BBC's are not only archiving digitally all new content originated by current broadcast, but are also digitizing their historic video collections. There are at least three good reasons why it makes sense for broadcast archives to migrate their video collection to digital at this point: first, video tapes of all sorts are poor preservation CARRIERS as they are much more perishable than film and there is not much that can be done to slow down their decay; secondly, the quality of a video image is relatively low and can be digitized without any loss and at a reasonably low cost; third, most broadcast archives are already storing data from current broadcasts and can insert data derived from the digitization of historic collections into their existing digital archive. While doing so, they make use of the same workflow, MIGRATION mechanism, search and retrieval systems.

This last point applies also to film production companies that archive their own films. This is the case of the Hollywood studios. Some of them have come to the conclusion that they need to set up a digital archive for their new DI productions. As will be discussed in Chapter Three, the case of Sony Picture Entertainment, owner of the Columbia Pictures archive, is quite outstanding in many respects. In 2005, Sony was the first Hollywood studio to design its own digital archive for its growing assets. Sony chose to outsource its digital archive to Ascent Media, a fast growing company in the field of digital assets, using its content management system called ViiA (formerly Atlas), a file-based repository for media management and delivery.[70] This transition has already proven successful as,

> In the first year of its implementation, Atlas has enabled SPE [Sony Picture Entertainment] to ingest and access more than 2,000 assets "film titles and TV programs as well as short-form commercial spots from a variety of sources, including 2K and 4K files" into its digital repository. By transitioning to file-based Atlas processes, SPE has been able to distribute marketing campaigns for top products to ten global territories digitally and simultaneously, transition to entirely file-based delivery to several distributors, and save an estimated 40% on time and materials, shipping, and labor versus traditional media versioning and distribution methods.[71]

Another approach to address the problem of obsolescence is represented by emulation as it focuses on the possibility of simulating outdated systems. This kind of solution to the problem of rapidly ageing technology proves particularly interesting when one wants to preserve a digital format in its original form. There are in fact two possibilities here: one is that of preserving the original hardware and software to be able to read older formats; the other is that of emulating the look of older formats by using new software. The former approach, similar to what archives have been doing in the past with film equipment and obsolete formats (for instance Pathé Baby cameras, projectors and their 9.5mm films, to name one of the thousands of examples), poses the problem of maintenance of electronics that is much more complex than maintaining mechanical analog equipment. The latter seems to be a more viable approach but it poses, of course, more urgently than with film duplicates, the question of the *original*. Indeed, the 9.5mm original Pathé Baby film is kept as long as possible in the vaults as the original artifact from which all new copies and restorations are made on existing standards, such as 16mm or 35mm. On the contrary, "original" files used to store a digital film would be constantly migrated to new file formats capable of emulating the original ones, which would in turn be dismissed. What does this mean for an archive used to preserve original artifacts? What does this imply for the already ambiguous concept of *original* in film? Or, as posed by Carol Stringari, Senior Conservator of Contemporary Art at the Solomon R. Guggenheim Museum in New York:

> How does one choose an appropriate format for migration and still retain the integrity of the original? How does one approach the logistical, technical, and legal issues surrounding time-based works on obsolete video formats or "dematerialized" conceptual works within a museum collection? What does one record and preserve when a work is meant to be refabricated for each exhibition, and how much of the "patina" of the period will we want to preserve in the future? (Stringari, 2003: 55)

The question of "dematerialization" of (film) archives and museums, raised by Stringari in relation to the Variable Media Network project, is a crucial one in the transition from analog to digital.[72] As will be discussed further, digitization is changing the relation between the archivist and the material artifact in ways that we cannot yet fully foresee. However, the problem of preserving data is today still quite a "material" matter, as large amounts of data are kept on digital tapes with a set of specific preservation issues (e.g. rapid obsolescence). In the last decade a few interesting research projects have looked into the possibility of solving the material problem by moving towards a truly medialess archive. An interesting idea was proposed by Jim Lindner at the Joint Technical Symposium held in Paris in January 2000. To finally free ourselves from all the problems related to a perishable CARRIER, instead of transferring content from an analog, as in the case of a film or tape, to a digital CARRIER, disk or tape, all doomed to physical decay, data could be kept in a network of hardware terminals, an "immaterial" medialess medium in which all information (in digital form) can be collected (Lindner, 2000). This could be a redundant system of information in continuous motion, an immaterial (film) archive that entrusts its collection to a huge amount of redundant files that travel within a network. Information could be retrieved on demand. The archive would then collect the necessary data, recompose and transmit it to the projection booth. A similar idea can be found behind the project LOCKSS (Lots of Copies Keep Stuff Safe), as well as the project DISTARNET (Distributed Archival Network).[73]

LONG-TERM PRESERVATION – UPDATE

As I have written elsewhere (Fossati, 2013), one of the main challenges for archives today is to be able to cope with "programmed obsolescence," typical of other modern industrial technologies.[lvi] "According to programmed obsolescence, technological improvements already within reach (also from an economic standpoint) are intentionally delayed for future products and technology releases with the aim of maximizing consumption and profit over the years" (Fossati, 2013: 104). Digital technology is particularly suited for embracing programmed obsolescence. As a consequence, long-term preservation of born-digital and digitized films has to deal regularly with software and hardware that need periodic replacement and this trend is expected to continue in the future.

In the last decade, many other fields have also had to deal with a rapidly growing amount of data to process and store safely for the long term (from banking and business to health care and research, etc.). In the audiovisual field, television networks and their archives had been the first to research possibilities for long-term

data preservation, as discussed below and in Chapter Three in relation to the project PrestoSpace. More recently, online video platforms such as YouTube, Vimeo, and the Internet Archive, have had to deal with the same problem. Unlike television where the transition to DIGITAL VIDEO had already started in the late 1990s, long-term preservation of data only became a pressing issue for film archives after the digital rollout of 2012. In addition, due to the high costs of film digitization and digital storage, film archives started digitizing their collections later than television archives. As a result, bigger scale digitization programs have only been realized in the last decade.[lvii]

With the growth of the digital holdings due to the rise of born-digital films after the digital rollout and the consistent use of digitization for film-born films, film archives needed to start formulating digital preservation strategies. The proposed conclusion by the *Digital Dilemma* (AMPAS, 2007) that recording back on film was the best solution for long-term preservation quickly proved unmanageable as it was neither cost-competitive nor realistic due in part to the gradual disappearance of film stock. Additionally, even when recording data back to film is the preferred method of preservation, archives still want to keep the data for access purposes and are therefore left with a growing amount of data to be stored.[lviii]

From the beginning of this century, knowledge and experience gained from research work, such as the Digital Agenda for European Film Heritage (DAEFH) Study (2011-2012) and pioneering projects such as *Images for the Future* (discussed in Chapter Two), and further stimulation by the rapidly lowering costs of digital storage, helped formulate the best practice guidelines and workflows for film archives. Today, these guidelines are being widely adopted in the field. In fact, looking at the final report of the 2012 DAEFH Study, we clearly see that at least one of its recommendations has now become practice within some larger film archives:

> [Film Heritage Institutions] should immediately start planning for digital repositories based on the OAIS [i.e. Open Archival Information System] Reference Model; these must be "trusted repositories" able to preserve content safely and securely. Many standards and experiences exist on the subject in other IT fields; EU digital repositories should be based on them.[lix]

A number of archives have chosen to build a digital archive in house (as in the case of Eye, discussed in Chapter Three). Others have preferred to outsource it (as in the case of Sony, also discussed in Chapter Three). However, they all adopted similar standards. In terms of file formats, some archives opt to store DCDMs as their digital masters, which combine sets of uncompressed image and sound files with additional data (e.g. subtitles) and metadata that together form the final film version(s), which are needed to create DCPs for projection.[lx] As mentioned above, most archival digital repositories are based on the OAIS Reference Model.[lxi] In terms of storage, the

most common choice is LTO tapes as they have been adopted also in many other fields. LTO tapes currently are the most reliable form of CARRIER when compared, for instance, with hard disks. [lxii]

Additionally, I would like to point out that the discussion on the "material turn" also has repercussions for long-term digital preservation as, in agreement with Mark-Paul Meyer, "[...] the original [film] artifacts can disclose unexpected knowledge, for instance about the making of the films and therefore also about the thinking, the intentions, the artistic interventions that were at play during the process of making the film. [...] Digitization largely ignores the knowledge that is undisclosed in the material artifacts" (2015: 1). Along this line, two interesting projects are being carried out addressing the need to preserve specific historical and aesthetic characteristics of the original analog film, namely the ERC project FilmColors, led by Barbara Flueckiger at the University of Zurich, and the FILMIC project. The FilmColors project focuses on, among other things, alternative ways to digitize films that would also allow retaining (information on) their material characteristics, in particular in relation to historical color systems.[lxiii] This project will be discussed in more detail in the Digitization and Re-Recording update. The FILMIC project, on the other hand, is a collaborative effort in which commercial companies, archives, and scholars in the film preservation field explore new digital possibilities for recording and preserving additional aspects of a film alongside its images and sound. Areas of investigation include multispectral film scanning and automated condition analysis to preserve all data on the film CARRIER, including physical irregularities such as shrinkage, tears, and splices, which are being overlooked in current film preservation technology.[lxiv]

Film Restoration

First of all it is important to define what it is meant here by film restoration. Paolo Cherchi Usai gives the following definition in his seminal book, *Silent Cinema. An Introduction*:

> RESTORATION is the set of technical, editorial and intellectual procedures aimed at compensating for the loss or degradation of the moving image artifact, thus bringing it back to a state as close as possible to its original condition. (2000: 66)

The definition can be further specified, as in the *Restoration of Motion Picture Film*, edited by Paul Read and Mark-Paul Meyer:

> When we speak [...] about restoration we mean the whole spectrum of film duplication, from the most simple duplication with a minimum of interventions up to the most complex ones with a maximum of manipulations. Since every duplication procedure has some decision moments which may influence the quality of the final product, it is important that certain principles are respected. For instance, restoration implies that it is not sufficient simply to transfer the information on a film to another carrier, which could involve video transfer as well, but to maintain as much as possible the original format of the film, in particular 35mm and 16mm cinematographic film. (Read, Meyer, 2000: 1)

In line with the above, film restoration in this book defines all kind of actions that are undertaken with the objective of bringing an archival film back to a form that is as close as possible to the original. To this I would like to add that a necessary requirement for a restoration to be complete is also to be in a form that can be shown to an audience. A restored film that cannot be seen, because, for instance, the restored preservation element (e.g. a new negative) has not been copied into a projection format, would rather fall in the category of long-term preservation than in that of restoration.

Note that I consider restoration all those cases in which a new copy is made from the original. Indeed, with film, differently than with art restoration, a copy needs to be made in the restoration process since original artifacts are too fragile to be projected without the risk of further damage.[74]

But what should be considered "the original" of a film? Several answers are possible, depending, for example, if one considers the philological or textual level (e.g. the editing of the film, the title cards, or the credits), or the material level (e.g. the 35mm celluloid film negative the film has been shot on, or the only surviving 9.5mm reduction of a film originally shot on 35mm, or the original tints). To restore a film being true to the original can mean a whole spectrum of different things. On the textual level, for example, the film as it was shown at its premiere can be considered as original as the film the director originally wanted before it was altered by the production company or cut by the censorship before the premiere. When considering film as a material artifact, the original black-and-white camera negative of a silent film can be considered as original as the derived film print in which colors were added, by stencil, tinting or toning. The discussion on the original in restoration is central to film archival practice and needs a broader reflection. In Chapter Two, the framework "film as original" will be proposed, indeed, as one of the theoretical approaches to film archival practice.

From my position as an archivist, I look at the question of formats from a different perspective than Read and Meyer. Whereas in their opinion a

restoration should "maintain as much as possible the original format of the film," I argue that maintaining the original film's look is more important than remaining true to the original format. For instance, if a digital copy of a film could reproduce (simulate) the original characteristics of an obsolete 35mm color system better than a copy on contemporary 35mm color film stock, I would opt for the digital copy. Indeed, if digital means can help restorers to better simulate the original film look, in my view they should be considered as suitable as photochemical ones, not only for restoration but also for showing the restored image on a screen. The simulation potential of digital means will be thoroughly discussed in Chapter Two as one of the concepts at work in film archival practices.

In the last decade, digital technology has proven to be an effective new tool for film restoration. In case of damage to a film that involves the loss of part of the image, for example scratches in the emulsion, while photochemical restoration is not effective, digital techniques can be used to replace the missing part. In such cases, digital technology enables restorers to do things that were impossible before.

"With great power comes great responsibility," as the uncle of Peter Parker says in Sam Raimi's *Spider-Man* (USA, 2002). This is the point when using digital software for film restoration. The restorer is charged with a greater responsibility as new digital tools offer more choices with respect to the extent of intervention, for example, they allow the easy addition or removal of image elements, e.g. a misplaced shadow, due to "wrong" scene lighting, or a director of photography that by mistake briefly invaded the background of the shot. However, with traditional analog restoration also, film restorers could interfere with the original artifact to a point beyond recognition. The digital simply provides the restorer with more effective tools, some of which could bring film restoration closer to art restoration practice. While in fine art restorers intervene directly on the artifact, in film restoration the intervention on the original artifact is limited traditionally to the so-called technical repair of the film. This includes cleaning, repairing of tears and broken or missing perforations. The intervention on the film artifact is in fact supposed to be reduced to a minimum, and only aimed at making the mechanical duplication of the film possible. It is limited to repairing tears and broken perforations to obtain a continuous piece of film that can be threaded in a film printer. With the exception of the WET GATE printing process, that dramatically changes the appearance of the restored image by providing a remedy for superficial scratches, photochemical interventions are restricted to the duplication of existing information on the film: nothing is added to what has survived of the original image. With digital restoration, on the contrary, everything is about intervening directly inside the image, and, in particular, replacing missing information.

For the reasons mentioned above, digital technology introduces new aspects in the debate on film restoration guidelines. Ethical issues have become more urgent since film restorers can alter the aspect of the film more easily and more profoundly. In this respect, certain questions gain new relevancy, such as "what is an original?," "where is the borderline between inherent (audio)visual characteristics (to be preserved) and defects (to be corrected)?," "is a film restorer allowed to *improve* the original aspect of a film and, if so, where lies the limit between improving and distorting?"

These issues are related to two theoretical frameworks that will be proposed and discussed in the next chapter, the earlier mentioned "film as original" framework, where the artifact is central, and the "film as *dispositif*" framework, where, on the contrary, it is the reenactment that is central. In Chapter Two, these and other relevant frameworks will be derived from the theoretical discourse and proposed as a functional instrument to theorize archival practice.

Finally, as will become evident in the discussion of contemporary restoration techniques that follows, film restoration today is as much a hybrid practice as it is current film production, where the best of both analog and digital technologies is combined to obtain the desired results.[75] In the following sections I will describe hardware and software available today for film restoration and how they can best be used in the practice.

FILM RESTORATION – UPDATE

As will become apparent in the following pages, not much has changed in the general workflow of film restoration in the last decade. Nonetheless, hardware, software, and tools in general have improved very significantly along with the expertise that is now available within archives and specialized laboratories. Nowadays, working with digital technology is part of the daily routine. While the pace of change remains rapid, also due to the obsolescence typical of digital technology discussed earlier, we can say that digital restoration has passed the initial experimental phase and has now been accepted and practiced throughout the field. This new phase brings with it renewed discussions and ethical dilemmas about the extent to which film should be restored or where to draw the line between restoring and creating new "improved" versions. Highly interesting discussions on this gray area have been triggered by specific restorations. These discussions have bridged the gap between academic reflection and archival practice and opened up a welcome dialogue. A recent example is that of the digital restoration of Georges Méliès' *Le Voyage dans la lune* (FR, 1902) realized by the Technicolor Foundation for Cinema

Heritage, Groupama Gan Foundation for Cinema, and Lobster Films in 2011, and presented at the Cannes Film Festival that same year. This restoration provoked a lively discussion among experts in the field which clearly shows that there are many different ideas of what a restoration is, or should be, as film scholar Martin Bonnard aptly analyzes (2016). As argued in the new Introduction, to support this very discussion I feel that the theoretical frameworks and concepts provided in this book and the proposed basis of a theorization of archival practice are as relevant and timely today as they were a decade ago.

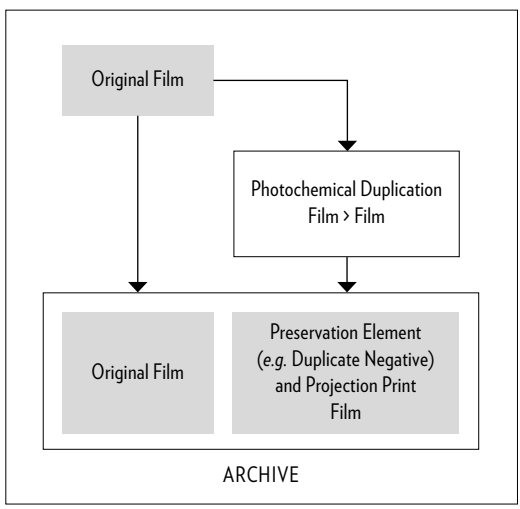
In the following updates, I will focus on the recent changes in the tools, workflows, and practices in the field with the aim of updating the decade-old snapshot of the archival practice in terms of restoration, exhibition, and access.

The Process of Digital Restoration

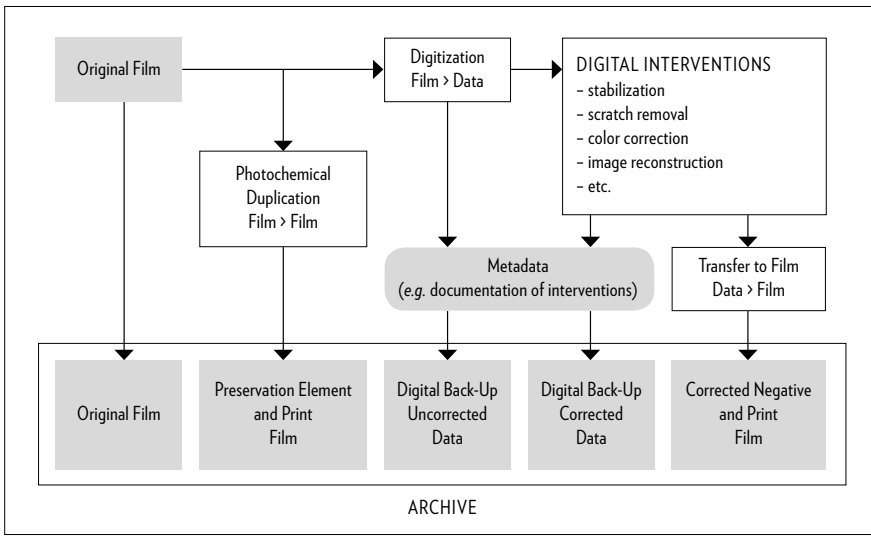
The following figures compare the workflows of two different cinematographic restoration processes, namely the traditional photochemical and the digital process.

A digital restoration process begins with a film being transformed into a sequence of binary digits (zeros and ones). This process is called "digitization." The parameters involved in digitization are discussed in detail later.

Once the film is digitized there are three basic operations to be carried out in the digital domain, namely editing, color GRADING and digital restora-



Photochemical restoration workflow.



Digital restoration workflow.

tion. Finally, the restored data are written back on film negative, the archival master of the restored version, from which new projection prints can be made.

Editing an archival film is in practice no different from editing a new film and the same equipment is used. The main difference is that in a restoration the original editing of the film should be reconstructed by the restorer. In case of multiple versions of the same film, the restorer determines which version should be reconstructed. Also in the case of digital restoration, the comparison between different sources and the choice of material needed for reconstructing the film are mainly done with the original (analog) film on traditional viewing tables as the costs of digitizing all the available material are in most cases too high. Archival material often needs to be repaired before digitization and this time consuming process is reserved only for the elements necessary for the final reconstruction. Repairing and digitization are both processes that can damage old film artifacts. This is another reason to apply them only to those film elements selected for the restoration process. However, it is quite possible that in the future more elements will be digitized as digitization prices will drop and working with digital means will become more widespread in film archives.

It should be noted that while Read and Meyer make a distinction between restoration and reconstruction, where the former "refers to the visual quality of the image" and the latter "to a philological activity of putting the pro-

gramme or narrative – [...] the 'text' of the film – back to something like an 'original'" (Read and Meyer, 2000: 69), here I intend the reconstruction phase as part of the restoration process.

Color GRADING follows the editing process in the digital restoration workflow. GRADING old and new films is in fact also a similar process, as the same equipment is used and a similar expertise is needed. As for editing, the main difference here is that the goal with archival films is usually to approach the original color character of the original rather than creating a new look. In many cases though, the reference to the original colors is not available, either disappeared or faded away. For this reason it is crucial that both the restorer responsible for the restoration and the grader operating the software are familiar with historical color systems and their look. Indeed, a two-color Technicolor film from 1922 looks different from a three-color Technicolor from 1940, and hundreds of other similar examples could be encountered in GRADING archival films.

Digital restoration is carried out with specific software and it can tackle different kinds of damage typical of archival films. The various tools for digital restoration are discussed further in relation to the kind of damage they can correct. When the data are satisfactorily restored, they are printed back on film.

It should be noted that, as is quite evident from the steps mentioned above, the digital does not bring with it a reduction in the number of steps needed for restoration. Also because of this, the wide-spread idea that a digital process can be more cost-effective than a photochemical one is disputable, for now, at least for film archives where film is the starting point and the final result. On the other hand, digital restoration tools are more effective than photochemical ones. For archives this is an important point to consider when re-thinking their practices. In Chapter Three, different examples of how archives are reshaping their goals in view of the extra capability of the digital tools will be discussed.

The following sections will address digital restoration. First, the digital restoration process is described along with the related hardware, from the initial step, film digitization, to the final one, that of re-recording the restored data back on film. Secondly, tools for digital restoration are discussed in relation to the kind of damage they can tackle. Finally, the issue of metadata and their importance is addressed.

Each step in the restoration process involves choices with respect to alternative routes and tools, and multiple parameters for the same tool. Understanding how the available tools and the currently adopted practices in film restoration work, with their advantages and disadvantages, is the basis for assessing a general snapshot of this transitional moment and to delineate the issues around which the debate on "grain and pixels" is taking place.

THE PROCESS OF DIGITAL RESTORATION – UPDATE

In the last decade, the film restoration workflow has basically remained unchanged; that is to say, it follows the same steps in the same order, from reconstruction to digitization, from digital restoration to GRADING, and so on.

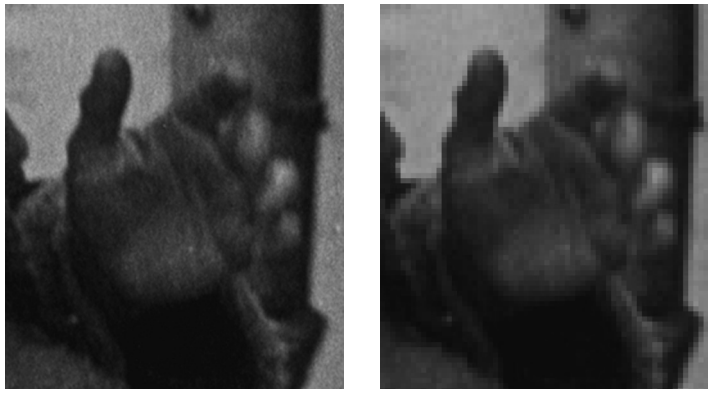
However, the tools (from scanners to digital restoration and GRADING software) have greatly improved and, after many years of hands-on experience, so have the skills of their operators. At the same time, the use of digital has increased at the expense of analog means. Based on the increasing number of digital formats screened in the last few years at specialized film festivals such as Il Cinema Ritrovato, Le Giornate del Cinema Muto, and Toute la mémoire du mond, the number of film-to-film projects and film output (re-recording on film) as a final result continues to decline.

In the following updates, I will analyze the recent main changes in the different steps of film restoration. The updates are based on research of recent literature on the subject and the tools currently available on the market, focusing specifically on those that are dedicated, solely or in part, to film restoration.[lxv] In addition, extensive interviews carried out with professionals working in film archives and film laboratories are included to investigate how the tools are being used and how they impact the film restoration workflow in everyday practice.[lxvi] Note that in most cases the interviewed professionals have remained the same as those interviewed for the earlier edition of the book.

Digitizing and Re-Recording

The concepts of RESOLUTION and COLOR DEPTH, already mentioned earlier, are crucial when discussing the hardware needed for digitizing films, as these are the two parameters that have the biggest influence on how a film is digitized and how much of its components (in terms of details and colors) will be transcoded to digital data. Also, these are two critical aspects in the debate on the digitization of archival films within the field, and are often sources of disagreement.

RESOLUTION refers to the capacity of a means of reproduction to describe detail, which can be quantified by measuring the amount of smallest distinguishable elements in the image. These elements are grain in photography and film, and pixels in digital imagery. The higher the number of grain or pixels per frame, the better the capacity to describe detail and, therefore, the RESOLUTION.



Example of resolution expressed in photographic grain (left) and digital pixel (right).

While grain in a photograph or in a film frame is a randomly distributed system of crystals of variable dimension and shape, pixels form a system of identical elements arranged in an orderly fashion. The RESOLUTION of a photochemical system is therefore hard to compare with that of a digital one, as they reproduce images by means of two different forms of representation.

High and low RESOLUTION in digital imagery are defined in analogy with traditional photography and film. In this phase of the transition to digital, any RESOLUTION below 2K (where 2K represents the number of pixels in a horizontal line of the image, namely, 2,000 pixels in width) is considered lower than the RESOLUTION of photochemical film.[76] In today's practice, for film production and film archiving 2K has become the accepted minimal required RESOLUTION for a film intended to be shown in cinemas. Although this might change in the near future with the increase of digital storage capacity and of data rate, the agreement on 2K RESOLUTION, although once again transitional, is important because it has been largely accepted and adopted in the practice for at least a decade now and it has recently been adopted also in the DCI specifications and published as a standard by SMPTE.

According to a number of sources, the typical minimal RESOLUTION of a modern 35mm color film, expressed in digital terms, is about 4K or 12,750,000 pixels per frame. As stated in the guidelines issued by the European Broadcasters Union (EBU), *Preservation and Reuse of Film Material for Television*:

> Technology is now available to scan and digitize the full information available in film images. Experience with such equipment shows that a pixel pitch of 6μm (about 160 pixels per mm) is considered sufficient to

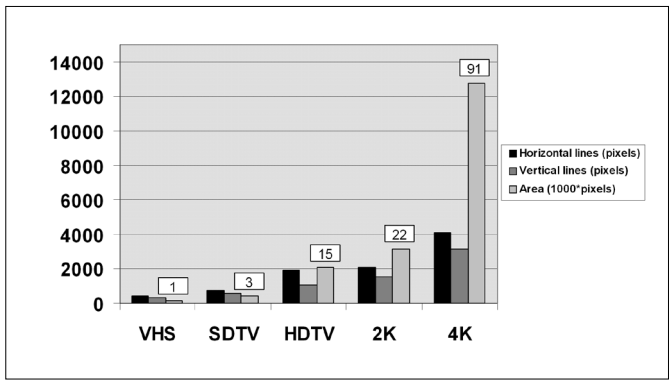
> reproduce current film stocks. This corresponds to a scan of 4k x 3k (actually 4096 x 3112) over the full aperture on 35mm film. If film is scanned at lower resolution (corresponding to a larger pixel spacing), less information is captured and more aliasing artefacts are introduced. (EBU, 2001: 60)

This statement has been challenged by many, and even the EBU has further commented on it in a supplement to the 2001 document quoted above:

> There are many opposing views on the resolution and bit depth needed to record film images, and the areas of contention may be summarized by reference to a number of different philosophies. These range from concepts that originate from intrinsic film characteristics (the nature of film and processed film emulsions themselves) to others that take more pragmatic approaches. (EBU, 2004: 10)

Interestingly, the statement above acknowledges "different philosophies," or rather perspectives, from which one can look at the RESOLUTION issue. This is indeed the kind of debate going on in the film archival field with regard to film digitization, for instance, around the question of the number of pixels necessary to properly digitize film grain. As will be argued in the next chapters, when discussing technical matters involved in digitization, such as RESOLUTION, different theoretical frameworks and concepts are at play and, depending on the framework of reference, different technical factors can gain more or less relevancy. If, for instance, one film archivist could argue that film is art and that the digitization of a film is acceptable only when it can guarantees that nothing of the original film artifact is "lost in translation," another archivist could maintain that digitization allows us to reach a larger audience and that is an acceptable trade off for losing something in translation. As discussed in Chapter Two, both positions can be defended and they can even be combined when, on the one hand, long-term preservation of the film artifacts is guaranteed and, on the other hand, digital access to the same films, even if at lower quality (e.g. lower RESOLUTION than film), is made possible.

However, with respect to the RESOLUTION issue, according to the guidelines of the EBU, only a digital reproduction system with a RESOLUTION equal or superior to 4K can be an acceptable alternative to film. The figure below shows the RESOLUTION expressed in terms of pixels of some rather common formats, from the analog magnetic VHS tape to high RESOLUTION digital film.



Comparison between different formats in terms of pixels (horizontal lines, vertical lines, and area) and of resolution expressed relatively to VHS format (VHS = 1).

If the previously mentioned limit of 4K is considered as a standard of reference for safeguarding the integrity of original information of a film, the loss of detail that occurs by copying a film on the various formats is obvious. In terms of pixels, choosing to make a digital copy with a RESOLUTION of 2K means losing 75% of the original details. This loss is higher than 80% for both television formats (SDTV and HDTV). At the lowest end of the spectrum lies the traditional VHS format in which only 2% of the RESOLUTION is preserved.In reality, it is necessary to bear in mind that not all films have the same grain RESOLUTION to start with and that a pixel RESOLUTION lower than 4K might be sufficient for the larger part of archival film. Indeed, unfortunately, in most cases they are not original negatives, but just projection prints two or more photographic generations down the line, as the negatives have been lost. Since each photochemical duplication results in an unavoidable loss of RESOLUTION, even when duplicating onto a (potentially) higher RESOLUTION format, it can be concluded that most archival films in fact have a RESOLUTION lower than 4K. As pointed out in the already mentioned EBU document:

> At present 35 mm Academy images on Eastman or Fuji color negative films exceed the capabilities of digital cinema although it is clear that given optimum projection specifications and high quality original material, digital versions can exceed most multigenerational film duplicates in terms of viewing quality. (2004: 12)

Anyway, one of the aims of film archives is to safeguard the integrity of the cinematographic heritage. To do so the original information (e.g. image details and colors) contained in films should not be lost during digitization. On the other hand, a standard value to quantify the RESOLUTION needed for correct digitization of a film does not exist, since for every film (and for every scene or shot within the same film) a different RESOLUTION might be sufficient to guarantee that all information is safely digitized.

But RESOLUTION is not all there is to it. Another fundamental concept to be introduced is that of BIT DEPTH, also referred to as COLOR DEPTH, which defines the capacity of a pixel to describe gray and color tones. A "bit," short for binary digit, is the smallest unit of data in a computer and consists of a single binary value, either 0 or 1. A pixel able to depict only black and white (2 tones) has a BIT DEPTH equal to 1. A pixel able to describe also gray tones (256, typically) has a BIT DEPTH of 8. For pixels able to describe tones for the independent colors (red, green and blue) the BIT DEPTH is typically 24 (corresponding to 16,777,216 tones).[77] (See figure 1 in the color insert).

It should be noted that in cinema, differently than in other disciplines like photography or graphic design, a different terminology is in place by which a 24 BIT DEPTH is referred to as 8 BIT DEPTH.[78] To complicate things even more, such color combinations can be quantified by means of a linear or logarithmic scale. The latter is much more useful when converting an image from analog to digital:

> [...] as all electronic light sensors are linear, they produce an output proportional to the light they see, in this case, representing the transmittance of the film. This means a large portion of the numbers describes the black and dark areas, and too few are left for the light areas where 'banding' could be a problem – especially after digital processing. Transforming the numbers into log[arithmic] by use of a LUT [LOOK UP TABLE] gives a better distribution of the detail between dark and light areas and so offers good rendition over the whole brightness range without having to use more digits. (Pank, 2002: 12)

Film digitization is carried out by using a film scanner. This is the first hardware used in the process, by which the information of every single frame of cinematographic film is translated into digits. The scanners' maximum capacity of RESOLUTION today is 6K.

Scanners were originally designed for contemporary production to digitize newly shot film for special effects. Nowadays they are mostly used to digitize the entire footage to create the DIGITAL INTERMEDIATE described earlier in this chapter. Film restorers and laboratory technicians involved in restoration of archival films are not a primary target of hardware manufacturers and they

are therefore used to adapt standard equipment for their own goals. In the case of scanners, they have adapted the feed system of the film, to be able to handle fragile and shrunken films, where deterioration has made the distance between perforations irregular.

Some of the scanners used for restoration of archival films have also been equipped with a WET GATE to allow partial removal of scratches during digitization, as described earlier. Other solutions have also been introduced, such as the use of diffused light in the gate. It is certainly important to eliminate as many scratches as possible in this early phase of the process because, once digitized, a scratch is treated like any other piece of information contained in the original image. For a computer, there is no difference between a wrinkle on the lined face of old Buster Keaton and a scratch on the surface of the image. Elimination of scratches during scanning reduces significantly the time needed for digital restoration and the risk of mistakes by the software (e.g. any unintentional removal of image detail).

Scanners' speed is a point of concern, especially when aiming at a cost-effective workflow. There are scanners today able to scan film at "real-time," that is to say 24 frames in one second, but this is still slower than some traditional printers. Sometimes with extremely damaged films it is necessary to feed the scanner frame by frame. A modified printer for shrunken and damaged film is usually still friendlier than a scanner, and can go through a film with less human intervention.

The use of so-called digital telecines is also possible for digitizing archival film. Here the digital GRADING (discussed in the first part of this chapter in relation to the DI process) is carried out during digitization. This practice has the advantage that a lower BIT DEPTH is needed and consequently the resulting files will be smaller. On the other hand, in this way there will be no room left in the digital format for a further refinement of the colors.

DYNAMIC RANGE is another important factor determining the quality of a scan. The DYNAMIC RANGE is the range of tonal difference between the lightest light and darkest dark of an image. It is governed by the BIT DEPTH at which a film is digitized and is of course influenced by the system performance of the scanner used. The system performance is the overall quality of the scanner, depending on the quality of its components, in particular of the optics, and on the general level of maintenance. Of course, as in all analog processes, and also for digital ones, the critical judgment of the operator defines the quality of the overall result.

Before discussing the software used for restoring the film image, let us already move to the last step in the chain of the restoration in the digital domain, that of the re-recording of the data back to film. This is done using a special printer that provides a function specular to that of the scanner in the

digitization process. Also in this case a machine is used that was not specifically designed for film restoration, although here there is not really a difference in procedure since both for modern productions as for restoration the data is written back on modern film stock. However, one obstacle is created by the fact that every re-recorder is typically pre-calibrated for a limited range of film stocks. In the process of restoration, on the other hand, it is important to have the freedom to choose the type of film stock most suitable for achieving a result as close as possible to the original look. A film stock that gives the best result when reproducing an original film in Technicolor from the 1950s will not necessarily give such good results for a Kinemacolor film of 1912. In a case like this, technical modifications of the equipment become necessary. These kinds of modifications require the creation of specific LOOK UP TABLES (LUT), which are conversion tables used to transfer information between two related systems. The use of LUT is functional to the calibration in the whole digital workflow for post-production of a new film as for restoration of an archival one. Calibrated equipment (scanners, monitors, digital projectors and data-to-film re-recording machines) within the same workflow will display the image exactly as it will end up on screen when the film will be ready.

DIGITIZATION AND RE-RECORDING – UPDATE

Within the technical debate on film digitization for archival purposes, RESOLUTION and BIT DEPTH are still the most frequently addressed topics. By now, most professionals agree that 4K is the most desirable compromise for 35mm film (in particular when the camera negative is still available as a source material). Nevertheless, only archives that can afford the higher costs of scanning at such high RESOLUTION have switched to it. For those archives that already have in-house digitization and digital restoration tools, adopting 4K entails higher costs for upgrading the scanner, longer processing time (rendering, copying, etc.), significantly larger files, and an almost four times larger data storage. For example, a single frame digitized at 2K 10 BIT DEPTH generates a file of approximately 12 megabytes. The same frame digitized at 4K requires approximately 47 megabytes. If one also includes higher BIT DEPTH (for instance 16 as supported by the ACES), the same frame becomes 18 megabytes for 2K and 71 megabytes for 4K. A 90-minute feature film will result in approximately 2.6 terabytes at 2K and 10.1 terabytes at 4K for the image alone.[lxvii]

Currently, only a few studio archives can afford a fully 4K workflow. A case in point is the Sony film archive, which had already started the transition to 4K a decade ago, with the restoration of *Dr. Strangelove*, discussed in Chapter Four. A

number of non-profit archives are now also moving on to 4K scanning (on a selective base) as in the case of Eye and a few other archives.[lxviii]

As digitization in the last ten years has become an integral part of film production and restoration, more manufacturers have started producing scanners that are adaptable, or even fully dedicated, to archival needs. One of the necessary features is the ability to handle fragile and damaged film material without causing further damage while also keeping the scanning time (the time it takes to digitize each single frame separately as the film runs through the scanner) to a minimum. Among these new scanners, two have been widely adopted by archives in the last decade, namely the Scanity and the Arriscan. Developed by the German company Digital Film Technology (DFT) and launched in 2009, the Scanity built on technology that was initially developed for the Spirit Datacine scanner, which had already been used for experimental restorations in the late 1990s. In 2012, DFT was taken over by Prasad, an Indian company with a vast expertise in digital restoration services. Currently, the Scanity is available in 2K and 4K versions with WET GATE and HDR options and can scan 16 and 35mm film.[lxix] Similarly, the Arriscan, introduced in 2004 by the well-established German analog and digital camera manufacturer ARRI, is also available in 2K and 4K for 16 and 35mm film with WET GATE and HDR options.[lxx] Other scanners with archival features are the CTM Perfecta which can scan up to a RESOLUTION of 5K and is available for smaller film gauges such as 8mm, 9.5mm, 17.5mm, and 28mm; the Laser Graphics Director with a RESOLUTION up to 10K; and the Kinetta, available for a wide range of film formats.[lxxi]

An important question that has recently been raised in the field is whether the way we are digitizing films today provides us with sufficient means to preserve all the information we will need once the "original" film-born materials have decayed and we can no longer inspect them. Scanners are geared to capture the image information. At a high enough RESOLUTION, they can also capture the film grain; and, at a high enough BIT DEPTH, they can register most of the color information. But where does that leave the information inscribed in the film CARRIER (the size and shape of the sprocket holes, the scratches on the film base, the shrinkage, etc.)? This kind of information is also very relevant, particularly for film aesthetic and historical reasons. Therefore, a number of research projects are currently investigating new possibilities for more comprehensive digitization processes, as in the case of the earlier mentioned FilmColors and FILMIC projects. For instance, the FILMIC project is considering multispectral film scanning as a promising alternative to current scanning techniques. With this technique, films are digitized in layers, thus capturing a much greater variety of color information than was possible up to now.[lxxii] Other experimental film digitization techniques include X-ray microtomography (typically employed in medical research) for film so heavily damaged it cannot even be unrolled to be threaded through a scanner.[lxxiii] Unlike regular film scanners, these still very experimental techniques could offer valuable

tools for capturing more information about the analog film material, at least as a representative sample.

With regard to re-recording, the digital rollout has caused a steady decline in the recording back to film for projection. Furthermore, archives are only selectively re-recording to film for preservation and projection. As a consequence, the industry has not invested in re-recording equipment. Although such equipment is still available today, the risk in the long run is that re-recording equipment will become obsolete and then archives will no longer be able to re-record data to film. A similar problem may also arise when suitable film stock for re-recording will stop being produced altogether.

Digital Restoration Tools

In the last few years, film archives have resorted to digital restoration more and more frequently. Preservation laboratories working with archives have invested in scanners for high RESOLUTION digitization suitable also for archival films. Some archives, such as for instance Eye Filmmuseum, the Centre national du cinéma et de l'image animée in France and the George Eastman Museum in the United States, have installed software for image restoration and trained their personnel to work with it. Eye Filmmuseum, in particular, has participated from 2000 to 2003 in the project Diamant, co-financed by the European Union within the IST (Information Society Technologies). Diamant was aimed at developing one of the first software packages specifically designed for digital restoration of archival films. Eye Filmmuseum and the project Diamant will be re-encountered in Chapter Three, where they will be treated as case studies to describe one of the possible ways of integrating digital restoration in an archive's workflow.

A variety of computer programs for the manipulation of moving images is available on the market today. But, as with hardware, these products are typically designed for the post-production of modern films, for editing, CGI and GRADING. Only in the last few years, a small number of software packages have been designed specifically for restoration. One of the first computer systems designed for the DI process and initially developed for the task of digital film restoration is CINEON. This complete system produced by Kodak, which included scanning, digital manipulation and re-recording on film, was developed in 1993 for the first digital restoration of a big studio production, namely *Snow White and the Seven Dwarfs* (USA, 1937).[79] In 1997, the CINEON system was discontinued, only the file format CINEON still exists and is commonly used both in restoration projects and CGI productions, along with other file formats such as DPX

(Digital Picture Exchange). Of the digital manipulation software that is used today, there are in particular three software programs that have been designed for archival restoration and are relatively widespread in the field: Correct DRS (Digital Restoration System) produced by the MTI Film, Revival by DaVinci and the already mentioned Diamant by Hs-Art.[80] While there is more restoration software for lower RESOLUTION images aimed at restoration of television content, such as Archangel Ph C. by Snell & Wilcox, all three programs mentioned above are RESOLUTION independent and can be used for images at a RESOLUTION of 2K or higher.[81] It should be noted that most of the commercial software packages are based on academic work as their core routines for computation (algorithms) have been developed within Information Technology research projects. In Chapter Three the case study of Diamant will be discussed. Some of its recent developments are still based on the original research carried out at universities such as at the University of La Rochelle and at Trinity College in Dublin.

The basic functions of software for the restoration of old archive images are: elimination of scratches, elimination of so-called dust (i.e. any type of small stain extraneous to the image content), stabilization of the images, and de-flickering. These functions are based on the analysis of motion inside a scene (to identify and to eliminate scratches and stains), on the identification of an average light level (for de-flickering) and position (for stabilization). For the restoration of colors, another kind of software is usually applied, although some of the tools of the software mentioned above can also be helpful, as will be discussed below.

Most software for digital restoration allows the operator to set a certain number of parameters for each different tool. Of course, the operator can use the manufacturer's default settings as well. Parameters are usually on a scale from conservative to aggressive, where conservative means solving fewer problems in one single rendering session. Apart from the time needed by the operator to define the areas to be restored and, in some cases, to intervene manually with some tools (described below), the processing time is the most time consuming part of the process. Depending on the RESOLUTION at which the film has been scanned, the available processing power and the amount of tools to be applied at one time, the processing time can take up to several minutes for a single frame. A 90-minute film contains about 130,000 frames and to process them all at one minute a frame would take about ninety days of uninterrupted processing, not counting the time needed by the operator to set up the system, check the results and make the necessary adjustments. However, in the logic of Moore's Law mentioned earlier, the processing time will soon become faster, whereas the bottleneck will remain the operator's time.

If the digital restoration of television content is often done on a large scale relying mainly on automated processes, film restoration at high RESOLUTION

must be done counting on an expert human supervision in order to ensure that restoration guidelines are followed. Indeed, although digital restoration allows more intervention than any photochemical process, the aim remains to restore the original look of the film. An operator with no restoration expertise could too easily make an old film look like a new one, for instance in terms of light and color, or stabilize its image to the extent of a rock steady DIGITAL VIDEO. Too much automation, or rather too little human supervision, can also easily lead to the creation of so-called DIGITAL ARTIFACTS, which are new image elements erroneously created by the computer, or existing elements erroneously removed. These may be caused, for instance, by the abusive removal of an image element mistaken for emulsion damage, or by the deformation of the image through the stabilization process. It should be noted that there are also all kinds of DIGITAL ARTIFACTS typical of born-digital images, such as noise and fringing, which must often be addressed in the post-production phase of contemporary born-digital films. These kinds of DIGITAL ARTIFACTS will be restorers' concern in the future when born-digital films will become objects of restoration. It is an intriguing question whether DIGITAL ARTIFACTS typical of born-digital films should be kept or be erased in the restoration process.

The digital tools available in software packages for film restoration are discussed below in relation to the kind of damage they are designed to tackle. These are mainly defects that cannot be solved with traditional photochemical means.

DIGITAL RESTORATION TOOLS – UPDATE

Like manufacturers of scanners, software developers have also started focusing on the expanding needs of film archives due to the increase in digitization and digital restoration projects. New dedicated software has been developed and new tools for digital restoration have been added to the existing post-production software.

In general, the way restorers approach restoration, including the kinds of damages they choose to tackle and the way the digital tools operate in tackling those damages, has not changed over the last decade. But the efficiency of the software and the speed of the processors have improved considerably, allowing restorers to work quicker and with higher accuracy. With increased processing power reducing rendering time significantly, evaluation of the results of the interventions can be done sooner. This also contributes greatly to improving the overall result of new restoration projects.

A recent development in the industry is the combination of several tools into all-round software packages. For instance, software for color GRADING has been

expanded to include tools for stabilization and other image manipulations (as in the case of the Nucoda suite) or for sound editing (as in the case of DaVinci Resolve). These kinds of packages are mainly used by post-production professionals, whereas film restorers generally choose software tailored to specific tasks for film and sound restoration. When possible, restorers apply multiple software tools simultaneously to obtain the best possible solution for each specific problem. Today, some of the most commonly used software by film restorers working in archives or in specialized laboratories are MTI Film DRS, Hs-Art Diamant, and DaVinci Revival, as was already the case a decade ago.

Since software tools for digital restorations have improved significantly in the last decade, a snapshot is provided below, divided according to the kinds of damages the software addresses. This is followed by an additional update covering tools for digital sound restoration.[lxxiv]

SCRATCHES, DUST, AND OTHER SPATIAL PROBLEMS

Scratches deep enough to have removed part of the emulsion, and, therefore, of the image, are mostly caused by wear (for example by running the film through the projector). This kind of damage cannot be corrected via photochemical duplication.[82]

The same is true for almost any other type of physical damage of the emulsion, such as small scratches (bright) or embedded dirt particles (dark), both referred to as dust. Scratches in a color film can be either whitish, if the emulsion has been completely removed, or of the color of the remaining layer(s). (See figure 2 in the color insert).

In all the cases mentioned above a software correcting tool, usually called dust removal, can be very effective. Before applying the dust removal tool, the software needs to carry out a number of pre-calculations, shot detection and motion analyses. With shot detection, the software marks the first and last frame of every different shot. Once a shot is defined, the movement of all objects within the same shot can be analyzed and tracked. The software detects not only moving objects but also camera movements. This analysis is necessary in order to identify and eliminate all and only those elements extraneous to the image. Motion analysis, dust detection and removal tools unfortunately do not work flawlessly. Sometimes elements are recognized as extraneous even if they are part of the image. The greatest problems arise with elements appearing only in one frame, like the sparkle of a jewel, the glare from the sea surface or from lighting, or with elements moving very quickly, such as raindrops and snowflakes. (See figure 3 in the color insert).

Example of a scratch on a frame of a surviving film print of *J'Accuse* (Abel Gance, FR, 1919 – courtesy of Eye Filmmuseum).

These kinds of image elements behave in a similar way to small scratches or particles stuck to the emulsion. Motion analysis identifies them as extraneous and the software tool substitutes them with what it finds in the same area in the preceding or following frame, or in the neighboring area in the same frame. A digital-era legend holds that all the diamonds in the mine of the seven dwarfs were, at first instance, erased during the digital restoration of *Snow White and the Seven Dwarfs* (USA, 1937), the first restoration of a theatrical-released feature film done entirely by digital means. However, software tools are in constant development and one can hope that soon diamonds, snow and all that appear fleetingly on one frame, will no longer be erased.

A different case is that of heavier damage that causes a larger loss of information in the image. For instance, tears on the surface of the film can be physically repaired on the film itself but, even if the two edges are accurately re-attached, they remain visible. Also, splices that have exceeded the space between frames typically invade and alter the image. Similar is the case of cue dots, which are punched-in holes made by projectionists in the top right hand corners of two consecutive frames at the end of a reel, as a signal to start the projector on which the following reel has been loaded. Projection prints that

have been shown numerous times in the course of the years by different projectionists often have accumulated many such perforations. When it is necessary to resort to a projection copy for the reconstruction of a film, cue dots can only be concealed digitally.

For this severe damage it is often necessary to intervene with digital tools that require a much higher level of human control. Typically, two kinds of tools come to hand. First is a paint tool by which the operator can manually paint over the bigger damage using cloned pixels as varnish. The pixels can be cloned from adjacent areas or painted through from neighboring frames. Another way to deal with this kind of extensive damage is by interpolating frames, usually the one preceding and the one following the damaged frame. In this case it is wise to define a so-called Region of Interest (ROI) to be interpolated rather than having the software interpolate the entire frame: this would cost more processing time and would also replace pixels where there is no damage. Compared to the paint tool, interpolation is usually quicker but also less precise.

The case of vertical line scratches, quite common in films that have been damaged during projection, is altogether different from dust and larger scratches, as the damage is often in the same location throughout a length of film. For the software it is more difficult to recognize the scratch in the first place as there is almost no relative difference between adjacent frames. Once

Example of cue dots on a few frames of a print of *De Minder gelukkige terugkeer van Joszef Katus naar het land van Rembrandt* (Wim Verstappen, NL, 1966 – courtesy of Eye Filmmuseum).

Example of line scratch across a few frames of a print of *Rubia's Jungle* (Pim de la Parra, NL, 1970 – courtesy of Eye Filmmuseum).

located, a line scratch can only partially be removed using pixels from neighboring frames, as these will be partly damaged as well. Pixels adjacent to the scratch must be cloned to cover up the missing information.

Damage of a chemical nature can be treated with the same tools discussed above: dust removal for smaller and paint or interpolation for larger ones. Also chemical damage usually causes loss of information in the image. An inadequate preservation of the film, e.g. at too high a temperature or humidity level, can cause the film emulsion to decompose. In this case there may be areas of the image in which the emulsion has "melted" and the image information is lost. Inadequate chemical treatments are equally dangerous: a film that has not been developed or washed long enough can show deterioration in which the image has faded or disappeared. Inadequate preservation conditions can also cause the proliferation of organisms in the emulsion such as fungi and bacteria. In this case, the image will be literally consumed.

When the image loss is particularly pervasive, within the frame, and persistent, throughout successive frames, there is no automated tool that can help and only special software for CGI and COMPOSITING, such as Inferno or Fusion among others, can be used to reconstruct the missing information.[83] In this case a COMPOSITING tool is needed to create lost image elements. The line between restoration and forgery in this case is hard to draw. Such an inter-

Example of nitrate deterioration in the only surviving print of *Die Filmprimadonna* (Peter Urban Gad, DE, 1913 – courtesy of Eye Filmmuseum).

vention should therefore be well pondered and, in any case, properly documented. (See figs. 4 and 5 in the color insert).

All of the above defects can be either in the film to be restored or they could have been duplicated from a previous generation, the original camera negative or any elements in between. Of course, the restoration should make use of the earliest generation element, if still suitable. In the case of a digital restoration, the earliest element, possibly the original camera negative, should be digitized. Unfortunately, in many cases this is impossible, and the best source for restoration is a poorer duplicate that has survived bearing not only the signs of photographic loss due to photochemical duplication but also the signs of all duplicated defects that were present on the source element. In the case of duplicated damage, the digital treatment does not need to be any different.

SCRATCHES, DUST, AND OTHER SPATIAL PROBLEMS – UPDATE

Software that tackles spatial problems such as scratches, dust, and all kinds of image-information loss has been improved in the last years. One aspect that has been addressed is that of facilitating human supervision, which is still essential for maintaining the image quality during the restoration process. Software manufacturers have effectively recognized and realized the need for a more efficient interaction between the operator and the software.

As Eye's Film Restorer Annike Kross points out, it is now easier to intervene more quickly and accurately during projects than it was ten years ago. This is very important, for example, in identifying and correcting those instances in which software mistakenly identifies original-image information as damage. In addition, as rendering has become significantly faster due to improved software tools, restorers can now see the result of what they are doing in (almost) real time when intervening frame by frame. Not only does this speed up the whole operation it also benefits image assessment. By presetting the tools' parameters, which have become more accurate in scope and have increased in number, restorers can more readily rely on the software's automatic mode. For instance, it is now possible to pre-set variables such as the brightness and the size of possible dust. This helps prevent instances in which quickly moving objects are wrongly identified as extraneous to the image. Even so, rain and reflections (for instance on water surfaces) are still problematic as current software is more likely to identify these as dust than as part of the image. Additionally, as Kross points out, restoration software nowadays has better interfaces for visualizing applied changes (e.g. by highlighting the changes made in the image with a bright color). This helps restorers assess whether the results are satisfactory or not.[lxxv]

Robert Byrne, President of the San Francisco Silent Film Festival and independent film restorer, also agrees that digital image restoration has become faster and the tools more accurate, which will ultimately lead to a decrease in the creation of DIGITAL ARTIFACTS. When tackling spatial problems, one of the main challenges is to find information that can be used to replace the damaged or missing parts of the image. However, sometimes damage reappears in the same position, frame after frame (as in the case of line scratches) so that no useful information is available from an adjacent frame to replace and correct the damage. According to Byrne, despite all the improvements, the biggest challenge for film restorers working with digital restoration software is still recognizing and avoiding DIGITAL ARTIFACTS, as it is better to keep an "original" scratch than introduce a new DIGITAL ARTIFACT.[lxxvi]

Digital Film Restoration Supervisor at Cineric Seth Berkowitz agrees with the observations above. He underlines, in particular, the importance of the integration between interactive and automatic processes and how the recent improvements

in this area have allowed for a more effective intervention by the user. According to Berkowitz, motion-tracking tools have also been greatly improved, and, with them, accuracy in the identification and quality of the correction of image spatial problems. Berkowitz typically applies a fully 4K workflow in his projects at Cineric, thus he needs to apply corrections to very large files containing high-RESOLUTION frames. The shortened rendering time of the new digital restoration software has had a significant positive impact on his output.[lxxvii]

An important development in digital restoration of spatial problems in film is the creation of tools to tackle new kinds of born-digital problems such as the aforementioned dead and defective pixels, an undesired result of digital capture that needs to be dealt with in post-production.[lxxviii] These new kinds of born-digital problems are mainly a concern for filmmakers who need to correct them during post-production, but it is also important that they are researched by film archivists and scholars and recognized as inherent to contemporary digital film history and technology.

INSTABILITY, FLICKER, AND OTHER TEMPORAL PROBLEMS

Damage or defects from previous inadequate duplication pose different problems. In most cases an expert can determine whether the defect is indeed produced by a clumsy duplication.

Such an example is that of image instability. All films, especially the early ones shot with manual cameras, have an intrinsic instability, which may have been amplified by duplication. In this case, stabilization of the image during restoration seems a justifiable choice. Many kinds of software are already capable of stabilizing entire sequences automatically, taking a number of frames as a reference to stabilize the others. The result is an average position of the frame. In this case, the degree of stabilization is set by the operator and it is not directly related to the original instability of the film as this can hardly be determined. The restorer has to guess how stable the film might have been originally.

There is also a different technique for digitally stabilizing a whole sequence of images that allows the operator to define a number of specific reference points in the frame to be stabilized (aligned). The reference point should be taken on the frame contouring the image. The frame corresponds to the mask in the camera and it is therefore a reliable original external reference. The frames will be realigned together with the reference points so that the re-obtained (in)stability will then be as true as possible to the original one.

A similar case is that of flickering. Here the instability concerns the lighting of a scene, and is often due to an error in duplication. When frames are more or less bright throughout a sequence, the effect on the screen during

projection is an annoying flicker. This problem can be solved digitally by choosing a number of reference frames throughout the scene that set the target brightness for the rest. The software computes an average lighting between the reference frames and applies it to the rest of the frames. As in the case of stabilization, de-flicker sets an average value, which is not necessarily what it was originally. On the other hand, the amount of original flicker is impossible to establish unless an original element is available where no additional flicker has been introduced by duplication. The de-flicker tool can also be used to correct fluctuation in the colors from fading. This is possible only in case enough reference frames in good shape are available. This is unfortunately not often the case as fading usually affects the whole film. Color fading is further discussed in the following section.

Finally, there are a few more tools that restoration software offers which can be applied on a temporal scale, such as re-grain, sharpen, stretch, and the more typical video tools, de-noise and de-interlace. These are usually not used in film restoration as they intervene in the image by changing its original appearance and this should not be the aim of a film restoration. Re-grain could be applied in case different sources were used for the reconstruction showing a different grain structure. Stretching can be and has been used for producing a sound version out of an originally silent film. As a silent film usually runs at a speed between 16 and 20 frames per second, a number of extra frames must be added to reach the standard of 24 frames per second needed to provide the film with a soundtrack. This is a highly controversial procedure. When a new copy is produced applying the stretching, typically another copy is also made where no stretching is applied. The latter is a silent print to be shown with live accompaniment. In Chapter Four, a number of cases, i.e. *Beyond the Rocks* (USA, 1922), *Matinee Idol* (USA, 1928) and *Zeemansvrouwen* (NL, 1931) where a similar choice has been made, will be illustrated and both the technical and ethical implications will be discussed.

INSTABILITY, FLICKER, AND OTHER TEMPORAL PROBLEMS – UPDATE

For tackling temporal problems such as instability and flicker, digital tools today are rather similar to their predecessors but improved in terms of accuracy and usability. Byrne points out that, even with the improved digital tools, stabilization is still a very time-consuming operation that needs careful supervision by the restorer. Digital tools are quite effective with static images, as in the case of title cards or scenes with a fixed camera angle and a still background, but they become unreliable when there is considerable camera movement. Byrne remarks that at times

the only choice for stabilizing a sequence is to move the entire frame manually to match the position of one object in the frame and repeat this operation frame after frame by hand.[lxxix]

Berkowitz uses different software for spatial problems such as flicker and grain. In particular, he finds that some software can tackle grain management quite successfully. Grain-management tools harmonize the film grain once the image has been restored using information derived from different film sources, each with a different grain structure.[lxxx]

COLOR FADING AND OTHER COLOR ISSUES

One last application area where digital techniques encounter fewer limitations than their photochemical counterparts is that of color. For techniques such as tinting, toning and stencil, used to color black-and-white films from the early 1900s until about 1930, digital technology offers a system of simulation that can give results that are much closer to the look of the original colors than photochemical duplication methods.[84] In particular, for films that are tinted and/or toned, it is possible to digitally recreate the photochemical process known as Desmet method.[85] Here, the original tinting is simulated by flashing (i.e. by exposing the entire frame uniformly to a colored light in the printer) on the new duplicated black-and-white negative the original color; the toning is obtained by duplicating the blacks in an image adding the color of the toned original. (For examples of faded tinted and toned films, see figs. 6 and 7 in the color insert).

The combination of tinting and toning is obtained by applying the two techniques. The Desmet method allows, in the case of tinting, the black-and-white image to be reproduced as neutrally as possible before flashing a color layer upon it. Similarly, in the case of toning, it allows the black parts of the image to be turned directly into the same chosen color as the original chemical toning process did. This method is not only the best photochemical procedure to restore original tinted and toned films but it is also the closest simulation of the original chemical procedure of tinting and toning black-and-white films.[86] Besides Noël Desmet himself, who developed the method at the Cinémathèque Royale de Belgique, a few other preservation laboratories master this technique and apply it regularly for restoration of silent films. Among them there is the laboratory Haghefilm in the Netherlands, further discussed in Chapter Three.

The digital version of the Desmet method is in many ways similar to the photochemical one. It is carried out on the black-and-white image and, only at the end, a color layer is added for the tinting; or the blacks are replaced by

a color value, for the toning. The Digital Film Laboratory in Copenhagen, also discussed in Chapter Three, is probably the first laboratory where the "Digital Desmet method" has been put into practice. Other laboratories, such as Haghefilm mentioned above, have followed.

Digital tools can also be used to simulate, more effectively than photochemical techniques, early so-called natural color systems, such as two-color Technicolor or Gasparcolor or any of the hundreds of color systems that have appeared throughout the history of cinema.[87] Also, modern color films can turn to digital techniques, especially when colors are fading as one or more color components have become chemically unstable. (See figure 8 in the color insert). This problem can be encountered even in quite recent films, as in the famous case of the first *Star Wars* trilogy (1977-1983) that was restored in 1997 after advanced color fading was detected, together with serious mechanical damage.[88]

Only complex, time-consuming photochemical techniques can help in case of severe fading. Such techniques are mastered by very few laboratories in the world and they are extremely costly and not very accurate. In recent years, some fairly successful photochemical restorations of faded originals have been carried out by two North American laboratories, Cinetech, based in California, and Cineric, based in New York City. Some of these projects will be touched upon in the discussion of Cineric and Sony Picture Entertainment archives in Chapter Three. Digital technology, on the contrary, offers new solutions for the restoration of color-faded films. As mentioned earlier with regard to digital color GRADING in current post-production, better reliability and a much higher flexibility are possible, as digital GRADING allows each color component to be altered, red, green and blue, independently from the others. This is indeed the way to reintroduce a faded color component without affecting the others, whereas photochemical GRADING always affects all three color layers.

The biggest obstacle in a color restoration, whether it is carried out digitally or not, is usually the lack of reference for restoring the original colors: in most cases all original elements of a film have suffered the same sort of color deterioration and, as a result, a truthful benchmark for reconstructing the original colors no longer exists. As a consequence, film restorers often need to guess (this should of course be a well-educated guess) what colors are to be restored. In fact, the same goes for other, if not all, aspects of restoration, where the target reference no longer exists or, if it exists, it is in such a deteriorated state that its original appearance can only be conjectured. The restorers' work is based on their knowledge of the historical context from which the work to be restored originates, of the technology used to produce it, as well as the knowledge of the work itself and of its maker(s). Based on this

knowledge, the restorer will finally resort to an interpretation to restore the original look of the work. Since the final result of a restoration is partly based on an interpretation, the act of documenting every choice made along the way is an essential part of process. And it is also the only key to reversibility in film restoration practice.[89]

Indeed, reversibility is one of the fundamental rules in the ethics of art restoration since its theorization in the last century, especially thanks to the work done by Cesare Brandi, e.g. for his fundamental work, *Teoria del restauro* (1963). Brandi argues that a restoration intervention on an artifact should be removable or reversible, as he states that a "restoration should not prevent any future restoration but, rather, facilitate them" (2005: 57). Because film restoration implies making a new copy that incorporates the restoration carried out on the image (e.g. the correction of faded colors or the removal of image damage), restoration intervention carried out on film cannot be reversible. The only way to undo a restoration is to start again from the original film artifact that has served as the source for previous restoration. This can sometimes become impossible over time, as the original artifact may not be suitable anymore. In this case only a proper documentation of the restoration process can facilitate and direct future restorations. In this respect, documentation and *metadata* will be further discussed in the following section.

COLOR FADING AND OTHER COLOR ISSUES – UPDATE

Although the general workflow and the available software are still very similar, the specific tools for resolving color issues have clearly improved in the last decade. In line with the general development in the field, restoration software packages have included some basic color correction applications which can be used for tackling smaller problems; and, with a faster processing and rendering time, color restorers can work efficiently with high RESOLUTION (typically 4K) material.

For simulating early color techniques, such as tinting and toning, the aforementioned Digital Desmet method has become more widely used and its results have improved significantly.[lxxxi] It should be mentioned that analog techniques for recreating tinting and toning effects are still quite practical and can also give very good results. This is certainly the case of the so-called Prague method in which the original tinting and toning techniques are used to simulate the original colors on a black-and-white analog copy of a film (Fossati, 2013 and 2015).

Similarly, in the case of hand-colored and stenciled films, digital restoration has proven to be quite satisfactory in simulating the original tints (or rather those

still present on the nitrate film prints on which such colors were applied in the silent era). In this case, digital GRADING does not only allow for great flexibility in determining each separate color that was originally applied with an aniline tint on a black-and-white image but it also provides a neutral reproduction of the underlying black-and-white image. The latter is difficult to obtain in an analog workflow when stenciled or hand-colored films are copied onto color film stock. Moreover, due to the disappearance of specific color film stock from the market, in particular the Fuji camera negative used for hand-colored and stenciled films, analog restoration of early color films has become a less viable alternative for the restoration of such films (Fossati, 2013 and 2015).

The restoration of later chromogenic color films has become common practice in the field as digital, unlike analog methods, allows restoring faded films more easily and efficiently. For all color restorations, the same tools are used as those used for color GRADING in post-production. As pointed out by Senior Colorist Daniel DeVincent, in the last decade tools have been optimized and new possibilities have been added which are often not necessarily useful for restoration (e.g. 3D and HIGH DYNAMIC RANGE imaging); however, the basis of color GRADING has stayed the same. DeVincent points out that HIGH DYNAMIC RANGE can be useful in scanning film material that has a high density (e.g. prints, FINE GRAINS, duplicate negatives, and color reversals) as it allows capturing a wider color range, providing more color information to work with during color correction.[lxxxii]

FILM SOUND RESTORATION

This section contains a short addition on sound restoration, which was omitted from the earlier editions of *From Grain to Pixel*. Film sound archiving is a very important and vast area of film archival practice; unfortunately, it is still too little discussed. While it would benefit from being studied on its own and this short section cannot possibly offer the adequate space and attention it needs, I would still like to touch upon some of the current trends in archival film sound restoration and mention some interesting projects and recent publications on the subject. I will also refer to recent interviews with professionals commenting on the most advanced film sound restoration tools.

A recent publication that provides a comprehensive overview on film sound technology and film sound restoration practices is the book *Film Restoration. The Culture and Science of Audiovisual Heritage* (2013: 116-125) by film technology expert and researcher Leo Enticknap. Enticknap points out that, due to the dismissal of most analog sound equipment, "[e]xcept on a small scale, using remaining tape stock and principally for cultural or ethical reasons [...] audio remastering for film restoration is now almost exclusively digital" (121). Although digital sound has

been standard practice for a long time now, the theoretical reflection on its advent has been significantly scarcer than for film image restoration.

One of the first scholarly reflections on the practice of film sound preservation and presentation addressing, among other things, the transition from analog to digital, is the forthcoming publication *Film Sound in Preservation and Presentation* (2019) by film scholar Sonia Campanini. In her new work, Campanini analyzes film sound archiving practices from a broader perspective which includes theoretical reflection. While drawing parallels to film image preservation, Campanini underlines aspects that are unique to the presentation and preservation of film sound. Surprisingly, she is one of the first film scholars to do so.

In the last decade, important initiatives by film sound specialists and film restorers have contributed to an increase in the overall awareness and knowledge of film sound and film sound restoration. These initiatives are diverse, from papers and DVDs to lectures, like those by film sound specialists and restorers Jean-Pierre Verscheure (President of Motion Picture Soundtrack Restoration Center at Cinévolution, France); Robert Heiber (President of Chace Audio by Deluxe until his retirement in 2014); and John Polito (Founder and Chief Engineer of Audio Mechanics Music and Sound Restoration) who all regularly present at symposia (e.g. The Reel Thing) and provide demonstrations to students and fellow professionals.[lxxxiii]

Another very important contribution is that of the *Century of Sound. The History of Sound in Motion Pictures* DVD sets, in which former UCLA Preservation Officer Robert Gitt illustrates and discusses in depth hundreds of film sound systems dating back to the late 1800s and leading up to 1975 (Gitt, 2007 and 2015). This kind of documentation, focusing not only on how film sound technologies worked but also on how they sounded is of fundamental importance as it provides film archivists with the basic knowledge to set up an informed preservation and restoration plan of film sound that considers both the historical equipment and the original sound effects.

Recently conducted interviews with Ronald Bosdam (Audio Engineer at Haghefilm Digitaal) and Andréa Seligmann Silva (Audio Restorer at Eye Filmmuseum) confirm that film sound restoration nowadays is carried out almost exclusively via digital means, as indicated by Enticknap. According to sound restoration professionals, the most important new development is once again the improvement of the available tools. Today, film sound scanners and recorders can digitize optical soundtracks from film sound negatives with great accuracy and efficiency (Heiber, 2015).

At Haghefilm Digitaal, Ronald Bosdam uses the German MWA film sound recorder for digitizing soundtracks. And although the MWA recorder can digitize soundtracks from a number of optical and magnetical sources, most projects Bosdam works on require the digitization of positive optical soundtracks, usually

derived from film prints. Indeed, these are often the only surviving film elements.

Similar to image restoration, sound restoration software packages from different vendors offer similar tools. Nonetheless, some film sound restorers work with several packages simultaneously, like Bosdam, who relies on different packages as he finds that each one presents advantages when tackling specific problems.

The final result of sound restoration is usually a digital (sound) which can be combined with the image file(s) in the DCDM. However, there are still archives that, as with film image restoration, require a preservation element on film for the (digitally) restored soundtrack. Bosdam fears that in the future some of the essential equipment for film sound restoration will no longer be manufactured, in particular obsolete digital equipment such as DAT (Digital Audio Tape) and DTRS (Digital Tape Recording System) and recording equipment to recreate optical soundtracks on film, with the consequence that film sound restorers will have to make do with a limited choice of tools.[lxxxiv]

Andréa Seligmann Silva uses the Sondor Resonances soundtrack scanner for the digitization process. This device, whose rights have recently been acquired by the Indian company Prasad, which also owns DFT Scanity film image scanners, uses an image-based technology that can digitize both 16 and 35mm optical soundtracks, negatives included (Heiber, 2015: 19). The Sondor Resonances employs tools to tweak the optical soundtrack to improve its legibility during digitization. Thus, elements such as contrast, brightness, and grain size can be adjusted. It is also possible to record the soundtrack as image, which can come in handy for documentation purposes to keep alongside the sound files. And like so many of her fellow colleagues, Seligmann Silva also works with different software packages for sound restoration as each one offers slightly different plug-ins which can all be useful in different circumstances.[lxxxv]

In Chapter Four, sound restoration will be further discussed in relation to the newly added case study of the restoration of *We Can't Go Home Again*.

Documentation and Metadata

Unfortunately, documentation of film restorations is often insufficient. Only a few restorations have been documented in detail and reports of them have seldom been published and made available to the public.[90] Only a basic form of documentation can be found in most archives' databases where, by comparing information relative to the various film elements stored, restoration work can be retraced. In many cases some basic information on the restoration process has been added to the restored film's catalogue entry. Nevertheless, these

are just fragments of the complete restoration. The main obstacle in creating a complete documentation for restorations is often lack of money, but also the lack of a general agreement on the documentation procedure.

Digital tools can help to change the situation. When films are restored digitally the process' documentation can be automatically produced and linked in the database. Unfortunately, this is not yet the case as most restoration software creates documentation (for instance log files) that cannot be easily interpreted. However, restorers and software producers are collaborating in creating a better way to keep track of digital interventions, as for instance in the last version of the earlier mentioned software Diamant, for which a so-called Restoration Report has been added. Such a report collects information per single shot relative to all the digital tools that have been applied and their relative parameters. This information is an example of metadata, literally data on data. The term refers to all information that is created around an object, in our case the digital restoration of a film.

In the case of films, metadata cover a wide spectrum of information, from filmographic information (e.g. cast and crew or technical information about the film sound, color and ASPECT RATIO) to secondary sources related to the film (e.g. posters, lobby cards or continuity scripts), from documentation with regard to the restoration (e.g. the Restoration Reports mentioned earlier) to users' comments added to an online archive (e.g. YouTube).[91]

Even though most hardware and software systems available today are not yet designed to record and format the metadata in a way useful to the restorer, digital technology could facilitate detailed documentation of restorations in the future. And, the documentation of restoration interventions could be kept as metadata together with the actual restoration. This will require further investments in research and development, though, to tailor metadata management for film restoration purposes.

DOCUMENTATION AND METADATA – UPDATE

In the passing ten years, not nearly enough steps have been taken to improve the documentation of film restoration. Therefore the situation is not much different than described in the earlier editions of this book. Film restoration packages come with documentation tools which restorers mainly use for annotations or in team projects to pass along information among different users. Documentation tools are typically used for practical short-term objectives and are not meant for the long-term documentation of restoration projects or for other purposes. Most packages do offer the opportunity to produce a complete record (or log) of all the

interventions made during a project (tools applied, chosen parameters, etc.) which can be saved in an archive's database to document the digital restoration process. However, it should be pointed out that these records are difficult to interpret and contain too much and too detailed information to be useful as documentation.[lxxxvi]

As was the case with past analog film reconstruction and restoration projects, manually compiled spreadsheets are still the most common way to document film restoration projects. An early example of this kind of documentation was proposed by Koerber in 2000 for the restoration of *Menschen am Sonntag* (DE, 1920), for which a reconstruction based on several source materials was documented. Byrne, likewise, compiles documentation spreadsheets for each project he works on, tracking tools, colors, provenance of different sources, and so on. He also keeps a hand-written journal he saves as a PDF-file at the end of each project containing project data and a summary spreadsheet.[lxxxvii] Berkowitz uses yet another approach to documentation. He believes that an accurate description of the initial problems combined with a detailed record of the quality control analysis at the end result yield a comprehensive documentation of the restoration work.[lxxxviii] Finally, it should be mentioned that professional and academic journals often publish accurate reports of film restoration projects, which serve as valuable documentation even when some of the more technical information cannot be included.[lxxxix]

What has clearly become more urgent in the last decade due to the increased digitization of collections is the need to retrieve an exponentially growing number of digitized elements (data) and information about them (metadata) within archives' catalogues and digital repositories. If information is not properly stored and documented in these systems it is as good as lost. Therefore, the standardization of digital storage and retrieval models is very urgent today, as already underlined in the update to Long-Term Preservation. As stated, the OAIS Reference Model is considered to be the most widely accepted framework for building repositories and organizing all related metadata within the cultural heritage field. Although nowadays more and more audiovisual archives are adopting OAIS as their reference model, an across-the-board standardized reference model is not yet a reality.[xc]

Distribution, Access, and Exhibition

After discussing the role of digital technology in current film production and in the film restoration practice, another area of application should be considered, which is profoundly changing due to digital tools, that of access to the collections. I have chosen to divide access practices into three categories: access for the broader public via reproduction at low RESOLUTION (e.g. video

tape, DVD, online), distribution via film prints or, more recently, via digital masters at high RESOLUTION for cinema audiences outside the archive, and, finally, exhibition of film prints and digital masters for cinema audiences inside the archive. These three categories have also already been proposed by Sabine Lenk in the *Manual for Access to Collections* compiled on behalf of FIAF Commission for Programming and Access to Collections (Lenk, 1997). Note that, when the *Manual* was published, digital access to film collections was not yet a widely recognized practice.

Today, digitization of video originals into digital media is already a common practice in many broadcast archives. The situation is somewhat different for film archives, as has been discussed, since digital media cannot offer a sustainable alternative for long-term film preservation yet. Whereas broadcast archives see digitization and further MIGRATION as a means of preservation and access for video content, film archives still resort to film as the best preservation medium and to digital only as a tool for restoration and access. In the project PrestoSpace, already mentioned earlier and discussed in detail in Chapter Three, broadcast and film archives have found a common ground to discuss their different approaches in the field of preservation and access. Whatever the differences, film archives are also appreciating the great potential of digital media for access purposes and there are currently several initiatives for digitizing parts of film collections to make them available either on DVD or online. A recent example of this is the project *Images for the Future*, which is the result of the collaboration between several Dutch institutions with the aim of preserving and digitizing film and video heritage and making it available online. In Chapter Three this project will be discussed in detail in relation to Eye Filmmuseum.[92]

As discussed earlier, the concept of RESOLUTION is fundamental in the transition from grain to pixel, and with it, the distinction between high and low RESOLUTION. Low RESOLUTION cannot compete in terms of image quality with traditional film. Digitization for restoration purposes should be done at a RESOLUTION of at least 2K. Nevertheless, digitizing at a lower RESOLUTION serves the purpose of making film collections accessible. In the last decade the debate on RESOLUTION has somewhat paralyzed archives. Afraid of losing information, archives have typically refrained from taking any decision on the course to follow with respect to the digitization of collections. The idea that films could be digitized for both high-end restoration and low-end access has led most to wait until the technology could offer the ideal workflow to meet both these goals at once. By now it is accepted that high-end digitization is still too expensive, especially when applied to entire collections, and, therefore, the digitization of entire collections is now being conceived mainly at lower RESOLUTIONS for access.[93]

Relatively high costs and lack of infrastructure for managing a digital library are currently the main factors to slow down digitization in most film archives, also at low RESOLUTION. Undoubtedly online archives like the Internet Archive, discussed later, are showing the way and something is definitely moving in the film archival community. It should, however, be mentioned that complex policies and entangled issues of rights management still make access to audiovisual heritage an adventurous field. Even when the content is digitized, rights issues can often restrict access. In this territory there are still too many differences among national legislations, there is a general lack of transparency and no agreement on how the issue should be addressed. These, and more factors discussed below, restrain film archives today from conceiving large-scale digital distribution and access to their collections.

In the past, film archives have been rather closed with respect to their policy for giving access to and for distributing archival films. More recently, however, enthusiastic, if not fairly a-critical attitudes are emerging. This change is certainly driven by the new means offered by digitization, but is also forced by political pressure for allowing social participation and for creating new revenues.

These contradictory attitudes can be traced back to the traditional ideal of "making available" – a *push* model – and that of immediate on-demand access – a *pull* model, if you wish. Before discussing this notion of (digital) archival accessibility and distribution – what it looks like today, and what it may become tomorrow – it is useful to take a look at how it has emerged and evolved over the years.

Since the early years, archivists have seen themselves as collectors and guardians of forgotten films.[94] Their goal was to protect film heritage, a treasure whose value not everybody could immediately recognize and understand. Archivists have been aware of belonging to an elite, the happy few who could appreciate the importance, recognize the beauty and, most importantly, who could be trusted with the fragility of films. In my opinion, this is the basis for the protective attitude that in the past has made archives difficult to access, even for scholars. This attitude has long been necessary, until the recognition in the recent decennia of archives' institutional role in safeguarding cultural heritage.

The issue of copyrights has also played an important role in limiting the freedom of distribution of archival material, together with the fear of restrictions and financial consequences imposed by rights holders. With the exception of a relatively small number of films, considered public domain, most

films can be collected, stored and preserved in film archives but cannot be shown without the rights holders' permission, let alone be enjoyed in a renewed archival distribution.[95] The situation of copyrights is still quite complex and far from being solved, even though many new possibilities for distribution are emerging with the use of digital technology. These may benefit both rights holders and archives.[96] The consequences of the rights' issue for a film archive are clearly described by Lenk when discussing advantages and disadvantages of publishing catalogues online:

> The relationship between copyright owners and archives is still somewhat legally murky, and the general availability of such information [film catalogues or data-bases] through the 'net' may give rise to an unforeseen problem: when the existence of a print in the collection is revealed, the result may be a move to obtain the rights to it.
>
> This might even lead to an archive having to return a print which it has restored at considerable expense, without any legal means of defence [...]. (1997: 18)

Ten years later the situation has not changed significantly. Although a few archives have made part of their catalogues available online, the large majority still refrains from publishing its entire catalogue since the rights status of many films is uncertain and researching the status of the rights for each title would be too expensive. Today, new possibilities in this respect are being experimented with, as will be discussed later in this chapter.

Although often necessary, the conservative approach of most archives until recent years has clearly prevented archival films from being seen and appreciated by a larger audience. Only since the late 1970s (yet again, the FIAF Congress held in Brighton in 1978 cannot be ignored) have archival films, especially silent films, started to cross archive thresholds, and reach specialized festivals such as Le Giornate del Cinema Muto, Il Cinema Ritrovato, The San Francisco Silent Film Festival and, more recently, the Filmmuseum Biennale. In addition, film studies have emerged as a popular topic in humanities departments, creating demand in the form of curricular support, new researchers, and eventually even an educated public for archival films. At the same time, archives have started to make their programs better known to a larger audience and offer film for inter-archival distribution. Also, in recent decennia new means, both in terms of funding and technology, for film preservation have made it possible to restore and show films that were previously only available as unique and "unshowable" nitrate prints.

Despite the fact that commercial distribution has long been regarded as a dangerous territory, a new and wider form of archival distribution has

started developing as a natural bridge towards new potential audiences. With the growth of most film archives, such as the BFI, the Museum of Modern Art (MoMA), Eye Filmmuseum, and thanks to the strong network of FIAF archives, it has been possible to present film programs not only locally, in the archives' theaters, but also to have them tour other archives and art houses.[97]

With a few years of delay when compared to commercial distribution, film archives have also started new forms of distribution alongside traditional theatrical distribution, namely, videotapes and, later, DVDs. Since the late 1980s and early 1990s many archives indeed offer feature films or compilations of shorts in these forms. Although limited, this kind of distribution has contributed to increase the visibility of archival films for the public.

Both theatrical distribution, through the network of archives, and direct distribution of video and DVD can be defined as a *chaperone model* of distribution.[98] The archival films in these cases are brought to the public with the archives acting as a chaperone to show the way and, at the same time, protect the films and their content. In the chaperone model, archives present film programs as selections, often with the use of explanatory titles or with an accompanying catalogue that explains and justifies the archive's choice and contextualizes the films either historically or aesthetically. In the case of DVDs, the chaperone model is realized through the use of interfaces that offer an interpretation key to the viewer.[99]

This model is based on the notion by the "expert" that a contemporary audience needs help for understanding old films. This seems relevant when considering the enormous differences in cinematographic traditions and visual cultures between the contemporary public and that of the time when the films were produced and shown for the first time. On the other hand, in the chaperone model, the archive, by mediating the viewing experience, stands in the way of a direct and spontaneous appreciation of historical films by the public.

In a media culture such as the one taking shape today, in which large and hardly defined audiences are being replaced more and more by individual users, the chaperone model does not seem to be appropriate anymore. Although it can still be useful for educational purposes, it should also allow for alternative and more open distribution and access modes.

Although it is only a recent phenomenon, the growing demand for archival content by a larger segment of users seems to be insatiable. The demand is not only coming from researchers, but also from students (also of disciplines other than film or media studies), found-footage filmmakers and artists, and from other users on the Internet. Today's audiences, or better users, demand a direct access to content. They do not want content to be solely brought to them within a traditional distribution push model. They also want to be able to grab it, tap directly from its source (pull model). Consequently, new systems

of content distribution, like YouTube, are being invented to satisfy and further stimulate this demand.

An example of how these new ways of content distribution operate is offered by Chris Anderson in his article *The Long Tail*, published in *Wired* in 2004.[100] The Long Tail model comprises a worldwide distribution system in which the current, relatively small number of mainstream hits – the head of the demand curve (the blockbusters, in film terms) – is substituted by a large number of niches – the tail (the art film, but also the archival film). Thanks to the new ways of online distribution this system is becoming economically viable. The need for a large number of people in one place (the film theater) to justify high production and distribution cost, is replaced by the need to satisfy the largest number of individual users spread world-wide with (cheaper) niche products.

Also, it seems to be possible to tackle the complex rights issue. In this respect, the recently developed Creative Commons license offers a very interesting alternative to traditional copyright legislations.[101] Many archives look at Creative Commons because it facilitates distribution (especially online), keeping some of the original rights intact, but at the same time stimulating creative re-use of content. An example of an ambitious archival project that intends to use the Creative Common license, where possible, to make hundreds of thousands of hours of video, film and audio content available online, is the Dutch project *Images for the Future*, mentioned above and further discussed in Chapter Three. The example of the Internet Archive will be discussed below as one of the first online archives making use of Creative Common licenses.

While the conflict between protectionism and openness is getting more and more visible, archives, often pushed by funding entities and by the growing demand of users, are quickly adjusting to this new phenomenon. This conflict can be seen as a renewed version of the half-century-old dispute between Henri Langlois and Ernest Lindgren. While Langlois, the legendary co-founder and first director of the Cinémathèque Française, is traditionally associated with a policy of "showing" as many films as possible from the archive (whatever their physical condition was), Lindgren, first Curator of the National Film and Television Archive, is remembered as the man who put film preservation before everything else, including exhibition.[102]

Although large-scale digitization projects of film collections have been extensively discussed in the last ten years by many archives and some of them are ongoing, archivists are still struggling with the questions regarding the kind of access that should be granted to their users once the content would be available in digital form. In other words, the question is whether film archives will move on from the chaperone model and let go of their collections, acknowledging the new role of the users.

The example of the Internet Archive is quite striking when compared to traditional film archives.[103] The Internet Archive is a non-profit organization founded in 1996 in San Francisco with the purpose of offering access to historical collections in digital format. The Internet Archive collaborates with institutions such as the Library of Congress, the Rick Prelinger Archives and the Smithsonian. Its collection includes texts, audio, moving images, software and web pages. Although its main goal is to prevent born-digital material from disappearing, this online archive also offers free access to a large amount of digitized (film-born) material, including archival films, also from the silent era. Found footage, newsreels, shorts, as well as feature films can be streamed or downloaded in various formats (e.g. MPEG1, 2, and 4, Cinepack and Real Media). All kinds of material from new to early films can be found there – examples stretching from Georges Méliès' *Le Voyage dans la lune* (FR,1902) to George A. Romero's *Night of the Living Dead* (USA, 1968). All content is offered under Creative Commons' licenses, which, depending on the status of the material, can be public domain or in agreement with the rights holders. In the case of film-born content, the image quality and the available information regarding the source material that has been used may vary greatly. When the Library of Congress makes a film available, for instance, it is possible to find out if the original material has been properly preserved, and other sorts of information about the original film print are made available, but this is not the case for all archival material. So, compared with traditional archives, the Internet Archive represents a novel form of open and free access to content for the users. On the other hand, it should be noted that this brings with it also a lack of a clear and crucial link to the original film, in the case of digitized film-born films.

Also in the traditional film archival field there are more and more examples today of archival distribution of films on a relatively large scale. The use of digital technology for restoration, as discussed in the second part of this chapter, provides the means to restore more in terms of image reconstruction, and it also provides a high quality master for all possible digital formats, from HD to streaming formats. However, the kind of distribution that these films have experienced is quite similar to the already existing form of archival distribution used for traditionally restored films. In theory, digitally restored films could be offered online to viewers/users, but this is still rarely the case. Only a few exceptions can be found on a limited number of film archives' web sites where samples of the collections can be viewed (but can rarely be downloaded) at low RESOLUTION.

One may wonder why (non-profit and publicly funded) archives still tend to protect their content, even when it could be offered freely to users in a digitized form. Is it only fear of copyright issues? Or is it the notion discussed

earlier that these films need a chaperone to be escorted to the users? Or is it rather the archives' fear of losing their *raison d'être*? All these reasons apply, together with others, such as the lack of know-how and experience with digital technology, as well as the added costs.

As an archivist, I think that by combining the archival distribution of the films in a chaperone model with free accessibility of their collections online, film archives would not lose their *raison d'être*.

Both models described above are necessary and desirable for the future visibility of archival films. But it should not be a matter of choice between the two. In fact, they are two faces of the same coin. On the one hand, the chaperone model for archival distribution guarantees a secure and proper preservation of the films; without it online accessibility would not even be possible. On top of that, it does provide today, still, the *raison d'être* of film archives, specifically to their (specialized) public and their funding entities. It is, however, the online archive that allows for a visibility to a larger, contemporary audience: today's users, who demand direct access to content. Both "distribution" models (if the term distribution still applies) thus feed one another when open, online access can create new, varied, and specialized audiences, as well as new practices based on the creative re-use of, or inspiration by archival material. It is the combination of these two models that will grant a true new life to archival films in the future.

DISTRIBUTION AND ACCESS – UPDATE

In terms of distribution and access there have been a few important developments. In particular, archives are increasingly in the habit of making their collections accessible to the public, for instance, by making them available online. Recent developments such as high-end digitization becoming less expensive and the faster-paced process of digitizing the archives' holdings have made this possible. What has not changed, unfortunately, is the copyright issue, which prevents film archives from realizing the kind of open access to the archival collection that many in the field wish for.

It is important to mention that digitized titles are but a small fraction of those held by film archives, let alone by all audiovisual archives. For instance, during the large-scale preservation and digitization project *Images for the Future* (2007-2014), a unique project in terms of manpower and capital investment, Eye Filmmuseum managed to digitize about 20 percent of its entire film collection (i.e. approximately 10,000 of its 50,000 titles).[xci] The current rate of Eye's digitization efforts, since the *Images for the Future* project has ended, is much lower and amounts to

a couple of hundred titles a year.[xcii] During the more recent project *Unlocking Film Heritage* (2013-2017), BFI digitized 5,000 film titles of their collection, which, with a total of 150,000 titles, is significantly larger than the collection held by their Dutch colleagues.[xciii] These numbers show that there is still very little film heritage that is available in digital form and even more so in those countries where film archives need to operate on tight budgets. In many cases, archives cannot afford to purchase digitization equipment and can only outsource the digitization work for a small number of selected titles. Today's abundance of online footage tricks many into thinking that most of the film heritage has been digitized and made available to the public. Unfortunately, this is still far from being the case.

Of all the audiovisual archives, perhaps the Hollywood studio archives are the closest to having digitized their entire collection.[xciv] This is not only because studio archives tend to have more (financial) means but also because they typically control the licensing rights of their collections.

Copyright is still a major obstacle to large-scale digitization as not much has happened to improve the situation in the last decade. So, for instance, after the *Images of the Future* project, only slightly more than 2 percent of the overall digitized content (including films and videos held by the two audiovisual partners Eye Filmmuseum and Netherlands Institute for Sound and Vision) could be made available online for the general public.[xcv]

In an effort to find a new approach to copyright legislation for audiovisual works, a new EU directive was issued that deals specifically with Orphan works (i.e. works whose right holders are untraceable). The new EU directive permits archives to make Orphan works accessible after a so-called diligence search has failed to retrace possible right holders.[xcvi] Following up on the adoption of this EU directive by a number of European countries, the Association of European Film Archives and Cinémathèques (ACE) launched the project FORWARD aimed at setting up a procedure for compiling national registries of audiovisual Orphan works.[xcvii] For a recent analysis on the copyright situation in relation to film archival holdings, I would like to recommend Claudy Op den Kamp's book *The Greatest Films Never Seen. The Film Archive and the Copyright Smokescreen* (2018), which is a very welcome attempt at bridging the gap between the copyright and film archival perspective.[xcviii]

Film archives today still rely on the network provided by the International Federation of Film Archives (FIAF), which facilitates the loan of material among member archives. The only remarkable recent change is that, in addition to film prints, loan items also regularly include DCPs for exhibition purposes within thematic programs, retrospectives, or specialized festivals. Besides the more recent online platforms such as Vimeo and YouTube, or streaming services like Netflix and Amazon Prime, the distribution of archival films through DVDs and Blu-Rays is still a viable channel within the archival field. However, it should be pointed out that streaming

services offer an extremely limited choice of archival content, usually offering but a small selection of well-known Hollywood classics acquired from studio archives. While other online services such as Hulu, Mubi, Criterion, and Fandor provide a much larger selection of archival content, the films on offer still mostly consist of classics and *auteur* cinema.[xcix]

In terms of access, a recent interesting development in the film archival field has been the experimentation with new alternative platforms to promote interaction (especially through on-site exhibits and installations) and re-use (through online platforms) of digitized film collections.

Building on the idea of an immersive panoramic display of digitized and/or virtual cultural heritage, a number of very inspiring projects have been realized which make use of audiovisual archival material.[c] These projects include installations such as the T-Visionarium, an immersive installation that allows interaction with 3D audiovisual content, and other projects such as the ones realized by scholar Sarah Kenderdine and new media artist and researcher Jeffrey Shaw.[ci] In recent years, a number of film museums have exhibited similar kinds of installations to engage their audiences with their collections through digital immersive tools. For instance, at the Australian Centre for the Moving Image (ACMI) in Melbourne, the *Screen Worlds* permanent exhibition, launched back in 2009, mixes educational installations with commissioned artworks with the common goal of engaging audiences with old and new audiovisual media in immersive and interactive ways. Similarly, since reopening in 2011, the Museum of the Moving Image in Queens, New York, has exhibited the *Behind the Scene* core exhibition which brings together interactive educational installations with immersive commissioned artworks. Another example is that of the *Panorama* exhibition at Eye Filmmuseum in Amsterdam, with its interactive works and a 360° immersive installation that showcases 120 years of cinema through film fragments drawn from the collection since 2012.[cii] Finally, I would be remiss not to mention one of the earliest examples of immersive exhibition held at the Museo Nazionale del Cinema in Turin, which was launched back in 2000. While the original exhibition did not focus on interactivity, its immersive character and the spectacular use of the interior of the landmark-building Mole Antonelliana still leave a lasting impression on visitors and fellow film museum curators today.

Additionally, in the last decade a number of noteworthy online projects were realized that made use of archival material to allow new forms of access and re-use. These examples span from platforms where users could edit archival film fragments by choosing themes and keywords, as in the case of the Scene Machine developed by artists Dima Stefanova and David Lammers, to the online competition *Celluloid Remix*, where filmmakers were invited to use archival fragments to edit new original films that were eventually assessed and awarded by a jury in a live event. Both initiatives were launched in the framework of the project *Images for the Future* and

have been discussed in a number of academic papers (Fossati, 2012b; Groo, 2012; Ingravalle, 2015). A more recent example is the Jan Bot project in which filmmakers Bram Loogman and Pablo Núñez Palma have integrated an algorithm that combines found-footage fragments based on real-time online trending news.[ciii]

Meanwhile, in academic research, a number of projects are being carried out that use digital means to study digitized film archival content in original ways. These kinds of projects, often associated with the so-called Digital Humanities, rely on fruitful collaborations between media scholars, film and media archivists, and data scientists.[civ]

EXHIBITION

Whereas film archives have moved on from a conservative to a more open attitude regarding the use of digital technology in the fields of restoration and access, there is still a strong resistance in accepting digital as an alternative form of exhibition.

Digital projection at high RESOLUTION (the only kind of digital projection whose quality is comparable with that of film projection) is in many ways not a viable option yet, as discussed earlier. Projectors are too expensive and technology is still developing too rapidly, resulting in a lack of standardization, and, thus, in high risks.

However, apart from technical aspects, there is another important argument for archives not to use digital projection for exhibition. If preserving films as such is one of the film archives' primary task, preserving the practice of film projection, and its related viewing experience, is perceived as an equally important task. For many film archivists, indeed, projecting a (digitized) film-born film through a digital projector means betraying its original form. This is no surprise since the FIAF code of ethics explicitly states that only a duplicate on film, in the original format, is to be considered a preservation master (FIAF, 1998).

Also, a number of film archives' curators, such as Paolo Cherchi Usai, Alexander Horwath and Mark-Paul Meyer have at times in different ways underlined the aspect of "authenticity" that only the projection of a film can provide. Taking their argument even further, authenticity is fully experienced only when an original (vintage) print is projected, as Meyer stated:

> In 1994, the Bologna archive film festival 'Il Cinema Ritrovato' presented Hitchcock's *The Man Who Knew Too Much* (1956) in its original format: a Technicolor VistaVision print (with its exceptional ratio of 1.96:1 and horizontal transport mechanism with eight perforation holes per frame) with Perspecta Stereophonic Sound. This presentation created an unpar-

> alleled cinematographic experience. An interesting part of this aesthetic experience was undoubtedly the experience of authenticity. The wear and tear on image and sound were of no importance and even contributed to the quality of the aesthetic experience. Compared to the print which was re-released in 1983 this 'original' print was a revelation and one felt privileged to participate in this event. (Meyer, 1996: 13)

This argument, which will be further discussed in the next chapter in relation to the proposed "film as original" framework, will gain a different relevancy when commercial film theaters switch to digital projection and new "films" will be completely digital. At that time film archives will have to introduce digital projection to remain true to new "digitally- born" films. And they will then become the only place where the projection experience for "film-born" films will be preserved. As put by Martin Scorsese:

> The issue is what we've all been talking about: the death of cinema – the idea that eventually, at some point, in a hundred years from now if we're still around, the last film projected on a big screen might be [only] in a museum somewhere. [...] There's no doubt I'm an older advocate of pure celluloid, but ultimately I see it going by the wayside – except in museums, and even then it [could be] a problem.[104]

As we will see in Chapter Three, there are cases like the Danish Film Institute and like Hollywood studios' archives such as Sony Picture Entertainment, which have already adopted digital projection as a way of exhibiting film-born and digitally restored films. One recent example is the digital restoration by Sony of *Dr. Strangelove* (UK, 1964), discussed in detail in Chapter Four.

EXHIBITION – UPDATE

While there was still a clear preference for analog projection within film archives ten years ago, today digital projection is widely accepted. In the last decade, most film archives purchased digital projectors that are now used alongside analog film projectors. Furthermore, archival festivals nowadays often combine analog with digital projections. Having the benefit of hindsight, we know that the 2012 digital rollout was a decisive factor in making film archives become one of the few venues today where one can still watch an analog film projection. Yet, there are many who predicted this outcome. Among them, Martin Scorsese, who remarked back in 2005: "There's no doubt I'm an older advocate of pure celluloid, but ultimately I see it

going by the wayside – except in museums [...]"; and film archivist David Francis who, in 2008, stated that "[...] people will be coming to the filmmuseum to see a film projected in ideal circumstances, and it will get an aura about it, the same sort of aura you get when coming to see an original Goya" (Cherchi Usai et al., 2008: 21).

While the question of whether audiences deliberately choose to go to film archives to experience analog projections has not yet been researched, the case of *The Hateful Eight* (USA, 2016) discussed in the update to DIGITAL CINEMA seems to show that, given the choice between an (70mm) analog projection and digital projection, many people still prefer the experience of the former.[cv] This remains a specific case but can also be considered an example of the earlier mentioned "material turn" and of the interest in experiencing pre-digital technology at a time when such an experience is becoming increasingly rare. This trend also manifests itself in the increase of art-house cinemas that offer analog projections.[cvi]

The film archives' goal of preserving historical film projection technologies and practice seems more relevant than ever. Such a responsibility lies mainly within heritage institutions now that the industry has moved on to new technologies and practices. Archives not only preserve historical projection equipment but also generally have the in-house expertise to operate them. Moreover, they hold large collections of analog films that can be projected as such. Furthermore, they still selectively choose to create new film prints (after analog, digital, or hybrid restorations) of films that they consider should be projected analogically for film aesthetic or historical reasons. As discussed in the updated Introduction to Chapter 1.2, this is often done with silent and experimental films as only analog projection allows for the correct frame rate (in the case of silent films) and the fulfillment of the author's intent (in the case of some experimental films).[cvii]

Finally, a recent research project by film scholar and former film restorer Guy Edmonds should be mentioned here. Edmonds' project aims at comparing different projection technologies, in particular the analog and the digital, and examines how they affect our perceptual and cognitive response. By using electroencephalography (EEG) to monitor electrical brain activity, Edmonds' empirical research seeks to describe the cinema-viewing experience through different technologies (Edmonds, 2016).

As in the case of film production, a picture of a practice in transition emerges also within film archives, characterized by a high degree of hybridization between analog and digital. The developments in film production inevitably push film archives to adapt to the changing technology. On the other hand, the new possibilities granted by digital media spur film archives to rethink their practices, their goals and, more generally, their role.

In regard to long-term preservation, although film archives still do not consider the digital as a viable alternative to film for film-born artifacts, they are starting to contribute to the development of a reliable digital storage system as new films are more and more often born-digital. Indeed, as DIGITAL INTERMEDIATES are already entering the archive, the need for a long-term digital storage solution has become an urgent one.

With respect to film restoration, digital tools have proven to be very effective, already, allowing restorers to obtain results that were unthinkable with photochemical means. These are also becoming more reliable and restorers are increasingly resorting to them. Digital restoration can also speed up and strengthen documentation of interventions, thus enhancing traceability and reversibility of the restoration process. Last but not least, the rapid growth of digital archives, such as the Internet Archive, is pushing traditional film archives to rethink their tasks, their practices and their relation with the users.

What has happened in the last fifteen years within film production and within the archival field is just the beginning of an even greater change to come. Although nobody seems to doubt that the direction of this transition is towards the digital, where it will lead is still unknown. Similarly, these many changes on all fronts of film archival practices are paired with new questions for film archivists (e.g. when and how to apply digital restoration). These new questions have a direct bearing on the assumptions an archive has with regard to film's nature. Although all the technical choices discussed in this chapter have a direct relation to costs (e.g. digitizing at 2K costs much less than digitizing at 4K and this will be true also if in the future the choice is between 6K and 8K), there is an equally strong relation to the film archive's assumption on what film is and how it should be dealt w ith when restored. Choices such as digital or photochemical restoration, the parameters for digitization (e.g. RESOLUTION and BIT DEPTH), the extent of restoration (e.g. the extent of application for a scratch removal tool or the criteria for color simulation when all surviving references are heavily faded) and the modes of exhibition (i.e. film or digital projection) are all related to the film archive's (changing) assumptions about film's nature.

It is from this perspective, with film in transition from photographic grain to digital pixel, that questions on film ontology gain a renewed relevancy. Different assumptions about what film is, lead to different approaches to what film is becoming and, consequently, to what film archives should become. Such approaches are visible in the everyday practice of film archives but are not based on a conscious theorization. And the opportunity to come to such a theorization is limited by the lack of a systematic dialogue with film and new media studies. The current transition offers both archivists and theorists a

unique chance to bridge the theoretical discourse on film with the reflection on film archival practice.

The following chapter intends to grasp this opportunity and starts by addressing the discussions within film and media studies that are relevant for the film archival field, and by elaborating on conceptual tools that can be derived from the theoretical discourse. These tools will form the basis for my new theorization of archival practice.

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CHAPTER TWO

Theorizing Archival Film

In this brief introduction, I would like to explain why I think the theorization proposed in this chapter is still relevant a decade after it was originally formulated and why I decided to add a new "film as performance" framework (Fossati, 2012a).

Over the last decade, the interest in film archives has increased significantly. Due to the growing number of digitization projects, film archives have increased their (online) visibility, which has made them interesting partners for online services offering audiovisual content. At the same time, the recurrent dialogue between archivists and scholars has stimulated academic interest. New gatherings are being organized which target both archivists and scholars (e.g. the annual Eye International Conference, The Nitrate Picture Show at the George Eastman Museum, the International Conference on Colour in Film at BFI, Toutes les memoires du monde at Cinémathèque Française), and previously existing festivals and gatherings focusing on archival films are becoming more and more popular among scholars and archivists alike (e.g. the Cinema Ritrovato, Le Giornate del Cinema Muto, the San Francisco Silent Film Festival, the Orphan Film Symposium, To Save and Project: The MoMA International Festival of Film Preservation, Zoom Arrière at the Cinémathèque de Toulouse, the AMIA Conference).

As mentioned in the new Introduction to Chapter One, numerous books and journal essays by scholars and archivists have been released which reflect on film archival practice. Additionally, a growing number of research projects have brought together scholars and archivists in an effort to gain more insight into film collections using new technologies. Some of these projects, such as the FilmColors and FILMIC projects, have already been mentioned in Chapter One; others, such as the Media Ecology Project and the Sensory Moving Image Archive project, will be briefly discussed in the update to the Conclusions.

However, there is still room for improvement. Because, while the dialogue between film archivists and scholars has certainly increased and is being recognized

as valuable to both fields, the shared vocabulary and conceptual tools need to be further refined and supported. As it stands, the interaction between researchers and conservators within fine art disciplines is still significantly closer than in film.[cviii] This is of course related to its long tradition of fine art conservation, which was already an established discipline in the nineteenth century, whereas the recognition of film archiving as an academic discipline is still very recent; the first academic programs devoted to film preservation having started in the 1990s. Over the last fifteen years, such programs have multiplied worldwide in an interesting parallel with the discussions around the "death of cinema" in connection with the digital turn.[cix]

With the emergence of film archiving and preservation programs and the training of a new generation of film scholars and archivists, the discussion on film materiality and its preservation has opened up new lines of inquiry and perspectives. Nonetheless, I think that for most scholars today the *archival life of film* is still insufficiently transparent and accessible. Ostensibly, many of them rarely perceive the *archival life of film* as relevant to their teaching and research within traditional film and media studies approaches (history, theory, textual analysis, etc.).

Furthermore, I believe that mass digitization, while making more and more content accessible, is simultaneously increasing the distance between scholars and the material film artifacts held in the archive. Many scholars appreciate a larger and easier access to archival holdings through digital means but do not necessarily question how the digitization process has affected their object of study. On their end, film archivists have more and more responsibilities; however, in order for them to ensure new means of digitization and access, activities such as the documentation of restorations are rarely a priority, as discussed in Chapter One.

Despite widespread digitization, it seems the concept of "original" remains central to a theorization of film archival practice. Furthermore, I still stand by my statement that:

> [F]ilms today are hybrid, being produced at the same time analog and digital. Although new films may perhaps become all digital soon, film-born and hybrid-born films (i.e. films from the analog past and films made during the transition) are destined to a perpetually liminal status. As material artifacts they are both analog and digital (e.g. the nitrate film stored in the archive's vault and its digitization stored on a server and available online); as conceptual artifacts they are both the historical artifact and the historized one (e.g. the nitrate film and its reenactment via a digital projection). Hence the urgency of formulating a theory of practice *in medias res* of this technological transition. (page 151)

For these reasons, the frameworks and concepts proposed a decade ago, when the transition was just about to reach its tipping point with the digital rollout in 2012,

are still valid today. As I stated back then, film was characterized by its transitional nature and in many ways it still is. "Transition as I understand it here is not the defined path linking A [analog] to D [digital], it is rather transition in itself, the very in-betweenness" (page 181). One could even contend that "in-betweenness" is an integral part of the discourse as the 120-year-old film heritage consists of all kinds of film, be it analog, hybrid, or digital.

In this chapter, I propose four frameworks – "film as art," "film as original," "film as *dispositif*," and "film as state of the art," respectively – as a basis for theorizing film archival practice. In this new edition, I am including a fifth framework, "film as performance," as a means to capture the performative dimension of film. And while, unlike music, it cannot be categorized as allographic, to use Nelson Goodman's (1976) term, one could argue that every new projection of the same film is undeniably a different performance in terms of versions, musical accompaniment for silent films, (theatrical) settings, and technological apparatus. In addition to other important contributions to the discourse (Hediger, 2011 and Flueckiger, 2012), it is my belief that this framework could provide theoretical tools which will further enhance and stimulate the discussion around film archival practice.

THE SCHOLAR, THE ARCHIVIST, AND THE FILM

In this time of technological transition from analog to digital film, along with changing practices, different perspectives, expectations and demands are at play. Scholars are re-evaluating the object of their study and archivists are rethinking the aims of their work. Both are questioning the nature of film and how film is changing while moving from grain to pixel. It is precisely at this time of transition that the dialogue between scholars and archivists can be particularly valuable for both theory and practice.

However, although both film archivists and film scholars are dealing with similar dilemmas, the dialogue between them is limited. In particular, archivists are quickly discouraged by theoretical approaches that seem far away from their practical concerns and scholars are suspicious of practice driven by compromises. As a result, scholars often neglect film as material artifacts, and archivists work with little reference to theoretical frameworks derived from academic research. As film theorists today can rightly pose the questions:

> What is left, then, of cinema as it is replaced, part by part, by digitization? Is this the end of film, and therefore the end of cinema studies? Does cinema studies have a future in the twenty-first century? (Rodowick, 2007: 8)

The same questions can be rephrased and posed by film archivists:

> What is left, then, of film as it is replaced, part by part, by digitization? Is this the end of film, and therefore the end of film archives and museums? Do film archives have a future in the twenty-first century?

Answers that address both questions are rarely attempted. There is very little theoretical work in the field of film and media studies with explicit reference to archives and archival practice. In a way, reading film and media literature one might think that the materiality of film, the significance of film as material artifact, has very little importance for theory, and that the objects of the scholars are not necessarily the same of the archivists.

There are a few important exceptions to this lack of dialogue, as a number of seminal works have been inspired, in one way or another, by the already mentioned FIAF Congress held in Brighton in 1978. Two decades later, the Brighton Congress has gained an almost mythical status in the field, in part because it inspired a new stream of studies by scholars such as Elsaesser, Gunning, Gaines, Uricchio, Gaudreault, Kessler, Verhoeff, Peterson, and others.[105]

As Thomas Elsaesser pointed out in his article on "The New Film History" (1986), by the second half of the 1980s a new wave of historians had brought about a new way of approaching film history. The Brighton Congress has undoubtedly been a determining factor for this development and has led to an unprecedented access to films and related sources from the silent period, bringing the "dissatisfaction with the surveys and overviews, the tales of pioneers and adventurers that for too long passed as film histories" to an end (Elsaesser, 1986: 246). The Congress also led to unprecedented collaborations between scholars and archivists, and, in Uricchio's words, it "gave novel stimulus to the distribution of archival films, but first of all to its restoration" (2003: 29-30).

Indeed, with the first large preservation and restoration projects financed in the 1980s, archives have become more open to the public and to researchers in particular.[106] It is in this decennium that a few attempts have been made to suggest a theory of film archival practice.

It should, however, be noted that the collaboration between archivists and scholars inspired by the Brighton Congress has been mainly in the field of film history. The "novel stimulus" to film restoration is of particular importance here. As Uricchio also points out, interpreting archival films based on their restorations can be somewhat dangerous:

> In a move not without serious conceptual dangers, this historical perspective effectively enabled the translation of historical insights and

> interpretations into historized artifacts (i.e., re-constructed or restored films), closing the loop between interpretation and text. (2003: 30)

The "serious conceptual dangers" mentioned by Uricchio, and appreciated by most scholars and archivists, have rarely been addressed in a programmatic discussion.[107] Indeed, as argued by Uricchio, archived films in general and their restorations in particular, are first of all "historized artifacts." Restorations of archival films are not original film artifacts shown for the first time to an audience, but, conversely, artifacts that have been historized both on a material level (e.g. the film has been damaged by projection and chemical instability is causing decay), and on a conceptual level (e.g. the film is a product of its own time as the people who restore, study, and watch it). What is missing in my view are some of the conceptual tools that can help archivists and scholars to recognize the "conceptual dangers" interwoven with film artifacts and their restorations. The *archival life of film* needs to be opened to the academic discussion, especially now that it is dramatically changing with the advent of new digital means.

In a theory of archival practice the film as artifact, in its different possible meanings, is central. In this work the term artifact is used in two different definitions, the material and the conceptual. The material film artifact is typically the film preserved by the archivist, whereas the conceptual film artifact refers to its abstraction as an historical and aesthetic object.[108] The dichotomy between material and conceptual artifacts plays an important role also within the archive and manifests itself in the tension between the preservation and the exhibition practices. Such tension has always been present in film archives' tradition (think of the dispute between Henri Langlois and Ernest Lindgren mentioned earlier), and it is at times embodied by the figures of the Programmer and the Conservator within the same film archive.

In visual arts the material artifact and the conceptual artifact would not easily be thought in separation (when discussing Leonardo's *Last Supper* there is no doubt that the fresco in Santa Maria delle Grazie in Milan is the artifact in discussion). Film has a different status because of its inherent reproducibility. Also, because of its performative dimension as a projection, it is more similar to performative arts (when discussing a theatrical performance of *Hamlet*, Shakespeare's handwritten manuscripts are usually not the artifacts in discussion).[109] If compared to art restoration and to the academic reflections around it, film restoration and media studies have never been closely related. As pointed out by Mark-Paul Meyer, the limited academic interest for film restoration practice is particularly striking when compared to the lively academic debate taking place among art scholars every time a painting undergoes a restoration (1996: 18-19). Only the restoration of titles like *Metropolis*

(DE, 1927) or *Napoléon* (FR, 1927) attract attention and stimulate discussion, while hundreds of less celebrated titles are restored every year, unnoted. Archivists seldom provide accessible documentation about these restorations and academics seldom ask for it.

These considerations, besides underlining once more the lack of dialogue, lead to the question of whether film, with its restorations, is comparable to other arts at all. The issue of "film as art" has been pushed forward from the 1910s by film theorists onwards, starting with Ricciotto Canudo and his manifesto *The Birth of the Sixth Art* (1911), as well as by pioneers of film archives, within the *cinémathèque* tradition sketched earlier. This issue plays a central role in the discourse on film ontology and it will be proposed later in this chapter as one of the relevant frameworks for theorizing archival practice.

Formulating a theory of archival practice in a time of transition to digital technology is particularly challenging, as there are no existing theories of archival practice to refer to, not even for analog film. It should be noted, however, that the archival field has produced important articles and books in the last two decades, many of which address film preservation and restoration in relation to existing theories of art restoration. These works form the basis of what the field refers to as the "ethics of film archiving and film restoration." The work of Raymond Borde (1986), Paolo Cherchi Usai (1991b and 2000), Mark-Paul Meyer (1991 and 1996), Michele Canosa (1992), Gianluca Farinelli and Nicola Mazzanti (1994), Ray Edmondson (1998), Paul Read and Meyer (2000) and, more recently, Andreas Busche (2006), Venturini (2006) and Julia Wallmüller (2007) is an important contribution to the definition of a film archival deontology. The reflection on archival practice mainly originates in the professional field (only Canosa is a film scholar at the University of Bologna, whereas the other contributors are all film archivists), and it is not surprising that the leading question addressed by these articles and books moves from and around ethical questions. The need for ethics, a discipline of practice, is indeed felt in the first place by those who carry out preservation and restoration practices.

Although I agree that ethics is key to define the limits within which film restoration work should be carried out, I argue that the often invoked "code of ethics" for film archival practice is not necessarily what film archivists need at this point. The FIAF's Code of Ethics constitutes a valid document of general guidelines for the field. However, as I will discuss in the following pages, especially in discussing the cases in Chapters Three and Four, the particular theoretical framework embraced when carrying out a film restoration project can lead to a different set of ethical standpoints. From this perspective, one of the most emblematic examples is the discussion around the definition of "the original." The FIAF's Code of Ethics states that: "When restoring mate-

rial, archives [...] will not seek to change or distort the nature of the original material or the intentions of its creators."[110] As will be discussed further on, "the original" can be many different things, from the film as the filmmaker wanted it, to the film as it was recovered by the film archive, bearing the marks of its material decay. Also in the discourse around "the original" the tension between the material and the conceptual artifact becomes central. "The original" can indeed be one of the possible conceptual artifacts (e.g. the director's cut or the film as shown to the audience) or one of the possible material artifacts (e.g. the original camera negative or the only existing fragment of a projection print recovered by the archive). Because ethical guidelines are inevitably challenged or interpreted differently by those who embrace a different framework, I will focus on defining the relevant theoretical frameworks embraced in archival practice rather than proposing new ethical guidelines.

In this work, preservation and restoration are central because these are the archival practices that are most radically changing with the advent of the digital, and because some of these changes are tied with the ontological question around film, which will be addressed in the following pages. It should be noted, however, that preservation and restoration do not happen in isolation and, therefore, they cannot be discussed separately from other archival practices, such as collecting, providing access and exhibiting, and without framing it in the field and with the relevant players, namely restorers, curators, archives, laboratories and funding entities.[111] Other archival practices, like collecting and exhibiting, have consequences in forming perspectives on film aesthetics and history but do not lead to irreversible actions on the film artifacts themselves.[112] Preservation and restoration, on the other hand, act directly on the film material artifact, (re)shaping the way it will be available to archivists, scholars and users in the future. This is true for analog as well as for digital technology. Once again the artifact appears to be a crucial issue to be addressed. Furthermore, the transition from analog to digital gives a new connotation to the film artifact. As discussed earlier, films today are hybrid, being produced at the same time analog and digital. Although new films may perhaps become all digital soon, film-born and hybrid-born films (i.e. films from the analog past and films made during the transition) are destined to a perpetually liminal status. As material artifacts they are both analog and digital (e.g. the nitrate film stored in the archive's vault and its digitization stored on a server and available online); as conceptual artifacts they are both the historical artifact and the historized one (e.g. the nitrate film and its re-enactment via a digital projection). Hence the urgency of formulating a theory of practice *in medias res* of this technological transition.

What happens to the film artifact in film archives, i.e. the *archival life of film,* defines the film (artifact) that will be available to a user in the future. This

is the main reason why film archivists, especially curators of film collections and those who are responsible for policies with regard to preservation, restoration and access, and film scholars cannot work in isolation. The archivist should make informed decisions that take into account developments in film historiography and theoretical discourse around film, and keep scholars informed of the developments in film archival practice. Theorists, on the other hand, should know what drives archival policies and understand the archival theories that stand behind them. Therefore, it would be of great benefit if film theory and film archival practice would interlace in a dynamic and constructive discourse rather than grow as separate domains with different, and at times conflicting, agendas.

As pointed out earlier, the introduction of digital tools raises questions on the nature of film. In the first part of the chapter, I will discuss different approaches to film ontology arising from the transition to digital. Also, I will link the discourse on film ontology to the tension between film as a material and as a conceptual artifact. The different approaches to film ontology will be further discussed in view of the four theoretical frameworks that I will distinguish and propose as the most relevant for the *archival life of film.* These frameworks are "film as art," "film as original," "film as *dispositif*," and "film as state of the art," and I will argue that they are all retraceable in the policies of film archives.

It should be noted that in this work I use the term framework as the conceptual framing within which theories and policies are formulated and practices are carried out. As discussed earlier, I have chosen for the terms "framing" and "frameworks" (instead of, for instance, context and paradigm) because they better suit the object and the point of view of this research, namely that of an ever ongoing transition that calls for a dynamic relation between analytical tools and the analyzed objects.

I mainly refer to framework, embracing Thomas S. Kuhn's definition for paradigm, namely the "constellation of beliefs [...] shared by the members of a given community" (Kuhn, 1996: 175), in this case that of theorists who agree on a similar interpretation of film. Frameworks here work as paradigms but are less binding. They can be of reference, explicitly or implicitly, in the interpretation process of the archival film.

In the second part of this chapter, I argue that the question of whether film's nature changes with the digital can be addressed from the perspective of transition. Also, I relate transition to three of the most influential theoretical concepts proposed by recent scholarly works, i.e. "remediation" (Bolter and Grusin, 2000), "media convergence" (in particular as reflected upon by Jenkins, 2004) and "simulation" (Manovich, 2001 and Rodowick, 2007), which, in my view, are the ones guiding today's film restoration practices.

I use the term concept here as the interpretation process of defining what we refer to. The "beliefs," in Kuhn's words, "shared by the members of a given community" (Kuhn, 1996: 175). Concepts define something and are shared by a community. As here I am trying to define film archival practice in transition, and I am focusing on film restoration, the concepts to be discussed are those defining film restoration, and, in particular, restoration technology in the transition to digital.
If a framework is a "constellation of beliefs" or concepts, the concepts I am discussing in this chapter can indeed be part of different frameworks. Furthermore, one and the same framework can draw upon different concepts. The frameworks and concepts proposed in this chapter form the conceptual tools that I use for theorizing archival practice in the second part of this work.

2.1 FILM ONTOLOGY BETWEEN REALITY AND MIND

> Film theory, then, is our best hope for understanding critically how digital technologies are serving, like television and video before them, to perpetuate the cinematic as the mature audiovisual culture of the twentieth century, and, at the same time, how they are preparing the emergence of a new audiovisual culture whose broad and indiscernible outlines we are only just beginning to distinguish. (Rodowick, 2007: 189)

Film theory, in agreement with Rodowick, is the most suitable field to look at when searching for answers regarding the changing nature of film. Film theorists have long debated on the ontology of film, as defined by Noël Carroll:

> The question, "What is cinema?" (which we derive from an unequivocally marvelous collection of essays by the distinguished film theorist and critic André Bazin) is an ontological one. "Ontology" is the study of being. The ontology of cinema is an inquiry into the being of cinema, or, to put it less awkwardly, it is an inquiry into the kind of being, the kind of thing, cinema is. To what category does it belong, or, in other words, under which concept do we classify it? [...] The ontology of cinema interrogates the mode of existence of cinema – its manner of existing (of being). It aspires to establish the kind of thing cinema is essentially. Another way of framing the ontologist's question is to ask "What is the essence of cinema?" (Carroll, 2008: 53)

From the Italian theorist, Ricciotto Canudo, who wrote in 1911 about the "birth of the seventh art," to Hugo Münsterberg, Rudolf Arnheim, and contin-

uing with a long list including Sergej Eisenstein, André Bazin, Siegfried Kracauer, Jean Mitry, Jean-Louis Baudry, Stanley Cavell, Gilles Deleuze and many others, all film theorists have offered their own approaches to the ontological question regarding film. Throughout the long history of theoretical discourse, one thing has become clear: a general consensus around the question "what is film?" has never been reached.

It is not the aim of this work to discuss the development of the theoretical discourse on film, nor to provide a complete overview of the enormously diverse argumentations that have accompanied it. The discourse on film ontology would deserve a broader and more nuanced discussion than the one I can afford here.

The main question I address in this work is whether the transition from analog to digital changes film's nature and what the implications are of this transition for archival practice. In the following pages different relevant approaches to the ontological question will be discussed, also in relation to the archival film artifact. This discussion will lead to the identification of a number of frameworks, analytical tools which I propose as a foundation for my new theorization of film archival practice. My own approach to the ontological question, as an archivist and a scholar, will also emerge along the way, to be further developed in the second part of the chapter. However, I would like to point out that the theorization I propose intends to address all different approaches relevant to film archival practice, including (but not privileging) my own.

In the economy of the line of my argumentation for theorizing archival practice, I have chosen to bring different approaches together into opposite poles, or categories, namely those of realism and mind/film. The use of categories here is instrumental for combining common elements, or "symptoms," within the thoughts of different theorists. In line with Deleuze, categories can be valid, "provided that we trace them to singular symptoms or signs rather than general forms. A classification is always a symptomology" (Deleuze, 2000: 368). The symptoms retraceable in the two approaches to film ontology addressed here are those of film as emanation of reality and film as product of the mind. It is in this spirit that I will frame the theoretical discourses relevant to the elaboration of my new theorization of archival films.

A number of theorists have associated the nature of film to its photographical (photochemical) basis. These theorists, including Bazin, Barthes, Sontag, and Cavell, see in the photochemical representation an emanation of reality and can be loosely referred to as realists (Carroll, 1996 and Prince, 1996). In spite of the differences among these theorists, it can be said that they have a common symptom as they all share "photographically based notions of cinematic realism" (Prince, 1996: 28).

Reference to "cinematic realism" can be found as early as 1898 in a letter

by photographer Boleslaw Matuszewski (1995), where, based on such a notion, the call for the creation of a *Cinematographic Museum* is made. Matuszewski's realism, however, goes further than the realism I am discussing here as he argues that film is a truthful record of historical events. The claim that photographic reproduction can be considered a truthful record of real events, the "truth claim" or "documentary value," as Kessler names it (2009), goes beyond the scope of this work's discussion.[113]

Roland Barthes describes the realistic approach eloquently when he writes that the "realists, of whom I am one [...] do not take the photograph for a 'copy' of reality, but for an emanation of *past reality*: a *magic*, not an art" (Barthes, 1981: 88-89 – emphasis in the original). It should be noted, however, that Barthes discusses photography and not film, and that photography and film might even be seen as ontologically different if looked at from a different perspective, taking for instance movement as film's specificity, as will be discussed further below.

Despite some differences, these critics share the common idea of a privileged relationship between photography and reality. For instance, Barthes writes that a "photographic referent" is:

> Not the *optionally* real thing to which an image or sign refers but the *necessarily* real thing which has been placed before the lens, without which there would be no photograph. Painting can feign reality without having seen it. Discourse combines signs which have referents, of course, but these referents can be and most often are 'chimeras'. Contrary to these imitations, in Photography I can never deny that *the thing has been there*. (1981: 76 – emphasis is in the original)

In Barthes' perspective the bond between referent and the real thing, what he refers to as the "photographic referent," is much stronger than in any other system of representation. This privileged relationship between reality and its photographic reproduction, argued by Barthes and the realists, however, does not imply that what a photograph shows is a truthful representation. As Frank Kessler warns, "one should be careful not to glide from stating the object's 'having been there' to the more global assertion that the image depicts 'how it was'" (2009).

A similar way to look at such a privileged relationship between reality and its photographic reproduction, originally suggested by Peter Wollen (1969), is that of photographic indexicality, whose definition derived from Charles Sanders Peirce:

> Photographs, especially instantaneous photographs, are very instructive, because we know that they are in certain respects exactly like the objects they represent. But this resemblance is due to the photographs having been produced under such circumstances that they were physically forced to correspond point by point to nature. In that aspect, then, they belong to the second class of signs, those by physical connection. (1894: §4)

According to Peirce, the second class of signs is that of "indices":

> The index is physically connected with its object; they make an organic pair. But the interpreting mind has nothing to do with this connection, except remarking it, after it is established. (1894: §3)

Emanation of reality or indexical representation of it, both analog photography's and film's specificity are challenged today by the different relation with reality introduced by the digital technology, as Mary Ann Doane points out:

> Certainly, within film theory, confronted with the threat and/or promise of the digital, indexicality as a category has attained a new centrality, as has the work of Bazin. One might go so far as to claim that indexicality has become today the primary indicator of cinematic specificity, that elusive concept that has played such a dominant role in the history of film theory's elaboration, serving to differentiate film from the other arts (in particular, literature and painting) and to stake out the boundaries of a discipline. (Doane, 2007: 129)

Indeed, from the realists' perspective the ontological question becomes fundamental at a time when a digital mode of reproduction is replacing the photochemical mode. Once a photographic image is transcoded into digits, it may be argued that it loses its direct correspondence with the real.

It is indisputable that the realists' perspective has always had a very strong influence on scholars and film archivists, including myself, and it still does. Nevertheless, the question of whether photochemical reproduction is ontologically different from digital reproduction needs a more articulated investigation. Moreover, the discourse about the indexicality of film might lead to a dead end. According to Gunning, it might have reached the limits of its usefulness as "the discussion of cinematic realism cannot be allowed to ossify into a dogmatic assertion about the photographic nature of cinema or an assumption about the indexical nature of all photography" (2007a: 36).[114]

Some of the discussions within the archival field in the past decade have implicitly relied on this dogmatic assertion, leading to conflicting positions

with respect to the transition to digital, read analog versus digital. Limiting the discussion to the ultimate essence of photographic reproduction and whether this is indexical or not, though, is not the right approach and does not lead to useful answers. As film is changing, it is appropriate to question the notion of photographic indexicality and (re)consider whether such a notion is useful in the discussion of film's transition to digital. The very assumption that a realistic or indexical approach to film should mark an ontological separation between photochemical (analog) and digital film, needs to be reconsidered in light of the technological transition to digital. The "assumption about the indexical nature of all photography" has been questioned among the scholars in light of the digital, and this on-going discussion is producing new perspectives. These perspectives invite, on the one hand, the abandonment of indexicality when discussing photography, as in the case of Gunning:

> The semiotic category of the index assimilates photography to the realm of the sign, and although a photograph like most anything (everything?) can be used as a sign, I think this approach prematurely cuts off the claims made by theorists like Barthes, Bazin (and I think Deleuze) that the photograph exceeds the functions of a sign and that this indeed is part of the fascination it offers. (Gunning, 2004: 48)

From this perspective, the thoughts of Barthes, Bazin and Deleuze are still valuable for addressing the digital image, as Gunning provides a welcome way-out of the impasse created by the unchallenged assertion about the indexical nature of photography. Also this perspective encourages new investigations of the fascination for photographic reproduction from this transitional moment.

On the other hand, there are also new perspectives maintaining that indexicality can still be a valuable conceptual tool for addressing digital film, but only if our thinking of it is reassessed. An approach where algorithms are bound to the digital images they produce by an "existential bond" comparable to that between reality and photographic image is proposed by Braxton Soderman (2007). This approach will be discussed further with regard to the "film as original" framework.

As mentioned earlier, the realistic approach to film ontology has always had a strong hold on the film archival field. On the one hand, it offers very strong arguments for stressing the importance of the original film artifact, as will be discussed with regard to the "film as original" framework. As Meyer argues, the closer a film artifact is to the original camera negative, the shorter the distance between the viewer and the "has been there" that has left its impression by light on the film (1997). On the other hand, in recent works, the realistic approach shows its validity also for the transition to digital as it has

inspired new perspectives, some of which recognize an ontological difference between photographic and digital film (Manovich, 2001 and Rodowick, 2007), while others oppose it (Marks, 1999 and Soderman, 2007). The discussion of both these new readings of the indexical approach, crucial for film archives in transition, will be resumed further on when discussing the "film as original" framework as they have a bearing on old and new assumptions on the film archival artifact.

Within film theory also, a different approach to film ontology from the one just discussed can be found, which brings together various theorists from different periods and perspectives. I will call it the "mind/film analogy approach," using a definition coined by Carroll.[115] It should be noted that, as in the case of realism, I intend this as a loose category that has a pragmatic function in my discussion of the relevant theoretical discourses with regard to the archival film. Although realists are usually opposed to formalists in classical film theory (Prince, 1996: 28), I have chosen the loose category of mind/film theorists as it best covers those streams of thought that do not focus on photographic indexicality as the core of film ontology.

An eloquent definition for the film/mind approach can be found in Deleuze's celebrated statement that cinema's movement is placed directly in our brain: "Cinema not only puts movement in the image, it also puts movement in the mind. [...] The brain is unity. The brain is the screen" (Deleuze, 2000: 366). According to Carroll (1996: 293-304), this approach was pioneered by Hugo Münsterberg in his *The Photoplay: a Psychological Study* (1916); it brings together scholars like Christian Metz and Jean-Louis Baudry, and it can be placed in the area of psychoanalytic semiotics. Differently than realism, the mind/film approach does not trace the nature of film back to its power of representing reality but rather to its effect (what it does) on the spectator. Rodowick gives a clear example of this approach when discussing Christian Metz's thought:

> In Metz's elegant description, psychologically the spectator is always in pursuit of a double absence: the hallucinatory projection of an absent referent in space as well as the slipping away of images in time. The inherent virtuality of the image is a fundamental condition of cinema viewing where the ontological insecurity of film as an aesthetic object is posed as both a spatial uncertainty and a temporal instability. (Rodowick, 2007: 22)

Film's realism is, thus, here a source of "ontological insecurity," partly due to the "projection of an absent referent in space," and partly due to the "slipping away of images in time." The latter is particularly interesting when it is put in relation with the accent that Metz poses on *movement* in an essay written

in 1965 and recently discussed by Gunning (2007a), "On the Impression of Reality in the Cinema" (Metz, 1974). In this essay Metz argues that motion is responsible for cinematic realism, in his words:

> The strict distinction between object and copy, however, dissolves on the threshold of motion. Because movement is never material but is always visual, to reproduce its appearance is to duplicate its reality. In truth, one cannot even "reproduce" a movement; one can only re-produce it in a second production belonging to the same order of reality, for the spectator as the first. [...] In the cinema the impression of reality is also the reality of the impression, the real presence of motion. (1974: 9)

What seems particularly interesting here is that a different approach to film realism is implied. It should be pointed out that Metz's essay as a whole raises more complex issues with regard to the bond between reality and its cinematographic representation that would place his work closer to the indexical approach than it could appear from my reading of this excerpt. On the other hand, I am quoting this particular passage because it does move the discourse from the pure photographic representation on the film artifact to its representation in movement, which can be experienced only when the film is projected and, thus, in its performative dimension, rather than looking at the single film frames. As Gunning argues, Metz's description of cinematic motion offers an alternative approach to film's indexicality:

> Metz's concept of the impression of reality moves in the opposite direction [than that of the indexical argument based in the photographic trace], toward a sensation of the present and of presence. The indexical argument can be invoked most clearly (and usefully) for films used as historical evidence. It remains unclear, however, how the index functions within a fiction film, where we are dealing with a diegesis, a fictional world, rather than a reference to a reality. [...] The effect of an index in guaranteeing the actual existence of its reference depends on the one who makes this connection invoking a technical knowledge of photography, understanding the effect of light on the sensitive film. Metz's cinematic impression of reality depends on 'forgetting' (that is, on distracting the viewer's attention away from—not literally repressing the knowledge of) the technical process of filming in favor of an experience of the fictional world as present. As he claims, "The movie spectator is absorbed, not by a 'has been there' but by a sense of 'There it is.'" (2007a: 47)

This brings us back to the previously mentioned difference between film and photography. A difference that Barthes also recognizes:

> [...] the photograph, taken in flux, is impelled, ceaselessly drawn toward other views; in the cinema, no doubt, there is always a photographic referent, but this referent shifts, it does not make a claim in favor of its reality, it does not protests its former existence; it does not cling to me: it is not a *specter*. (1981: 89 – emphasis in the original)

In this perspective, the flux or movement, typical of film, marks the difference between Metz's "has been there" and "there it is." It has been argued that this difference disappears when looking at a film on a viewing table, frame by frame, photograph by photograph (Meyer, 1997), but it can also be argued that film is meant to be seen in movement.

Apart from the notion that film's nature resides in movement, another argument of the mind/film approach is that of the performative character of a film exhibition. The performative character of film can be put in relation to Gunning's "cinema of attraction" (1990), an approach to (early) film that is still of great influence and, among other important contributions, has shifted the focus from the narrative (or textual) to the performative aspect of film. The performative character of film becomes of relevance, for instance, when discussing avant-garde and experimental films. There, often the film *dispositif* goes beyond the traditional cinema *dispositif*, when, for example, multiple projectors, color filters and other forms of live improvisations are used during the film "performance."

Whether looking at motion or at the performative aspect of film, the mind/film approach shifts the focus from the relation between reality and material film artifact, the photographic reproduction on film, to the relation between film and the viewer. This aspect is of particular importance for film archives, especially in the digital age when, as discussed earlier, users have a much stronger say on how and what of our film heritage they wish to access.

The mind/film approach with respect to the ontological question on the transition of film to the digital provides a theoretical basis for supporting the continuity between analog and digital, whereas the indexical approach, as discussed earlier, could serve to support both chasm and continuity. Indeed, by addressing the relation between film reproduction and reality, the indexical approach is concerned with the process by which photographic or digital film record such reality, whereas, an approach concerned with film motion and performativity, which I loosely defined mind/film, would disregard the recording process and would therefore not distinguish between analog and digital representation. On the other hand, as we have seen that continuity between

analog and digital can be argued even maintaining an indexical approach, chasm can also be the result of a mind/film approach. For example, Rodowick argues that a digital film projection does not involve the viewer in time (2007: 164), whereas a film projection does.[116]

In the following pages, four theoretical frameworks will be proposed and defined. They all arise from the theoretical discourse on film and media and they are all relevant for the theorization of archival practice. I will argue that both approaches to film ontology discussed above find their way in these frameworks. All four frameworks testify to the tensions between the indexical and the mind/film approach with respect to the ontological question, and also between film as material and as conceptual artifact. As pointed out earlier, my use of frameworks is pragmatic and instrumental for my new theorization of film archival practice.

It should be noted that the frameworks I propose are not always consciously adopted by film archives when defining their collection policies. Also, as I will show in the second part of this work, even though I take the liberty of associating the policy of a number of archives with one symptomatic framework, it should be considered that archives always operate within more frameworks at the same time.

Film as Original

The discussion around the idea of "the original" is central to film preservation practices. However, the meaning of "original" can change depending on the theoretical frameworks one embraces. "The original" can be a conceptual artifact (e.g. one particular version of a film) or a material artifact (e.g. the original camera negative), it can refer to the film as it was originally shown to the audience, as well as the material film artifact as it was recovered by the film archive. But it can refer to the film as text where its integrity is measured in terms of completeness and continuity (e.g. all the scenes that constitute the version as it was meant by the director, edited in their right order), or to the film as text and as technological artifact, where RESOLUTION, COLOR DEPTH and look in general are also integral parts of the whole. In view of all these different assumptions, "film as original" forms a framework of reference in itself and, as such, it lies at the core of the archival practice, the focal point for the discussion on the nature of (archival) film, again, both as material and conceptual artifact.

Looking at film as a material artifact, most archives can be associated with the "film as original" framework, as in the last decade the importance of keeping original film artifacts (i.e. the very artifacts made at the time of the film's original production and distribution) as long as possible has been acknowl-

edged by all archives (Meyer, 2001 and Enticknap, 2005: 192-194). But the "film as original" framework covers much more than the long-term preservation of film artifacts. The idea of the original is bound to that of authenticity and, therefore, addressing the authenticity of the film artifact is in my view the first step in defining the "film as original" framework. According to Walter Benjamin:

> The authenticity of a thing is the essence of all that is transmissible from its beginning, ranging from its substantive duration to its testimony to the history which it has experienced. Since the historical testimony rests on the authenticity, the former, too, is jeopardized by reproduction when substantive duration ceases to matter. And what is really jeopardized when the historical testimony is affected is the authority of the object. (Benjamin, 1979: 852)

The authority of the object is one of the main motors in the discourse on the *archival life of film* and it lies at the foundation of the archival mandate of preserving material artifacts. In 1936, Benjamin wrote of film as an exemplary form of mechanical reproduction. Authenticity, in line with Benjamin, ceases to matter when the object is mechanically reproducible, in other words when there is no difference between the original and its copies:

> Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be. This unique existence of the work of art determined the history to which it was subject throughout the time of its existence. [...] The presence of the original is the prerequisite to the concept of authenticity. (Benjamin, 1979: 851)

From this perspective, one can say that a blockbuster's simultaneous release in thousands of film theaters around the world undermines the idea of authenticity, as, according to Benjamin, from "a photographic negative, for example, one can make any number of prints; to ask for the 'authentic' print makes no sense" (1979: 854-855).

Film is indeed a serial product, a commercial release. On the other hand, a newly recognized authenticity originates when film enters the archive; it becomes heritage and its copies museum artifacts. To bring back the discourse to Benjamin's arguments, we can follow Boris Groys:

> Benjamin views the distinction between original and copy solely as a topological distinction and as such completely separate from the physi-

> cal existence of the piece of art itself. The original has a specific location and it is due to this particular location that the original finds its place as a unique object in history. Benjamin's formulation in this context is well known: "There is one thing missing even in the most perfect reproduction: the 'here' and 'now' of the piece of art – its unique presence in its location". On the contrary, the copy is virtual, without location, without history. From the beginning, the copy seems to be a potential multiplicity. The reproduction is a delocation, a de-territorialisation – it carries the piece of art into the net of topologically uncertain circulation. [...]
> In this way, Benjamin's new interpretation of the distinction between original and copy not only offers the possibility of making a copy from an original but also of making an original from a copy. In fact, provided there is only a topological, contextual difference between original and copy, it is not only possible to de-locate and deterritorialise a work of art, but also re-territorialise a copy. (Groys, 2002: 1-2)

In line with Groys, a film is multiplicity, delocation and deterritorialization, it is lost into the net of topologically uncertain circulation. However, when entering the archive, a film acquires authenticity status; the authority of the object is restored, the film copy is re-territorialized. Copies are compared and differences are assessed, such as different soundtracks (e.g. multilingual or dubbed versions), different texts (e.g. re-edited or censored versions), and different image qualities (e.g. different colors or different film stocks).[117] If production and distribution histories tell us that it is "impossible to locate a single coherent text that could be characterized as the film's 'original'" (Hediger, 2005: 136), from the moment a film enters the archive, "after all each copy is in a way an 'original', each copy is a document of its own history" (Kessler, 1995: 30 – my translation).

When a film-born artifact is digitized, things get a new and interesting turn with regard to its authenticity. In particular, the discourse on authenticity crosses over the discourse on photographic realism (indexicality and referentiality), which, as we have seen, has received a renewed impulse with the digital. According to Michael Punt, digital is not different from the analog technology, as neither can guarantee the existence of a definitive reality. Punt points out that:

> [...] just as there is no technology that is not the product of human action so there are no autonomous digits in electronic data – just pulses of electricity. The digits are introduced much later, and at each successive interpretation of pulses into digits, and digits into pulses of light that touch the screen and produce an image, a software programme needs to be written.

> In the same way that the photo-chemical procedures of the nineteenth and twentieth centuries depended on prior views of reality to inform chemical engineers and lens grinders, so computer programmes emulate a prior view of what that image should look like. (Punt, 2004: 12-13)

Even though human mediation is present in both photochemical and digital reproduction, it cannot be ignored that digital reproduction is based on a technology different from the photographic (analog). As discussed earlier, the latter is based on a transcription from reality to representation (and from representation to its copy), whereas the former is based first on a transcoding from reality into a code, and only later into a representation (and again, from a representation to its copy). Some theorists claim that the translation of light into discrete data marks the rupture between image and physical referent, and, therefore, they join the argument that digital imaging cannot claim the indexical character of photochemical analog imaging.[118] Others, such as Laura Marks (1999), transfer that physical connection to the "interconnected mass of electrons" that allows "materiality" to both kinds of images.

Similarly, Soderman argues that indexicality can still be applied to digital images by shifting the focus from the connection between the object of reality and its photographic representation to the process that makes a photograph reproduce reality. From this perspective, Soderman argues that, similarly to photographic images that are forced to correspond to reality, "digital images are produced under such circumstances that they are physically compelled to correspond point by point to a symbolic algorithm" (2007: 163). As mentioned earlier with regard to film ontology, Soderman's argument offers a new take on the discussion on film indexicality from the perspective of the transition to digital. Like Punt, Soderman also moves the focus of the discussion on human mediation. By stressing the passage in Peirce's words about the film being "forced to" reproduce an image, the accent is moved from the technical characteristic of a photograph to the human mediation. The fact that the analog photographic film reproduces reality becomes less important than the fact that it is designed and made to do so by someone. In this perspective, according to Soderman, the same applies to an algorithm for digital image reproduction:

> The "existential bond" between a digital image and the algorithms that produce or modulate it is simply that the image is *forced to* appear according to the execution of the program. (2007: 163 – emphasis added)

The human mediation in taking a photograph, making a film, writing an algorithm, becomes of crucial importance in archival practice. It can mark the link

between the film-born artifact and its digital copy. Moreover, human mediation can be the carrier of the authenticity from an original film artifact to its restoration. Restoring a film implies making a copy of an authentic film artifact: the authenticity of the new restored copy depends completely on how this copy is made, and the way the copy is made depends, in turn, on how the restorer instructs the process, whatever the process. Whether it is a photographic, analog duplication or a digitization, in this perspective is irrelevant for the authenticity of the result. In line with a similar interpretation of the indexical approach, although the focus is still on the reproduction process, there is still continuity between analog and digital with the accent lying, not on the photographic or digital process, but on the human mediation that executes it.

By contrast, Paolo Cherchi Usai takes a position on film's nature that does not consider a continuity between analog and digital film, not even between a film artifact and its analog copy. In *The Death of Cinema*, he writes that film is by nature auto-destructive. Chemically unstable, mechanically damaged by each run through a projector, film dies while living. Thus:

> [t]he ultimate goal of film history is an account of its own disappearance, or its transformation into another entity. (2001: 89)

In this light, the profession of the film archivist is compared to that of a doctor easing his or her patience towards an unavoidable death:

> Moving image preservation will then be redefined as the science of its gradual loss and the art of coping with the consequences, very much like a physician who has accepted the inevitability of death even while he continues to fight for the patient's life. 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. (2001: 105)

Indeed Cherchi Usai's description fits with the practice of long-term preservation of the historical film artifact, which is kept in the vaults as long as possible in the best climatic condition an archive can afford.[119] Nevertheless, the nature of film according to Cherchi Usai can be challenged. In my view, whereas artifacts are to decay, films do not need to disappear with them. In this line the archivist's duty is that of a mediator who can make sure that film restoration does not become "a process involving a [...] spectrum of apparently unethical actions such as *lying, cheating, stealing, and pretending*" (Cherchi Usai, 2002: 25 – emphasis in the original).

Elsaesser raises the question of whether authenticity is verified by the institution rather than by indexicality:

> Yet what if we were to turn the argument around, by claiming that the status of authenticity and proof of a photograph or moving image does not reside in its indexical relation at all, but is a function of the institutions in charge of its verification and dissemination? (1998: 207-208)

If we turn the indexical argument around with Elsaesser, the status of authenticity of a film artifact would be a function of the film archive in charge of its verification and dissemination. And it will become even more so in the future, with the further introduction of the digital. In addition, recognizing the framework behind the work of film archivists and restorers becomes a requirement for the verification process. This was already true with the analog, and the ongoing transition towards the digital is making it only more urgent.

The "film as original" framework is very strongly felt in film archives and it is the framework that is most heavily affected by the transition to digital. Whereas a analog photographic film artifact is an easily identifiable object, which can be defined as "original," the definition of a digital film artifact, e.g. a DIGITAL INTERMEDIATE stored on a digital tape or a hard drive, as an "original" is more problematic, and not only if one embraces indexicality in a strict sense. Even if one agrees with Marks' or Soderman's views, a DIGITAL INTERMEDIATE is still much harder to define as a material artifact than a photographic film negative. A DIGITAL INTERMEDIATE is, if you wish, a "virtual artifact": it exists but it is not strictly bound to its CARRIER (e.g. a digital tape or a hard drive), it is unique but it can be "copied" without quality loss (if the copy is uncompressed). Making a copy of a digital film "virtual artifact" is not like making a copy of an analog film. Since a digital copy can be identical to the "original," its duplication is referred to as MIGRATION. From an approach that considers indexicality applicable to digital film, like Soderman's, the data are preserving their "originality" also with MIGRATION. The difference with photographic images in this context is that they do not necessarily lose quality. The case of a digitized film-born film is, of course, different since the film is both the material artifact (the photographic film before digitization) and the virtual artifact (its digital copy). The latter might or might not preserve its authenticity depending on the adopted view on film indexicality. Strictly speaking, only a photochemical copy can guarantee the preservation of the film's "originality" (though there is a loss in image quality), whereas, if a less strict approach to indexicality is adopted (like Mark's or Soderman's), a digital copy of a film-born film preserves the film "originality" (without loss of image quality).

I have argued that reading Benjamin (1936) through Groys (2002), the

"film as original" framework defines the historical film artifact as the carrier of the film's authenticity, once it is re-territorialized by entering the film archive. Within this framework it can also be argued that each copy of a film does acquire authenticity as it is a subsequent sign of a film's life-line. This line will cease with the digital, from a perspective that places photographic indexicality at the core of film ontology (unless indexicality is still considered applicable to digital), or it will move on, from a perspective that focuses outside the material film artifact, for example on the human mediation provided by the film restorer by guaranteeing the verification of the new copy. The "film as original" framework could lead to opposite archival practices: on the one hand the original artifact could be considered so precious that it becomes untouchable, on the other hand access to the original artifact could be considered irreplaceable and thus granted with the consequence that its deterioration would be accelerated. In reality, most archives carry out a policy somewhere in between these two extremes.

Film as Art

Is film art at all? Rephrasing Benjamin:

> Earlier much futile thought had been devoted to the question of whether photography is an art. The primary question – whether the very invention of photography had not transformed the entire nature of art – was not raised. (Benjamin, 1979: 857)

Has film changed the concept of art? Benjamin puts the finger on a crucial issue, whether photography and film have changed (our perception of) the nature of art. This issue is particularly relevant today, seventy years later, when digital imaging is replacing analog photography and film. Is the digital transforming the nature of art or, at least, that of film as art? And, how are film archives dealing with this issue?

The question of whether film is art has been relevant not only for theorists, but also for the pioneers of film archiving that in the 1930s started setting up the collections that later became our contemporary film archives. Early film theorists, starting from Canudo (1911), avant-garde filmmakers, and pioneers of film archives, like, among others, Iris Barry, the first film Curator at the Museum of Modern Art, all agreed that film is a form of art. With the *politique des auteurs* in the 1950s, the "film as art" argument was reinvigorated by the definition of a genuine creative mind behind some films, the film director. From the 1970s, "film as art" has become an important argument also for

scholars to promote the creation of film departments, and for film archivists to raise funds to support preservation and restoration programs, but also to affirm their *raison d'être* among other archives and museums.

The two main aspects traditionally associated with "film as art" that I see as the most relevant in relation to film archival practices are those of medium specificity and of the *auteur*. According to Carroll, the argument on film as art relies mainly on medium specificity:

> Medium specificity arguments are attractive for the purpose of transforming a new medium into a new artform, because they appear to provide a way of individuating arts and, thereby, isolating new ones. (1996: 7)

This tradition of argumentation can be brought back to Gotthold Ephraim Lessing, who in the eighteenth-century theorized that "each art, in virtue of its medium, has a uniquely appropriate range of effects such that only that medium can discharge" (Carroll, 1996: 7). Carroll has written extensively about this approach focusing on medium specificity, discarding it as an essentialist false doctrine, a "strategy for legitimatizing the new medium as a prospective art" (1996: 2-3).

In any case, medium specificity is a very strong argument for film archives since it lies at their origin and it is often intertwined with their very mission, that of collecting, preserving and promoting the art of film. For those archivists who feel that the art of film resides in the analog photographic film, it will be problematic to accept the digital as part of the same tradition. In this line, similarly to the indexical argument if taken strictly, the film specificity argument leans toward a chasm between analog and digital film.

A different take on the medium specificity argument is offered by Rodowick. Although sympathetic to Carroll's antiessentialism, Rodowick fears that Carroll's critique "might risk throwing the baby out with the bathwater" (2007: 40-41). Rodowick prefers to look at media specificity from a non-essentialist perspective and to place emphasis on the hybrid nature of film and the multiplicity of its styles and practices:

> For this reason, media are plural not only because they are various or admit historically to qualitatively different styles and practices, but also because the self-identity of a medium may accord less with a homogeneous substance than with a set of component properties or conceptual options. I am happy to admit as many hybridizations of media as artists can invent in their actual practice. But what makes a hybrid cannot be understood if the individual properties being combined cannot be distinguished. (2007: 41)

The coexistence of the specificities of different media is evident when looking at the variety of artifacts collected in film archives, from lantern slides to mixed media installation where film, video and digital have all been used. Rodowick's line of thought eventually leads him to conclude that there is a fundamental difference between analog and digital, based on the different relations the two engage with time. What I find particularly interesting in his argumentation at this point, though, is his emphasis on the variety of media hybridizations. This variety is becoming even more striking with the ongoing hybridization between analog and digital in mainstream film production. In fact, contemporary films can hardly be defined analog or digital specific, they exist as hybrids. On the other hand, it is the preservation of the "individual properties" of the hybrid that allows the idea of medium specificity.

This is another way to look at medium specificity, one of the founding reasons for film archives to exist as autonomous entities, other than contemporary art museums or audiovisual libraries. In this way, the transitional nature of film and its related hybridism can be incorporated in the medium specific argument. In line with this perspective, the argument of medium specificity, within the "film as art" framework, offers the grounds for film archives to preserve the film material artifacts as the medium specific manifestations of different phases of an art form in transition. Similarly, it encourages the preservation of medium specific exhibition forms, from peep shows to film projections, from digital projections to portable viewing consoles.

The second aspect that "film as art" can be based on is that of the *auteur*, a creative intent (usually coinciding with the film director) responsible for a film or a cinematographic *oeuvre*. In this case, the material film artifact and its related medium specificity arguments acquire more or less importance depending on the artist's intentions, or on the film archive's interpretation of the artist's intentions.

From this perspective, it can be argued that, for instance, the work of an avant-garde artist who has chosen film because of its photographic base could not be digitized without distorting the artist's intention. This could be the case, for instance, for Peter Kubelka's *Arnulf Rainer* (AT, 1960), a film where both image and sound are also a reflection on traditional film projection. In most cases, though, "film as art" based on the *auteur* argument is more concerned with the filmmaker's visual style (e.g. the *mise-en-scene*) rather than with medium specific arguments as in the example of Kubelka's *Arnulf Rainer*.

An example might be found in the case of the *auteur par excellence*, Alfred Hitchcock.[120] By looking at his *oeuvre*, it can be argued that Hitchcock's artistry has a strong bond with film technology and therefore his films can best be re-enacted via an exhibition as close as possible to the original technology used (e.g. VistaVision widescreen format and Perspecta sound system in the case of

The Man Who Knew Too Much, USA, 1956). In this case, only the re-enactment of such technological aspects would be true to Hitchcock's intent. On the other hand, there are also good arguments to say that, because of Hitchcock's interest for state-of-the-art technology, the aim in restoring his films should be that of best reproducing the impact of their original technological characteristics, even through digital means, where appropriate. This is not to say that Hitchcock films should be shown as if they were made with today's state-of-the-art technology, but rather that, within the "film as art" framework, Hitchcock's intentions might be better simulated with new technologies than they would be by recreating the historical technologies by which his films were originally made and shown.

The "film as art" framework lies at the foundation of many film archives and, in particular, of those with the specific mission of preserving, for instance, avant-garde films or films of a particular filmmaker or *auteur*.

The "film as art" framework has a bond with the concept of originality and authenticity via the medium specificity argument as it is the case of "film as original." However, especially from the *auteur* argument, the accent is more shifted towards the conceptual artifact (e.g. film style) than on the material film artifact. On the other hand, there are cases where the material artifact can also be closely related to the *auteur*. Especially in avant-garde cinema, the filmmaker may use the film as a canvas (e.g. Oskar Fischinger painting and scratching the film emulsion), or where film itself is central to the work (e.g. Kubelka's *Arnulf Rainer*). Because of its close relation with the filmmaker's intentions, the "film as art" framework is gradually incorporating the new digital medium, since many (avant-garde) filmmakers are more and more often adopting the digital themselves, as in the case of the recent digital work by Jürgen Reble or by Jonas Mekas.

Those archives that identify with the "film as art" framework can adopt an indexical approach to film ontology if they privilege the medium specificity argument and consider analog photographic film as the specific character of the art they strive to preserve. Or they can also accept hybridism as specific to film and inherent to its transitional character, in which case digital film would also belong to the same art. Differently, archives that favor the *auteur* argument within "film as art" are usually more concerned with the style or look intended by the filmmaker (unless the filmmaker reflects on the very film technology) and are, from this perspective, closer to the mind/film approach.

Film as Dispositif

The framework "film as *dispositif*" offers a way to look at film from a broader perspective than just looking at it as an abstract object of analysis. In "film as *dispositif*" film exhibition is central, therefore all archives with a tradition of film exhibition are bound to reflect on it. This is even more the case today with the transition to digital and the multiplication of new possible *dispositifs* that come with it.

The *dispositif* theory was introduced by Jean-Louis Baudry in the 1970s and is usually translated into English as the "apparatus theory."[121] In an essay published in 1975, Baudry "theorizes the screening situation in terms of a specific *dispositif*" and establishes an "analogy between the film spectator and the prisoners in Plato's cave" (Kessler, 2006: 60). In a recent series of articles, Frank Kessler has revived this concept, though from a different perspective than that of the 1970s apparatus theorists. In particular, what Kessler writes in relation to medium specificity from the *dispositif* approach is interesting for us:

> [An] implication of such an approach is that the notion of both textual and medial identity becomes problematic. On the one hand, any given text may trigger a number of different readings, depending on the context in which it is embedded, and on the other hand one can argue that in spite of a continuity in *naming* a given medium (cinema, television, telephone, etc.) its functions and its functioning can vary so much over time that it would be more accurate to describe the different *dispositifs* in which it takes shape, rather than to look for the 'identity' or 'specificity' of that medium. (2006: 62 – emphasis in the original)

From this perspective, film identity becomes a variable that realizes itself only within a *dispositif*, a situation if you wish, where the film meets its user. From the perspective of the archive this is certainly an interesting approach as it allows for a different way to look at films, namely, as dynamic objects where the material and conceptual artifacts are bound together. The preservation of historical *dispositifs* (how the film was shown at the time of its first screening or at the time or the re-release of a director's cut, etc.) remains one of the main tasks for many archives within the "film as original" framework. However, from the "film as *dispositif*" perspective, also showing a film within a different *dispositif* than its historical one becomes an equally important alternative. In this way a silent film viewed on an iPod should not be seen as a historical falsification but rather as one of the many possible *dispositifs* that can take shape within the "film as *dispositif*" framework. As Kessler writes:

> [...] a historical analysis based on the concept of *dispositif* re-interpreted in a pragmatic perspective could actually take into account different uses of one and the same text within different exhibition contexts, or different institutional framings. (Kessler, 2006: 61)

The institutional framing of the archive would also be one to look at carefully, not only for the ways it should or could re-present films in terms of *dispositifs*, but also for all the *dispositifs* that it has produced throughout the years while carrying out its tasks of preserving, restoring and showing film heritage. If, according to Gunning, "films must be approached as texts whose meaning is derived not simply from the maker's intentions or the film's own immanent form, but through a complex process of making meaning in the interaction of films with viewers and institutions" (2003b: 24), every restoration by a film archive, once presented to the public, can be considered as a potentially new *dispositif*. In addition, it should be stressed that, in this view, it is impossible to re-enact the historical *dispositif* as it originally was. Indeed, the same combination of film, audience and environment is impossible to recreate. Obviously, even if the setting and all the technical aspects could be reproduced, the audience certainly could not.

The example of the iPod mentioned above shows how radically the film *dispositif* has changed with the introduction of portable digital consoles. If we can say with Rodowick that the "cultural presence of computers and digital imaging has profoundly changed the function of the screen" (2007: 134), nowadays, personal consoles have introduced an even more radical change. In this respect, the recent work carried out by Nanna Verhoeff introducing the concept of a *mobile dispositif* is very interesting as it stresses, in the case of the Nintendo DS (Dual Screen) console, "the fact that the mobility of this mobile dispositif is multifaceted; it is a mobility of screen, user, and image" (2009). This kind of multiple mobility is indeed new when compared to the traditional film *dispositif* where screen and spectator did not move.

From the point of view of film archives, *mobile dispositifs* offer a whole new set of possibilities for making collections accessible to users, but they also pose a threat to their *raison d'être*. As discussed in Chapter One, archives are used to guide users through their film collections rather than open them to free and immediate access. A film viewed on a portable screen is the most striking example of such an unguided access. In this case the *dispositif* is the viewing situation of the mobile screen held by its viewer. Thanks to this new kind of mobility, the user would literally walk away leaving the archive behind with its historical forms of *dispositifs*. In a time of new and changing *dispositifs*, the film archive cannot hold the monopoly on films. As argued earlier, only by letting the films go there is a chance that (some of) the users will

decide to come back for more, maybe even to try out some of the historical *dispositifs* that only archives can offer. Archives choosing not necessarily to be the chaperone of their collection will still have the responsibility of preserving films and making them available for traditional projections as well as new, not yet imaginable, *dispositifs*.

Considering the above, the question arises whether a DIGITAL CINEMA projection is different from a traditional film projection from the *dispositif* perspective. Baudry defines the difference between the technical apparatus, what he calls *appareil de base*, and the *dispositif* as follows:

> In general, we distinguish between the *appareil de base*, which implies the equipment and the operations needed for making a film and projecting it, and the *dispositif*, which implies exclusively the projection, including the subject to whom the projection is directed. In this way the *appareil de base* includes the film stock, the camera, the processing, the montage in its technical aspect, etc. as well as the projection dispositif. (Baudry 1978, 31 – my translation; emphasis in the original).

Based on his words, it can be argued that by changing the technical apparatus and substituting, in the same cinema setting, the photographic film with a digital film, the *dispositif* would be unchanged. However, I argue that it depends on the "subject to whom the projection is directed" rather than on the setting. A viewer who is not aware of the specific technical apparatus in place (e.g. film or digital projector) will hardly notice any difference between an analog and a digital film projection and the digital projection, whereas a viewer who is aware of it will experience a different *dispositif.* Even for the earlier case it can be argued that the *dispositif* changes even if the viewer is not fully aware of the different apparatus as he or she will unknowingly perceive a different kind of projection.

Referring to the fact that a film projection is an alternation between image and a black screen forty eight times a second, whereas in a digital projection there is no black between images, Alexander Horwath argues that on a subconscious level "[...] it does make a big difference whether half of what your eyes see per second is black or not, as in digital" (Cherchi Usai, et al. 2008: 108). Whether we agree with Horwath or not, the fact remains that when the viewer is aware of the different apparatus, the *dispositif* changes. From this perspective, a film archive may count on an audience that is aware of the apparatus, maybe because the archive has provided the necessary background information. Another aspect central to this discussion is that of the possibility of simulating a film *dispositif* through digital means (including the black between images), an issue that will be addressed when discussing the simulation concept.

Since "film as *dispositif*" places emphasis on the relation between film projection and viewer, rather than between reality and film artifact, I consider this framework to be closer to a mind/film approach rather than to an indexical approach. On the other hand, an indexical approach to this framework is also possible. In this case, digital projections of film-born films would not only be different *dispositifs*, they would essentially differ from the film *dispositif* as the bond between reality and projection (via the film artifact) would be broken.

Those archives that have a tradition of reflecting on their exhibition practices might be associated with the "film as *dispositif*" framework, as here the focus is shifted from the film artifact to the relationship between projection and viewer. The conceptual film artifact and the mind/film approach to film ontology are stronger in this framework. As the "film as *dispositif*" framework can easily accommodate new media *dispositifs* along with traditional ones, it offers a more flexible perspective onto the transition to digital.

Film as State of the Art

"Film as state of the art" is a different framework than the previous ones, first of all because it has a stronger relationship with filmmaking practice than with the theoretical discourse. "Film as state of the art" is based on the idea that one of the driving forces in filmmaking is the search for pushing the limits of technology in order to translate ideas into moving images. State of the art, according to the Merriam-Webster Online Dictionary, indicates "the level of development (as of a device, procedure, process, technique, or science) reached at any particular time [...]."[122] Note that the level of development referred to here is a different one than that of the industry or the market. State of the art indicates a level of development that will not necessarily become an adopted technique or tool, neither a commercial standard nor product. The history of media counts many of these examples, like the legendary commercial defeat of the Betamax system in favor of the Video Home System (VHS).[123] Other examples in filmmaking vary from the "bleach bypass" process for obtaining a higher contrast and de-saturated colors, discussed in Chapter One, to Sam Raimi's "shaky-cam" (an alternative to the steady-cam); from the Gasparcolor system, introduced in the 1930s and used, among others, by Len Lye and Oskar Fischinger, to the Oscar winning algorithms developed by Anil Kokaram at the Trinity College in Dublin used for both special effects and film restoration.[124] State of the art indicates cutting edge innovation *regardless of* its implementation and it should not be intended in a technological deterministic sense. In this line, I am equally interested in state-of-the-art innovations that have been applied once and have been nearly forgotten, as

in those that have prevailed and have been mythicized as milestones of film history.

Throughout film history there are many examples of filmmakers, cinematographers and special effects engineers challenging contemporary technology and striving for new means to realize their visual ideas. Many have contributed to redrawing the limits of the medium, and their work has often (but not always) ended up in the film archives.

The drive from the market for technological innovation in film production should of course be acknowledged. From this perspective, I am not interested in addressing "film as state of the art" only as an artistic will for innovation (this would rather fall into the "film as art" framework). Indeed, state of the art can be also market driven, and innovation can be the result of the genius of a single person or of a whole team, of an independent filmmaker or of a studio. It can be applied to film production as well as to film preservation, in archives as well as in laboratories specialized in restoration. Confronted with films in need of restoration, restorers push technology beyond known limits to reproduce as closely as possible an obsolete film format or a color system.

From this perspective, "film as state of the art" is the framework where filmmakers' drive to translate ideas into moving image meets the drive of restorers to reproduce the (ideal) image of what films had once been. As a consequence, this framework can be associated especially with those studios' archives with a direct connection to film production, as part of the same enterprise, and with manufacturers and providers working directly with the film industry.

Since the awareness for preservation is a recent phenomenon in commercial studios, as will be discussed in the next chapter, the framework "film as state of the art" has become stronger in film archiving only in the last two decennia. It should be noted, however, that "film as state of the art" is not unique to commercial archives. There are examples of state-funded archives that have played a very important role in improving the technological means in the name of restoration, especially in those cases where a film archive runs an internal laboratory. A well-known example is that of the Cinémathèque Royale de Belgique and its laboratory, under the guidance of Noël Desmet, famous for its leading role in the restoration of tinting and toning of silent films. There are also cases where a film archive works very closely with a commercial laboratory, like the Cineteca di Bologna and the laboratory Immagine Ritrovata (recently taken over by the Cineteca), or Eye Filmmuseum and the laboratory Haghefilm. The latter collaboration will be further discussed in the second part of this work.

Within the "film as state of the art" framework, different ontological approaches to film can coexist. A more indexical approach will call for medium specificity (a preference for analog photographic film), whereas a mind/

film approach will be less concerned about the medium and more about the visual result.

As mentioned earlier, "film as state of the art" is different from the other three frameworks. It is the only one that does not directly relate to the theoretical discourse, and it brings in close relation filmmaking and film restoration. This relation, namely the will to create, for filmmakers, and the will to recreate, for film restorers, is not only a conceptual, but also a practical one. The equipment, the laboratories, the available techniques and the technicians involved in filmmaking (especially for post-production), and in film restoration, are often the same.

FILM AS PERFORMANCE[CX]

Earlier, I discussed the performative character of film and compared it to that of fine arts. Film differs from other arts not only because it is a reproducible medium but also because of its performative dimension as a projection, as a representation in movement, which it shares with other performative arts such as music and theater. I have also discussed film's performative character in relation to Gunning's "cinema of attraction" (1990). Indeed, since Gunning and Gaudreault's work on early film, scholarly focus has partially shifted from textual analysis to the performative dimension of film.[cxi]

In terms of the restoration and exhibition of early films, the interaction of film projection with other concurrent performances (e.g. accompanying music, narration, etc.) has not yet been properly addressed. Although recent research has provided valuable new insights (Hediger, 2011; Flueckiger, 2012; Loiperdinger, ed., 2012; and Askari et al., eds., 2014),[cxii] projects that take the performative dimension of film into account are still the exception. Director of the Cinémathèque de la Ville de Luxembourg Claude Bertemes points out that two important areas are still overlooked in early film exhibition, namely "its *performative* quality as a theatrical and gestural apparatus" and "its *sociological* quality as a mass medium and component of popular culture" (2008: 192). An interesting example of archival exhibition practice that can be subsumed within the "film as performance" framework is the project *Crazy Cinématographe*, a Trier University and Cinémathèque de la Ville de Luxembourg collaboration that has managed to recreate the experience of a traveling show by "performing" films (i.e. making the act of projecting the film alongside live elements like narration and music its own attraction) from the first decade of the twentieth century in a tent at a number of fairgrounds and carnivals in Luxembourg and neighboring countries since 2007 (Bartemes, 2008).

By broadening the discussion beyond that of the film artifact, its projection,

and the *dispositif*, the "film as performance" framework includes those elements that ensure a film exhibition's unique "performance." In that sense it bears similarities to music; for, as Hediger underlines, "in music, like in film, there is either no original, or each and every performance is an original" (2011: 46). Thus, Hediger proposes "performance" as a conceptualization of the film work that does not exclude the idea of "original." It should be noted that "film as performance" here does not refer to the performance of actors in the films, but only to the performance of the films when shown.

Aligning the concept of performance with the film's materiality, or rather, the (history of) processes that create the film's material artifact as well as its performance, Flueckiger writes: "film as an object is the result of a certain recording process in combination with subsequent development, editing, optical works, color GRADING, and printing. These processes are optimised from the outset to deliver film as a basis for projection" (2012: 137). According to Flueckiger, aspects such as the film's production history (e.g. its production and post-production), material qualities (e.g. the photochemical characteristics of the medium), and its performative character (e.g. its projection) all coincide with film's affordance.

Performative aspects are of great relevance not only for early cinema but also for avant-garde and experimental films, especially when creative elements are added during the projection of a film, for instance by relying on multiple projectors or color filters or when a live performance is integrated into the exhibition as in the case of Guy Sherwin's *Man with Mirror* (UK, 1976), to name but one of many examples.

It should be pointed out that avant-garde and experimental films bear a resemblance to time-based art, also referred to as media art (e.g. art installations with a moving-image component). Experimental filmmakers are very often also time-based artists, and vice versa. For example, British artists Tacita Dean and Ben Rivers make films either intended for theatrical release or as gallery/museum installations, or both.

Consequently, art curators and scholars often draw from time-based art discourse for their approach to the preservation, restoration, and presentation of such films. In the last twenty years, some very important contributions have been made to the theory and practice of time-based art. In the 2009 version of this book, I referred to the Variable Media Network project (see p. 94) in relation to the concept of "original," citing Carol Stringari, Deputy Director and Chief Conservator of the Solomon R. Guggenheim Museum, who posed the question of how to preserve the integrity of the original work when migrating to a new format or medium (2003: 55).

In a similar vein, a number of works in different ways have focused on the performative aspect of time-based work rather than on its material artifact (e.g. Laurenson, 2006 and Noordegraaf et al., eds., 2013). By drawing a parallel between

time-based art and music, contemporary art conservator and scholar Pip Laurenson (2006), focuses on the performative aspect of time-based art, as does Hediger with music and film (2011). If we consider these approaches in relation to the dichotomy between the conceptual and material artifact discussed in Chapter One, time-based media theory tends to focus more on the conceptual artifact. However, it should be pointed out that these approaches do not altogether discard the material artifact but rather identify "work-defining properties," to use Laurenson's words, which are carriers of the work's authenticity and also include material elements (e.g. visual and aural characteristics of playback equipment) that should be preserved in all new performances, even when the audiovisual component has been migrated to different media and is played back by different equipment.

However, as discussed in relation to the "film as art" framework, there are also experimental filmmakers and time-based artists who consider the original medium equally as important as the performative aspect. A number of scholars and curators have raised the concern that migration from one medium to the next could result in a loss of certain elements specific to the original medium, especially in the case of a migration from analog film to digital media (e.g. Friend, 2011 and Monizza, 2013).

The "film as performance" framework as intended here does not necessarily exclude the material artifact, especially if we consider it not only as the medium on which images are impressed or encoded but also as the process, in accordance with Flüeckiger (2012). Indeed, as already discussed, the (post-)production and presentation process of films (both analog and digital) have radically changed over time. As a medium in transition, film is constantly being adapted to the wants, needs, and practices of the time: films originally made in one format have often had subsequent releases in different formats; film prints are shown through different projectors with different light systems; and soundtracks are played through different sound systems. Thus, if we consider the performance history of a film as inherent to its life-line – without solely focusing on one specific performance (e.g. its first public screening) – the "film as performance" framework can also be associated with the material artifact as a dynamic concept. In doing so, we can chart specific instances in which the material artifact changed throughout its performance history, either on a material level – image and sound – or on a conceptual level – (post-)production and presentation.

"Film as performance" seems a necessary addition to the frameworks proposed earlier, particularly to address specific questions in relation to avant-garde and experimental films.

Indeed, many experimental films have been conceived as a performance, for example Harry Smith's *Mahagonny* (USA, 1970-1980), discussed in detail in Chapter Four; or, newly added to this book, the restoration of *We Can't Go Home Again* by Nicholas Ray and his students at Harpur College (USA, 1972-1976).[cxiii] In both these cases, the restoration process deals with the existing material film

artifact (negatives, projection prints, and work prints) and the conceptual artifact, which, in the case of *Mahagonny*, includes the limited screening of the 16mm multiple projection performance at Anthology Film Archives in 1980; and, in the case of *We Can't Go Home Again*, the limited screening of different versions at the Cannes Film Festival in 1973 and on a few other occasions.

As is the case with early films, it is the role of interpretation that determines which framework is most suited for a particular restoration project. Regarding *We Can't Go Home Again*, for instance, a "film as original" approach would fail to do justice to the film's element of performance. Restoring a performance entails a different approach; one that looks beyond the material artifact and takes into consideration processes that may have influenced the production and presentation of the film. Contrastingly, applying a "film as art" framework, as archives focusing on avant-garde films and specific directors/*auteurs* are accustomed to do, might also not be very relevant, considering *We Can't Go Home Again* was essentially a collaborative project between Ray and his students, who might all have had a different idea of how the film should have been shown. Even if we consider Ray as the *auteur* of the film, it is widely known that he continued to rework his film until his death in 1979, making it nearly impossible to ascertain his creative intent in terms of editing and presentation at any one time. In Chapter Four, we will further elaborate on the film's restoration process from a "film as performance" perspective.

Thus, a "film as performance" framework can easily accommodate the performance aspects associated with early films and experimental and avant-garde works; however, I would like to argue that it could also be adopted when looking at other kinds of archival films. Indeed, most films that end up in archives have been exhibited or performed in different ways since they were first produced, and their performance history often continues after entering the archive.

As mentioned above regarding experimental films, a "film as performance" framework would indeed be productive when looking at films as material artifacts that constantly change in appearance; from the deterioration and migration of film copies to new and changing *dispositifs* and technological means (to invoke Baudry's *appareil de base* [1978: 31]). Because it includes the more ephemeral aspects of concurring multimedia performances and the changing materiality of film artifacts, the "film as performance" framework is quite different from the "film as *dispositif*" framework, which mainly focuses on the film exhibition or reenactment, and the "film as original" framework, which primarily focuses on the material film artifact.

So what are some of the benefits of adopting the "film as performance" framework? In terms of archival exhibition, a "performative" approach would reiterate that film exhibitions are unique performances in which performative elements (such as live-music accompaniment or an introduction or narration, etc.) and different media (other audiovisual content compiled for a specific program, etc.) are integral parts of the work to be restored and (re)presented.

As for the restoration process, a "film as performance" framework would allow restorers to look at the broader performative setting when taking on a project. Thus, restoration would not be limited to the intervention on image and sound but would also include the documentation (and possibly the simulation) of one or more specific historical performances of a film. Similar to other performing arts such as music or theater, new performances would then be accepted as new authentic interpretations. Thus, the role of a curator or restorer would be similar to that of a conductor, for music, or a director, for theater.

As it stands now, film archives and museums working with time-based art best represent the "film as performance" framework in that they primarily focus on avant-garde and experimental films. Only a few examples can be found in which such an approach was applied to early cinema, one of which is of course the aforementioned *Crazy Cinématographe*.[cxiv] However, here, to my knowledge, the "film as performance" approach was primarily applied to programming and presentation and not specifically to the restoration of the featured films. Also, a recognizable "film as performance" approach to films that are by definition neither experimental nor early has not yet been adopted in film archival practice but it would certainly be interesting to investigate the consequences of approaching the restoration of a more canonical film title from this perspective. While a number of restorations and presentations of early and experimental films have been partly approached from the "film as performance" framework, there is, as yet, no archive that represents this specific framework in terms of policy and practice.

2.2 FILM ONTOLOGY IN TRANSITION

> For if, for example, that ship of Theseus, concerning the difference whereof made by continual reparation in taking out the old planks and putting in new, the sophisters of Athens were wont to dispute, were, after all the planks were changed, the same numerical ship it was at the beginning; and if some man had kept the old planks as they were taken out, and by putting them afterwards together in the same order, had again made a ship of them, this, without doubt, had also been the same numerical ship with that which was at the beginning; and so there would have been two ships numerically the same, which is absurd. (Hobbes. *De Corpore* 11, 7, 2)[125]

Part of the ontological question (i.e. what is the essence of something, what makes something that thing and not something else?) is whether something remains the same when undergoing a process of transformation. Its nature

may change or, differently, only accidental aspects may be affected, leaving its fundamental core unchanged.

The transition of film to digital is comparable to that of ship of Theseus, as told by Thomas Hobbes. As its planks are substituted one by one with new ones and the old planks are reassembled, which of these two ships is then the ship of Theseus? Are the two ships ontologically different? This question resembles the one posed by Rodowick and quoted at the beginning of this chapter: "What is left, then, of cinema as it is replaced, part by part, by digitization? Is this the end of film [...]?" (2007: 8). The analogy fits particularly well the transformation that films undergo in their *archival life*: they are literally replaced, frame by frame, by duplication through analog and/or digital means. The original pieces are kept, as in the case of Theseus' ship, and "put together" in a can and preserved in the archive's vaults. Which *Beyond the Rocks* (USA, 1922) is the same as at the beginning: the nitrate film print kept at Eye Filmmuseum, too shrunken and fragile to run through a projector, or its analog restoration, projectable anytime on any screen equipped with a 35mm projector; or, a third option, when considering also the transition to digital, its digital restoration, projectable as such or after being printed back on film?

To answer this question, one could take film's reproducibility as an argument. From this perspective, film is different from Theseus' ship as it is from other art forms prior to photography. As there can be analog copies of the same film, so there can be digital copies. But are analog and digital copies ontologically the same? A possible answer to this question is, in agreement with Rodowick, that "film has no persistent identity" and that we have to deal with an "uncertain ontological status of the medium" (Rodowick, 2007: 23-24).[126] In my view, it is precisely film's uncertain ontological status that spurs us to recognize a "non ontological change" in the transformation from analog to digital, but, rather, a transition.

Transition can be the negligible in-between A and D, A being all analog film and D all digital. We are now in that in-between. We can look back at A and realize that A never was such a well-defined place to begin with. A was already an in-between, a transition by itself. Maybe a transitory "compromise" in the history of television, from the camera obscura to the television set, as Uricchio provocatively, and convincingly, suggests (1994, 1997 and 2002a).[127] Or, maybe, a transition toward the convergence where the daguerreotype and Charles Babbage's Analytical Engine merge into one, as Manovich argues (2001).[128] Transition as I understand it here is not the defined path linking A to D, it is rather transition in itself, the very in-betweenness.

If the ontological question is addressed from this state of transition, seeking a "persistent identity," a platonic essence of film, becomes irrelevant. In any case it is irrelevant for film archivists, as they see nowadays new films

entering the archives that definitely do not share the same physical identity with those already sitting in the vaults. And it is irrelevant also in retrospect, as cinema "has never been one thing," as Gunning points out:

> It has always been a point of intersection, a braiding together of diverse strands: aspects of the telephone and the phonograph circulated around the cinema for almost three decades before being absorbed by sound cinema around 1928, while simultaneously spawning a new sister medium, radio; a variety of approaches to color, ranging from tinting to stencil coloring, existed in cinema as either common or minority practices until color photography became pervasive in the 1970s; the film frame has changed its proportions since 1950 and is now available in small, medium, and supersized rectangles (television, cinemascope, IMAX, for example); cinema's symbiotic relation to television, video, and other digital practices has been ongoing for nearly half a century without any of these interactions and transformations – in spite of numerous predictions – yet spelling the end of the movies. Thus anyone who sees the demise of the cinema as inevitable must be aware they are speaking only of one form of cinema (or more likely several successive forms whose differences they choose to overlook). (Gunning, 2007a: 36)

In this vein, a dynamic approach better suits the ontology of film. Film belongs to those things that change throughout time, that are inherently transitional. From this perspective, film's transition from analog to digital is a transformation that ontologically does not affect its (conceptual) artifact.

Based on this approach, that holds that film's nature is not affected by the technological change, I propose to adopt a number of key concepts introduced by new media theorists and to adapt them for a theory of archival practice. These concepts are those of convergence, remediation and simulation, and they are particularly relevant in relation to film archiving practices, as I will discuss in the following pages. Also, I will propose them as functions of film in transition, activated by archives and laboratories in the practice of film restoration.

In the second part of this work, the concepts discussed here will be used in combination with the proposed frameworks to analyze the archival field and a number of restoration case studies. As mentioned earlier, the term concept indicates here the interpretation process that defines something, and is shared by a community, in this case that of archives and laboratories. Concepts refer to specific interpretations or beliefs by an archive or a laboratory with respect to the technological means adopted for the film restoration practice. As discussed earlier, whereas the frameworks are a "constellation

of beliefs" (Kuhn, 1996: 175), the concepts I propose function within one or more frameworks as one of the shared beliefs within the film archival community. The concepts I have elaborated define different beliefs with respect to the practice of film restoration in this time of transition to digital. They can be part of any of the frameworks introduced earlier.

Convergence/Divergence

The concept of convergence/divergence proposed here is inspired by the idea of convergence as introduced by Ithiel de Sola Pool and more recently re-elaborated by David Thorburn and Henry Jenkins. Here, I intend to further elaborate on convergence as one of the most relevant concepts introduced by new media studies. In particular, I argue that convergence is a relevant and useful concept for theorizing archival practice in this time of transition.

Pool describes convergence in terms that are reminiscent of my earlier definition of transition:

> Convergence does not mean ultimate stability, or unity. It operates as a constant force for unification but always in dynamic tension with change. [...] There is no immutable law of growing convergence; the process of change is more complicated than that. (Pool, 1983: 53-54)

Convergence thus defines an on-going process that does not necessarily originate in stability nor heads to a new stability. It should, however, be pointed out that, since the 1980s, the term convergence has started assuming a different connotation, as it has not been used to indicate a process but, conversely, a target, in a teleological sense:

> Current discussion about media convergence often implies a singular process with a fixed end point: All media will converge; the problem is simply to predict which media conglomerate or which specific delivery system will emerge triumphant. (Thorburn and Jenkins, 2003: 3)

From similar misconceptions of media convergence, which seem to be surprisingly widespread, originates the idea that all moving images are already all digital, or will shortly become so. Filmgoers often think that they are already looking at digital projections whereas, as discussed earlier, the number of movie theaters equipped with digital projectors is still small. Similarly, it is my personal experience that most people visiting the archive, from students to delegates of funding entities, are puzzled when confront-

ed with the fact that digital tools are used only to a limited extent for film restoration.

Philip Rosen describes the convergence rhetoric as a "strategy of the forecast," where "purely digital practices become something like an inevitability that is nevertheless 'not yet'" (2001: 316). The effects of this attitude in the field are manifold and range from a rush to digitization "before it is too late," to confusion and paralysis. These attitudes, often retraceable to either blind confidence in the digital or mistrust of it, can also be found, with the necessary nuances, in film theory and in archival practice.

An example of mistrust originating in the convergence perspective emerges in Friedrich Kittler's work. Kittler's discussion of convergence reaches apocalyptic tones when he writes that:

> Before the end, something is coming to an end. The general digitization of channels and information erases the differences among individual media. Sound and image, voice and text are reduced to surface effects, known to consumers as interface. Sense and the senses turn into eyewash. Their media-produced glamour will survive for an interim as a by-product of strategic programs. Inside the computers themselves everything becomes a number: quantity without image, sound or voice. And once optical fiber networks turn formerly distinct data flows into a standardized series of digitized numbers, any medium can be translated into any other. With numbers, everything goes. Modulation, transformation, synchronization; delay, storage, transposition; scrambling, scanning, mapping – a total media link on a digital base will erase the very concept of medium. Instead of wiring people and technologies, absolute knowledge will run as an endless loop. (Kittler, 1999: 1-2)

Kittler offers a vision of total digitization where differences among media are erased, as they become a "standardized series of digitized numbers." Digital technology, having once reached total convergence, will finally cut off people from its endless loop. Kittler and other theorists of (this kind of) convergence, are in my view missing the importance of this transitional moment. It is here and now that things are happening. Transition is the media of today with its hybridizations of analog and digital. It is the in-betweenness that is meaningful in itself, and not a step towards digital purity that may occur someday. Reading this transition through the glasses of a future that is (perpetually) "not yet," is at the risk of prophetism, that will lead convergence as an idea to lose even more credibility, as Elsaesser warned already ten years ago:

> The "convergence" argument around the digital media as the "motor," by overstating the case, is in danger of losing credibility. It gives a false impression of destiny, and with it, a sense of disempowerment that overlooks a number of salient forces also shaping the current situation. (Elsaesser, 1998: 201)

I will elaborate on some of these "salient forces" in Chapter Three, where film archives, laboratories, policies at European level and global professional associations will be addressed as the forces that are reshaping the current archival practice.

Thorburn and Jenkins, both affiliated to the Massachusetts Institute of Technology (MIT), as Pool was, also criticize the idea of convergence as a teleological concept by bridging their understanding with Pool's original concept:

> [...] if we understand media convergence as a process instead of a static termination, then we can recognize that such convergences occur regularly in the history of communications and that they are especially likely to occur when an emerging technology has temporarily destabilized the relations among existing media. (Thorburn and Jenkins, 2003: 3)

Media convergence, in Thorburn and Jenkins' understanding, is, like Pool's, similar to what I define transition, that is a process of becoming. More recently, Jenkins has further refined his definition of convergence in his book *Convergence Culture: Where Old and New Media Collide*. Here a shift of focus can be registered towards the media cultural dimension as Jenkins welcomes the reader to "convergence culture":

> where old and new media collide, where grassroots and corporate media intersect, where the power of the media producer and the power of the media consumer interact in unpredictable ways. [...] By convergence, I mean the flow of content across multiple media platforms, the cooperation between multiple media industries, and the migratory behavior of media audiences who will go almost anywhere in search of the kinds of entertainment experiences they want. (Jenkins, 2006: 2-3)

Nevertheless, the idea that media will converge towards an all digital something, be it the Web or else, still risks bearing a teleological approach. Jenkins alerts the reader in this respect with warning words:

> Keep this in mind: convergence refers to a process, not an endpoint. There will be no single black box that controls the flow of media into our

> homes. Thanks to the proliferation of channels and the portability of new computing and telecommunications technologies, we are entering an era where media will be everywhere. Convergence isn't something that is going to happen one day when we have enough bandwidth or figure out the correct configuration of appliances. (Jenkins, 2006: 15-16)

To avoid misunderstandings about the meaning of convergence, and to clearly differentiate it from the popular idea that convergence refers to an endpoint where a black box will control all media flows, I propose to add its antonym to the concept: divergence. Convergence/divergence are two inversely related concepts. They constantly remind of the dynamics of change and differentiation and, therefore, their use in combination best defines the transition in the media environment. In the case of archival practice, convergence/divergence describe what is happening in a field stretched between two forces, one heading towards convergence of technology, standards, and means, and the other heading towards diversification of means, multi-specialization and, literally, divergence.

Remediation

The concept of remediation discussed below has been derived from Jay David Bolter and Richard Grusin's seminal book, *Remediation. Understanding New Media* (1999).

I argue that remediation, in the case of archival film, defines the practice that remediates old restoration technologies attempting to "rival or refashion them in the name of the real," using Bolter and Grusin's words (1999: 65). The "real" in the case of film restoration stands for the film artifact to be restored and corresponds to the idea of the "original" as discussed earlier. The idea of the real to remediate, as well as that of the original can vary according to the adopted framework, from the material film artifact as it has survived through the years to the film as it might have been when it was first shown to an audience.

Bolter and Grusin have elaborated on the concept of *remediation*, originally introduced by Paul Levinson (1997: 104-114), describing the logic by which media refashion and improve themselves by competition:

> We offer this simple definition: a medium is that which remediates. It is that which appropriates the techniques, forms, and social significance of other media and attempts to rival or refashion them in the name of the real. A medium in our culture can never operate in isolation, because

> it must enter into relationships of respect and rivalry with other media. (Bolter and Grusin, 1999: 65)

In Bolter and Grusin's perspective, thus, remediation is not typical of the digital but, rather, typical of media in general. Also, in their theory an a-teleological approach is embraced, based on the idea that also older media refashion themselves when challenged by new media:

> But ours is a genealogy of affiliations, not a linear history, and in this genealogy, older media can also remediate newer ones. (Bolter and Grusin, 1999: 55)

Remediation works, thus, by refashioning both the old and the new media in a continuous process. If convergence/divergence indicate a process where, as media tend to converge, still a different force pulls towards higher specialization and divergence through niche techniques, remediation, on the other hand, is rather a parallel process where old and new media interact, influencing one another.

In this line, remediation also matches the idea of transition as discussed earlier. This is even more evident if one considers that remediation is not a new phenomenon introduced by digital media:

> We can identify the same process throughout the last several hundreds years of Western visual representation. A painting by the seventeenth-century artist Pieter Saenredam, a photograph by Edward Weston, and a computer system for virtual reality are different in many important ways, but they are all attempts to achieve immediacy by ignoring or denying the presence of the medium and the act of remediation. (Bolter and Grusin, 1999: 11)

This logic of achieving immediacy by ignoring the medium represents one crucial aspect in the remediation theory proposed by Bolter and Grusin. Remediation operates following the two opposing logics of *immediacy* and *hypermediacy*:

> *hypermediacy* A style of visual representation whose goal is to remind the viewer of the medium. [...]
> *immediacy (or transparent immediacy)* A style of visual representation whose goal is to make the viewer forget the presence of the medium (canvas, photographic film, cinema, and so on) and believe that he is in the presence of the objects of representation. (1999: 272-273 – emphasis in the original)

The dialectic between these two logics can be found in archival practice as well, in particular in the work of film restoration. A film restorer can be seen as a mediator, as I have suggested earlier when discussing the "film as original" framework in relation to Soderman's reading of indexicality. I have argued that human mediation can be carrier of the authenticity from an original film artifact to its restoration. In view of the remediation concept, the task of a film restorer is that of finding the subtle line between immediacy (be true to the artifact) and hypermediacy (be true to the medium). In other words, the restorer can choose immediacy, making the viewer forget the medium of restoration (either photochemical, digital or a mix of the two), or hypermediacy, reminding the viewer of the restoration process. For example, restoring the film as it possibly appeared at the time when it was first shown (immediacy), or adding elements that are typical of contemporary restoration tools (hypermediacy). An example of hypermediacy could be that of adding stills, animations or texts where a scene is missing in order to complete the narrative line and illustrate to the audience what used to be there but is now lost.[129] Most restorers, however, will aim for something in between immediacy and hypermediacy, depending on their framework of reference.

This role of mediator (or re-mediator) did not begin with the introduction of digital technology for restoration, but it has certainly been amplified by it. Restorers gain so much more power with the digital that their role is becoming very influential, as the subtle line between immediacy and hypermediacy is much more difficult to draw. Indeed, as Bolter and Grusin also stress, "[t]he digital medium can be more aggressive in its remediation. It can try to refashion the older medium or media entirely" (1999: 46).
Interestingly, Bolter and Grusin point out the connection between remediation and restoration. However, they never make the link with archival practice and (media) restoration activities:

> The word *remediation* is used by [...] environmental engineers for "restoring" a damaged ecosystem. The word derives ultimately from the Latin *remederi* – "to heal, to restore to health". We have adopted the word to express the way in which one medium is seen by our culture as reforming or improving upon another. This belief in reform is particularly strong for those who are today repurposing earlier media into digital forms. (1999: 59 – emphasis in the original)

An example of such a form of media repurposing in the archival field could be that of a digital projection of a film from 1912. This could even be seen as a double remediation where the old film medium (nitrate film stock, photographic reproduction, stencil colors, inherent image instability, etc.) is reme-

diated into the digital medium and, at the same time, the digital medium is repurposed in order to recreate the characteristics of the old medium.

Simulation

The concept of simulation is based on the idea that one typical characteristic of digital media is the ability to simulate analog reproduction media (Manovich, 2001 and Rodowick, 2007). Here I argue that such ability is already present in analog film and I propose a simulation concept that is relevant for theorizing film restoration practice.

Lev Manovich suggests that the digital is particularly suitable to create a faithful copy of a photographic image:

> [...] what computer graphics have (almost) achieved is not realism, but rather only *photorealism* – the ability to fake not our perceptual and bodily experience of reality but only its photographic image. [...] Once we came to accept the photographic image as reality, the way to its future simulation was open. (2001: 200-201 – emphasis in the original)

Manovich understands the photographic image as indexical, bearer of a direct bond with reality, and he points out simulation as a typical characteristic of the digital image, because the latter is non-indexical and therefore cannot refer directly to a reality but only simulate it. A similar conclusion is drawn by Rodowick when he argues that:

> This process [simulation through calculation] enables a new series of powers of synthesis and manipulation wherein, for example, computers can simulate analogical recording and editing devices in all their functions. (2007: 127)

In this case it is not only the simulation power to recreate a photographic image but also that of recreating a mode of reproduction (analogical recording) and tools (editing devices). Manovich and Rodowick point out that the digital has a potential for simulation unknown to analog representation.

From this perspective, simulation is a concept that brings restoration closer to filmmaking. If special effects are a good example of film's simulation ability of creating a realistic image from scratch, similarly, such ability enables the film restorer to recreate an image that was there and is now gone. This is particularly evident with the creation of a synthespian in a new film (e.g. the Gollum character in *The Lord of the Rings*) and with the restoration of

an image, or part of it, which has been removed by decay in an archival film (examples are shown later with regard to the restoration of *Beyond the Rocks*). But the case of *The Aviator*, discussed in Chapter One, where the look of Technicolor for a new film was recreated by digital means, also shows an approach similar to the one that would be taken in the restoration of a Technicolor film.

An approach that puts simulation into a broader media perspective than the one addressed above for the digital, is offered by Philip Rosen. In discussing "digital mimicry," his definition of digital simulation, Rosen argues that digital mimicry is more entangled with old media than is often assumed, in the false dichotomy that sees analog/indexical as old and digital/non-indexical as new:

> The quest for digital mimicry has been one of the driving forces in the history of digital imaging. All of this means that, to a significant degree, digital imaging is not separable from prior histories of mediated representation on screen surfaces, but overlaps with them. Any argument that treats digital imagery as radically novel must deal with such overlaps. [...] These overlaps may take on the appearance of a variety of admixtures or hybrid cases, which imply, among other things, temporal or historiographic conflations. (Rosen, 2001: 314-331)

These overlaps are certainly evident when embracing the point of view of the archivist. It is the archivist's everyday experience that films from the last twenty-five years are nothing but hybrids of analog and digital, as described in Chapter One. Hybridism, as argued earlier, can be seen as a function of film's transitional nature and, in this way, it should be seen as inherent to film in general, and not only to film in transition to the digital. In other words, film hybridism was already part of film before the digital and digital is just another expression of film's temporal conflations.

Similarly, simulation should be seen as a characteristic of film independent from the digital. Only accepting the dichotomy analog/indexical and digital/non-indexical, simulation would be seen as exclusively digital. Once such a dichotomy is questioned, simulation can be seen as typical of reproduction media in general. I argue that this line of thinking applies to film restoration. As I discussed already elsewhere with regard to early color films (Fossati, 1996), restoration is simulation. Film restoration is based on the best possible simulation of the original film artifact (where original is something in between the material artifact, as it has survived, and the idea of what it originally looked like), carried out using different technologies. The restorer can take his or her pick among available film stocks, printing and processing equipment and, since a decade ago, digital tools in order to simulate as close-

ly as possible archival films that were made with different technologies. This is true for a nitrate stencil film from the 1910s as well as for a Techniscope film shot in the 1970s. Because the history of cinema has seen a succession of different film formats and color and sound systems, all of which have become obsolete or have been modified one way or the other (as is typical of state-of-the-art industrial products), the restorer has no other choice than to simulate what was there by means of the tools available at the time of restoration.

The parallel drawn earlier between simulation in filmmaking and in film restoration was also true before the advent of the digital. Double exposure techniques to introduce an element in a shot that was not there during shooting were there long before the digital, and could have been applied also to film restoration if the costs would not have been that high. Similarly, a Technicolor look can be simulated with analog tools both for giving a certain look to the picture as in the case of *The Aviator*, as for restoring a Technicolor archival film. The difference is only that the digital can do it more accurately at ever decreasing costs.

The great potential of the digital for simulation has been one of the main reasons why, in the last decennia, the digital has been defined by many as a tool for obliterating the real, at least with regard to representation. In line with the traditional indexical argument, discussed earlier, the digital breaks the supposedly objective link with the referent that is the real. One of the most vibrant voices supporting this idea is that of Jean Baudrillard whose theory of simulation and of the simulacrum has been elaborated throughout his writings since the late 1960s:

> [...] with the digital turn the entire analog photography, the image conceived as convergence of the object's light and the sight, is sacrificed, irrevocably doomed. (Baudrillard, 2006: 44 – my translation)

This perspective is based on photographic indexicality and Baudrillard brings it as far as conceiving an all-pervasive simulation:

> Simulation is no longer that of a territory, a referential being or a substance. It is the generation by models of a real without origin or reality: a hyperreal. (1983: 2)

Baudrillard's theory also calls upon a nostalgic sense of loss. According to Andreas Huyssens:

> To see the entanglements of the real as no more than simulations designed by the system to feign that something is there, a presence, a ref-

> erent, a real, is a form of ontologizing simulation that betrays, perhaps, nothing so much as a desire for the real, a nostalgia of loss. (Huyssens, 1989: 8)

The "desire for the real," the idea of "nostalgia," and in general pessimism on the future of film, have been, in my view, all very strongly present within film archives in the last decennia. Probably the few archivists who have attempted a theorization of their practice have been somehow influenced by French theorists such as Baudrillard, Debray and Virilio, who all share a similar view on the crisis of the real.[130] On the other hand, such a perspective can be disputed by acknowledging the role of the media users. Baudrillard's theory of simulation is reminiscent of Kittler's idea of convergence, discussed earlier, as they both disregard the users' role.

Taking simulation as the interpretive key for the use of digital technology for film restoration, it can be said that the digital can theoretically provide the most suitable means for restoring and recreating the experience of an archival film. This is quite the opposite answer to the curatorial value offered by Cherchi Usai et al., which states that:

> As interpreter of history through the audivisual collection for the benefit of present and future generations, the curator must ensure that the work is experienced in a form as close as possible to the way it was intended to be seen and/or heard at the time of its creation. (2008: 153)

Whereas the above suggests that the curatorial value is strictly linked to the original apparatus (e.g. a film projection for a film-born film), it can be argued that a proper digital restoration and exhibition can recreate much more thoroughly the experience of an archival film, especially those made with a now obsolete format, which is the vast majority (e.g. long gone ASPECT RATIOS and color or sound systems).

Based on Manovich's definition of the computer graphic's photorealism (2001: 200-201), the ability of new media for simulation can be defined as the ability to simulate photographic images. Taking the concept a bit further by covering also the domain of film restoration, I argue that digital simulation can lead both to the creation of special effects and, in the case of a film restoration, to the recreation of elements that were once in a film image but have been erased from the emulsion by physical damage. On the other hand, if one agrees that simulation is a typical characteristic of media in general, it can be said that the digital makes it only more visible. From this perspective, digital restoration is a continuation of previous analog restoration but it does provide a more effective tool.

In conclusion, I argue that in this moment of transition from analog to digital a dialogue between film theory and film archival practice is particularly urgent. While film theory is reflecting on its usefulness in view of the digital and new media theory is proposing new perspectives for looking at the future and past of media, film archivists are questioning their role as their practice and the practice around them is changing by the day. Both discussions contribute to our understanding of film heritage and could therefore concur in determining its future, in terms of preservation, exhibition and access.

At this moment, a theory of film archive practice is necessary for promoting a mutual discourse among film archivists and film scholars. Film archivists can look at their practice from new perspectives based upon the theoretical discourse. In turn, a theory of archival practice can provide scholars with the tools for understanding the *archival life of film*, namely, for understanding film once they have been archived, restored, digitized, in other words, historized by archivists.

In this chapter I have elaborated a number of frameworks and concepts that form the basis of my theorization of archival practice. I have derived frameworks and concepts from both the academic and the archival discourse. The conceptual tools I have introduced are deeply related to the discourse on film ontology and to different assumptions among film theorists and film archivists on the film artifact, intended as both a material and a conceptual object. My theorization intends to comprise different and even opposite conceptions of the nature of film, from the indexical to the one I have loosely defined "mind/film," and different assumptions of the nature of the archival film, from the ones focusing on the material film artifact to those privileging the conceptual film artifact. Nevertheless, I have also argued that transition offers an appropriate way to look at film's nature and that the most productive perspective on this particular transition, from grain to pixel, is that of looking at film as inherently transitional.

In the second part of this work I measure these new theoretical tools against film archival practice in transition by addressing the question of whether the frameworks and concepts proposed provide a suitable means for investigating the archival field and, also, how the elaborated conceptual tools reflect (upon) archival practice and, in particular, film restoration case studies.

PART 2

THEORIZING (ARCHIVAL) PRACTICE

In the first part of this study I have discussed the most recent changes in film (archival) practice and in film theory in this time of transition and I have proposed theoretical frameworks and concepts as a basis for a new theorization of film archival practice.

In the second part, by measuring the proposed conceptual tools against a number of case studies from the current film archival field, I will show how they allow deeper dynamics and logics, between the social groups involved and, especially, between theory and practice, to be made visible.

In Chapter Three I focus on the different approaches to film archival practice of a number of relevant social players, such as film archives, laboratories and funding entities. The frameworks offer a tool for addressing different film archival policies, whereas the concepts are useful in assessing film laboratory practices. In Chapter Four, by means of a comparative analysis between a number of relevant film restoration case studies, the power of the proposed new analytical tools emerges in the analysis of everyday film archival practice. I will also show how these tools reflect the transitional nature of film.

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Fig. 1: Example of image in different color depths.

Fig. 2: Example of color line scratch on a film print of *Romance de Valentía* (Sonia Herman Dolz, NL, 1993 – courtesy of Eye Filmmuseum).

Fig. 3: Detail of raindrops in a frame of the film *Regen* / *Rain* (Joris Ivens, NL, 1929 – courtesy of the European Foundation Joris Ivens and Eye Filmmuseum Netherlands). Raindrops, as with other fast moving elements in a film image, can be mistaken for defects (e.g. scratches) by digital restoration software.

Right page: Figs 4 & 5: Images before and after digital COMPOSITING carried out for the restoration of *Visage d'Enfant* (Jacques Feyder, FR, 1925 – courtesy of Eye Filmmuseum).

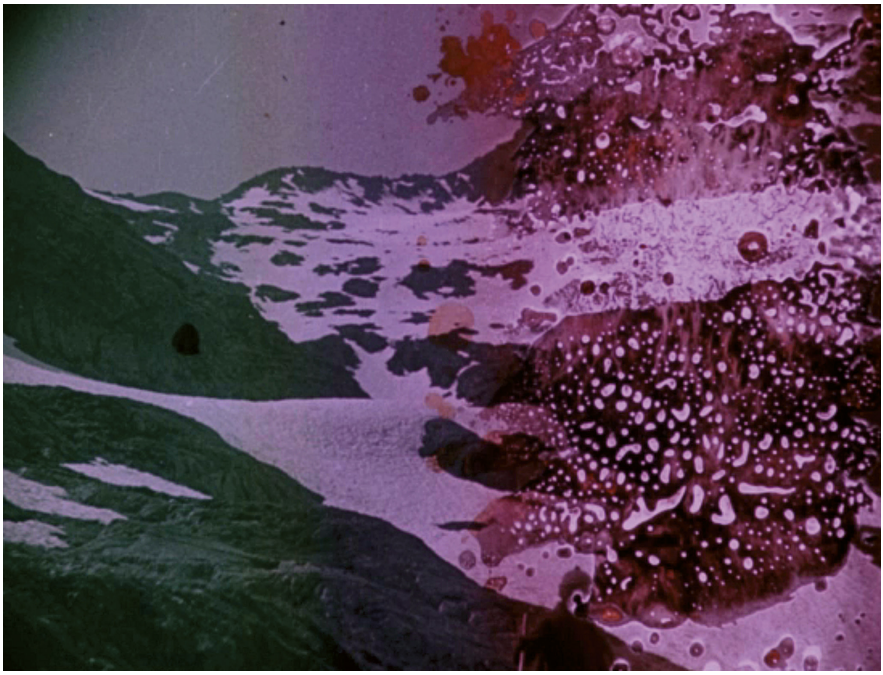


Fig. 6: Example of the fading of the tinting in a print of *The Lonedale Operator* (David W. Griffith, USA, 1911 – courtesy of Eye Filmmuseum).

Fig. 7: Example of the fading of the toning in a print of *Indian Seizes Kidnapper* (Original Title Unknown, Pathé Frères, FR, c.1910 – courtesy of Eye Filmmuseum).

Fig. 8: Example of color fading in a film print of *Sky over Holland* (John Fernhout, NL, 1967 – courtesy of Eye Filmmuseum).

Fig. 9: Frames from the stencil-colored film *The South of the United States* (Original Title Unknown, Eugene W. Castle, USA, 1928 – courtesy of Eye Filmmuseum).

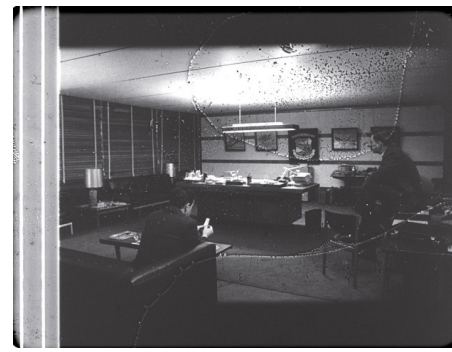
Fig. 10: Frames from the tinted film *Het Telegram uit Mexico* (Louis H. Chrispijn Sr., NL, 1914 – courtesy of Eye Filmmuseum).

Fig. 11: Frames from the tinted and toned film *De Molens die juichen en weenen* (Alfred Machin, NL, 1912 – courtesy of Eye Filmmuseum).

Fig. 12: Color separation workflow for the film *Les Pyrénées Pittoresques* (Pathé Frères, FR, 1910 – courtesy of Eye Filmmuseum).

Figs 13 & 14: Images before and after restoration of the color-faded film *Musica eterna 1452-1952* (NL, 1951 – courtesy of Philips and Eye Filmmuseum).

Figs 15-18: Images before and after restoration of *Dr. Strangelove* (Stanley Kubrick, USA, 1964 – courtesy of Sony Pictures Entertainment).



Figs 19 & 20: Two images of the restoration of *Mahagonny* (Harry Smith, USA, 1970-1980) in projection (courtesy of the Harry Smith Archives; photograph courtesy of Cineric).

Figs 21-23: Images before and after applying dust removal to a shot of *Beyond the Rocks* (Sam Wood, USA, 1922). In the third image the damage caused by the software is corrected. (Courtesy of Eye Filmmuseum).

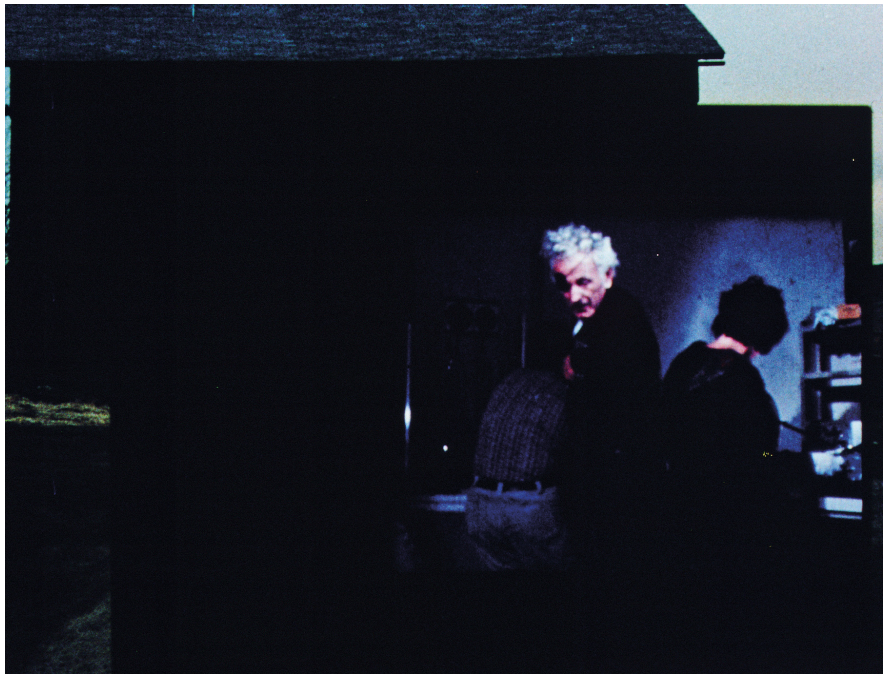
Figs 24 & 25: Images before and after digital restoration of a tear in a frame of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

Figs 26 & 27: Images before and after digital restoration of a patch in a frame of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

Figs 28 & 29: Images before and after digital restoration of a deteriorated frame of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

Figs 30 & 31: Nitrate deterioration of two shots of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

Fig. 32: Image composition in *We Can't Go Home Again* (Nicholas Ray, USA, 1973 – courtesy of The Nicholas Ray Foundation and Eye Filmmuseum).



Figs 33-36: Comparison of the test results of workflow 2 (33 and 35) and workflow 3 (34 and 36) for the restoration of *We Can't Go Home Again* (Nicholas Ray, USA, 1973 – courtesy of The Nicholas Ray Foundation and Eye Filmmuseum).

Figs 37-38: Before and after examples of the digital restoration of *We Can't Go Home Again* (Nicholas Ray, USA, 1973 – courtesy of The Nicholas Ray Foundation and Eye Filmmuseum).

Figs 39-40: Before and after examples of the digital restoration of *We Can't Go Home Again* (Nicholas Ray, USA, 1973 – courtesy of The Nicholas Ray Foundation and Eye Filmmuseum).

Figs 41-42: Before and after examples of color GRADING of *We Can't Go Home Again* (Nicholas Ray, USA, 1973 – courtesy of The Nicholas Ray Foundation and Eye Filmmuseum).

CHAPTER THREE

Film Archival Field in Transition

Ten years on in the transition from analog to digital, the film archival field is still in search of a balance between digital technology, which, while becoming ever more diffused is yet to be fully standardized, and photochemical means and services, which are growing increasingly scarce but are often still part of restoration and presentation workflows. Following the Social Construction of Technology (SCOT) theory, the methodological approach to this chapter still offers a valid method to look at the current situation in the film archival field. Its key concepts of "relevant social groups," "technological frame," and "interpretive flexibility," as described in the following sections, will once more help analyze the field and its changing relationship with tools, practices, and (analog, digital, and hybrid) artifacts, namely films.

Despite the new dynamics in the field after the digital rollout, the relevant social groups in the last decade have remained the same and, as we will see in the updates, the film archives and (most of) the laboratories that were previously discussed are still among the major players. As reported in Chapter One, after the digital rollout many laboratories have gone out of business. As for the three laboratories discussed in the earlier editions of *From Grain to Pixel*, one has indeed ceased its operation while the other two have managed to adapt and survive. Interestingly enough, those are the ones that still offer a full range of (analog, digital, and hybrid) film restoration services.

While the "technological frame" is progressively changing, it still follows the same cycle of stabilization and closure in which the established analog film artifact is gradually being replaced (in a number of practices such as restoration and projection) by the new digital film artifact. As argued a decade ago, film, being a complex technological artifact, is still the site of "interpretive flexibility," and as such is described differently by different relevant social groups (from filmmakers and archivists to film producers and scholars) as each group attaches a different meaning to it.

In this chapter, brief updates have been added to the original sections describing the film archives and film laboratory. The updates are mainly based on recent interviews that have been carried out with the same people (e.g. curators, heads of archives, and laboratory professionals) that were interviewed for the 2009 edition, or with their replacements.

As I am investigating the interplay between theory and practice in this time of transition from analog to digital technology, in this chapter I will be looking at the field trying to determine how new frameworks and concepts, elaborated from film and media theory, can be related to the different approaches to film archival practice in transition identifiable in the field. This work, as I have earlier pointed out, not only looks at transition from analog to digital as its object of research, but its very perspective is positioned in transition. Therefore, I will look in the first place for variations and tensions between different players within a relatively compressed time frame (approximately from 1997 to 2008) with the goal to further portray a practice in transition.

In the following pages, I intend to sketch the social framing of the current transition in film archival practice. I will do so by briefly mapping the field of film archiving at large, pointing out "relevant social groups," according to the terminology introduced by the Social Construction of Technology (SCOT) theory. The choice of calling upon some of the concepts introduced by the SCOT theory in this work has been mentioned earlier and is mainly based on the arguments that SCOT offers suitable tools for addressing a transitional process where a large number of players are involved and that, like other constructivist studies, rejects a deterministic approach to technology, making it particular relevant to this study.[131]

SCOT's key concepts are those of "relevant social groups," "technological frame," and "interpretive flexibility," which in the following pages will be put in relation to the case of (archival) film. Its model, according to Bijker (2001: 15524), consists of three main research steps. In the first, an artifact is described based on the meaning given to it by relevant social groups interacting with the artifact. In the second step, the artifact's dominance over others is analyzed as a process of social construction, and, here, it is noted that the different meanings initially attributed to the artifact are reduced to a dominant one, causing its diminished interpretive flexibility. In the last step, the broader theoretical framework (or "technological frame") is studied where the social process around an artifact takes place, looking at the dynamics among the relevant social group.

In contrast to most studies referring to SCOT, I will introduce a number

of variations to the method. First of all, I am looking at a curious sort of artifact, which is (archival) film and the set of practices related to it. Secondly, as stressed earlier, I am carrying out my analysis *in medias res* of the transition from analog to digital film and, consequently, my artifacts (i.e. archival film and its related practices) are still moving somewhere in SCOT's second step where the meaning attributed to the artifacts is not yet crystallized as would happen with an historical case. And, finally, along with the social groups I will be looking at (archives and laboratories), I am also discussing a number of European projects, which offer a different perspective on the social dynamics characterizing the field in transition, and which reveal different sets of interplays and networks between social groups.

It should be noted here that I do not intend to draw an exhaustive map of the film archival field. On the contrary, because I am looking at a field in transition, focusing on the transition itself from a perspective that is inevitably also positioned within the same transition, my goal is primarily that of creating a snapshot, rather than a map. As a consequence I will look at social groups and actors moving within the field in search for dynamics rather than benchmarks. This is the case for the archives, laboratories and European projects discussed in this chapter, and for the restoration case studies discussed in the next one. Accordingly, my emphasis will be on the dynamics between social groups, in the framing of archival film in transition. In order to analyze the field in the following pages, and the empirical cases in the next chapter, I will call upon those theoretical frameworks and concepts I have proposed in Chapter Two.

RELEVANT SOCIAL GROUPS IN THE FILM ARCHIVAL FIELD

Film's transition from celluloid to digital, from grain to pixel is profoundly interrelated with the change occurring around film and, in particular, around film as a historical artifact. This change has primarily a social character and it can be seen as one of the driving forces of the technological transition to digital. This would indeed be the case from SCOT's perspective:

> Technological development should be viewed as a social process, not an autonomous occurrence. In other words, relevant social groups will be the carriers of that process. (Bijker, 1995: 48)

From this perspective, the field where such social changes around film take place will be analyzed here in terms of relevant social groups.

As the object of study of this work is "archival" film, I will exclude from my

analysis those social groups dealing with the production of new films. Film production, however, finds its way back into the scope of this study in different ways. As we have seen in Chapter One, it is in most cases the same technology that is used for making new films and for restoring old ones. This also tends to be the case with post-production houses, laboratories, and the hardware and software they use. Also, filmmakers and producers use film archives as a source for footage and for the storage of their new films. Finally, part of the distribution chain can be the same for new and archival films. We might add that the theoretical discourse around film is essentially the same for film in general and for archival film in particular, and, from this perspective, most of the following discussion, although primarily aimed at archival film, is also relevant for the discourse on the transition to digital in current film production.

The archival film field comprises a wide spectrum of relevant social groups, including film archives, the commercial film industry (not only in the ways described above, as users, but also as owners of archives, as in the case of the Hollywood studios), politicians and policy makers in the culture sector, both at national, international (e.g. EU) and global (e.g. UNESCO) level, hardware and software manufacturers, which develop, produce and purchase film stock, laboratory equipment, digital CARRIERS, film and digital projectors, digital imaging software, film laboratories, especially, but not exclusively, the ones specialized in film restoration, other special interest groups, like various digital initiatives (e.g. DIGITAL CINEMA INITIATIVES and European Digital Cinema Forum), a broader array of cultural institutions (e.g. television channels with a tradition of showing archival content, such as ARTE), and, last but certainly not least, the archival film audience, which represents one of the groups that is witnessing the greatest changes, evolving from a relatively small elite of *cinéphiles* to an ever growing number of (digital) film users. Film users include different categories, from the filmmakers and media artists using archival footage in their work to the film archivists, the scholars and the students accessing archives for research purposes, from the film enthusiasts to the online users' population in general.

For heuristic purposes, I have chosen to focus here on a small number of relevant social groups, namely those of film archives and of film restoration laboratories. This choice is justified within the set up of this work. First, because what I am attempting is primarily a snapshot of this transitional moment in film technology and its implications for the archival field, in particular. Secondly, because film archives and film restoration laboratories are the only relevant social groups that "handle" archival film both as a material and as a conceptual artifact and, therefore, they retain a stronger bond to the object of this study than other groups. This is especially true with regard to their responsibility in terms of preservation and restoration of the film arti-

fact. Thirdly, within the technological frame of archival film, archives and laboratories are relevant social groups with a high degree of "inclusion," as they are the groups most directly involved with the (re)shaping of film archival practices resulting from the introduction of the digital technology. Note that SCOT theory uses the concept of "inclusion" to define the actors' degree of participation within a given technological frame.[132]

The choice of the individual archives discussed in this study has been driven by a number of factors, among which their influence in the field and their diversity in terms of background, mission, policy and strategy with respect to the transition to digital. But they have also been selected because they quite eloquently represent the theoretical frameworks I have previously identified as the most relevant for archival film, namely "film as original," "film as art," "film as *dispositif*," and "film as state of the art." For each framework, an archive will be discussed that best represents it in its practice, and how it is changing in the transition to digital. Differently, for each concept defined in Chapter Two (convergence/divergence, remediation and simulation), I have chosen to discuss a film laboratory that best embodies such a definition of the transition to digital. Also, the laboratories treated here have a close working relationship with the archives examined in this work, and they have been involved in the related case studies discussed in the next chapter. I will also be discussing a number of projects funded by the European Union (EU) and aimed at promoting technological development towards a sustainable use of digital media. Although a project is not strictly speaking a social group, it does express the agency of both its funding entity (EU in this case) and its members (e.g. film archives, research institutes and market players). It crosses the borders of social groups, interconnecting the field at large, facilitating communications between actors belonging to different relevant social groups. In addition, EU-funded projects clearly show another important dimension in the social construction of archival film, namely that of politics, which is of course present everywhere but it surfaces in a quite explicit fashion in the aims attached to projects funded by the European Union.

As the interaction between different social groups is extremely important, EU projects offer one of the possible channels for such interaction. In the triangle I am sketching here (archives, laboratory and EU projects) there is an obvious exchange of know-how, equipment and individuals. Within the named triangle the transfer and redistribution of knowledge takes place. Also, based on this knowledge, choices with respect to policies, standards, funding, etc. are formulated. Individual actors are often the carriers of meanings and ideas between social groups as they belong to one group but, by participating, for instance, in an EU project, come in contact with actors from other groups. In practice, such interactions take place on a regular basis between archives

and laboratories, as will be evident in the case studies discussed later. Note finally that individual actors are, like the whole field, also in transition and I address them as part of the snapshot I am drawing of the film archival field.

It should also be pointed out that relevant social groups overlap in many ways, and that other social groups, only touched upon in this work, are of influence in shaping film archival theory and practice, such as professional organizations (e.g. FIAF, ACE, and AMIA), archival film festivals (e.g. Il Cinema Ritrovato, Le Giornate del Cinema Muto, and Filmmuseum Biennale), MA programs (e.g. UvA, UEA, UCLA, and NYU) and other training programs (e.g. L. Jeffrey Selznick School of Film Preservation at the George Eastman Museum). In this respect, I would like to mention a one-day seminar organized at the Nederlands Filmmuseum (today Eye Filmmuseum) during the Filmmuseum Biennale 2007, in collaboration with AMIA and the organizers of the symposium, The Reel Thing, as an effort to bring different actors from the field together, which has been instrumental in shaping this chapter.[133]

All the groups named above can be defined as "relevant social groups" because they attribute similar meanings to the artifact (archival) film. In this sense, they all belong to the same "technological frame."

THE TECHNOLOGICAL FRAME OF ARCHIVAL FILM

SCOT's concept of technological frame is particularly useful for this work as it aims to analyze both changes and consistencies in technological development (Bijker, 1995: 192).[134] If film is changing, transitioning from analog to digital technology, the technological frame within which the relevant social groups interact around archival film is changing with it. Indeed, as Bijker points out, technological frames:

> are not fixed entities, but are built up as part of the stabilization process of an artifact. The building up of a technological frame mirrors the social construction of an exemplary artifact, just as much as it reflects the forming of a relevant social group. The social construction of an artifact [...], the forming of a relevant social group [...], and the emergence of a technological frame [...] are linked processes. (Bijker, 1995: 193)

The process of "stabilization," mentioned above, and the related concept of "closure" should be looked at more closely to see how such a process might work in the case of film. Stabilization indicates the process of social construction ("a discordant process in which several artifacts existed next to one another" – Bijker, 2001: 15524) leading to the moment of closure. With closure, one

of several coexisting artifacts is chosen as the "exemplary artifact" with a fixed meaning that brings together all relevant social groups. Such an exemplary artifact becomes then obdurate, which means that "it cannot be changed easily anymore, and it forms part of a hardened network of practices, theories, and social institutions" (1995: 282).

Applying this to our case, one can look at the transition from analog to digital film as a process from one exemplary artifact (photochemical film) through stabilization and (eventually) closure, once digital film should be chosen by the (most) relevant social groups as the new exemplary artifact.

In this perspective, all the relevant social groups discussed here operate within the technological frame built around the artifact photochemical film, as the exemplary artifact that has become obdurate after more than a century of practice. Social groups such as film archives, laboratories, the film market at large, etc. are now negotiating the introduction of a new technological artifact (digital film), marking in this way the outset of a stabilization phase. As discussed earlier, in this time, although many are the examples of digital artifacts within the film industry in general, and film preservation practice in particular, photochemical artifacts are still the norm for theatrical film distribution (less than 7% of the world's cinemas are equipped with a digital projector as of December 2007).[135] Furthermore, the controversy within and between most social groups with respect to digital film as a viable substitute for photochemical film is still on-going, marking the discordant process mentioned above, in which several artifacts, i.e. analog and digital CARRIERS and their related tools, coexist. Eventually, digital film will take the place of photochemical film as exemplary artifact, reaching in this way closure, and a new technological frame will then be formed around the new artifact.

If we look at film not only as a technological, but also as a conceptual artifact, though, we need to address the process described above differently. As mentioned earlier, the case of (archival) film is in many ways different from cases such as bicycles and bakelite (Bijker, 1995) and other similar cases usually addressed by SCOT theorists. Indeed, archival film and its related practices pertain to a technological process rather than a technological artifact. And, although one can think of the concept of "bicycle" as an abstraction and address its ontology, it would still be a less complex concept than archival film.[136] From this perspective, if we accept film's transitional nature, as put forward in Chapter Two, the transition from analog to digital should be considered as one of the many instances of stabilization and closure that characterize the technological frame of film. Indeed, film technology has found many instances of stabilization and closure, when most social groups have agreed upon one meaning for the film artifact, and 35mm film, color film, silent film, sound film, photochemical film, etc. have all reached a high

level of stabilization (and closure) at different times throughout film history. And, even though the transition from analog to digital film is the most radical technological shift that film has ever experienced and the one with the most far-reaching implications, this does not necessarily imply that the conceptual frameworks attributed to film as a photochemical artifact disappear once film has become a DIGITAL ARTIFACT. Instead they will adapt and, in turn, gain or lose dominance within the technological frame, or rather film's conceptual framing.

At this point another concept from SCOT needs to be introduced, that of "interpretive flexibility," which will add strength and complexity to the discussion.

FILM'S INTERPRETIVE FLEXIBILITY

As a complex technological artifact, film has always been the site of interpretive contestation, and is so now, once again, because of digitization. This has been the case over time, as film has been different artifacts throughout its history, but also at the same time, as film is (and has always been) different artifacts in one. As such, film is described differently by different relevant social groups (e.g. as a commercial product by film producers, as an artistic means of expression by experimental filmmakers, as a market place by manufacturers, as a piece of heritage by archivists, as a field of application by engineers, etc.). Film's "interpretive flexibility" implies that:

> Relevant social groups do not simply see different aspects of one artifact. The meanings given by a relevant social group actually *constitute* the artifact. There are as many artifacts as there are social groups; there is no artifact not constituted by a relevant social group. (Bijker, 1995: 77 – emphasis in the original)

In the case of (archival) film, let me add that there are more meanings given to film even within the same relevant social group, for instance that of archives. Because of this plurality of interpretations, different frameworks are applied to (archival) film, even by the same archive, not necessarily in contradiction with one another. It will be argued later in this chapter that the same film archive, for instance, can privilege a "film as art" framework but, at the same time, accept remediation as a process for creating new *dispositifs* in a manner that would apply better to the "film as *dispositif*" framework.

The transitional nature of film advocated in this work can be related to Bijker's notion of "interpretive flexibility." From this perspective, film is inter-

pretively flexible, and transitional in time, although not always to the same extent. It is true that, after closure:

> the interpretative flexibility of an artifact diminishes. Consensus among the relevant social groups about the dominant meaning of the artifact emerges and the "pluralism of artifacts" decreases. (Bijker, 1995: 86)

This has been the case in various instances throughout film history. For example, in the case of color in silent cinema: once the dominant meaning was closed around the exemplary artifact "black-and-white film" in the 1930s, not only tinted, toned and stenciled films disappeared from mainstream film production (decrease in "pluralism of artifacts") but the mere existence of such colors risked disappearing retrospectively since colored films from the silent era were often duplicated onto black-and-white film (decrease in interpretive flexibility). The practice of duplicating colored films to black-and-white film stock was actually carried out by film archives until the 1980s, when archives and film scholars "rediscovered" color in silent cinema.[137]

Something similar might of course happen once digital film should stabilize as the new exemplary artifact, completely substituting photochemical film:

> With the stabilization of an artifact, criteria of what defines this artifact as a working machine will also emerge. Such criteria form crucial elements of the technological frame being built up at the same time. (Bijker, 1995: 124)[138]

From this perspective, once all problems related to digital film are provided with viable solutions (e.g. long-term preservation issues, obsolescence of hardware, software, instability of standards), new criteria will emerge that will define digital film as a better "working machine" than photochemical film. This would lead to a consensus among relevant social groups.

> This consensus means that the interpretative flexibility of, for example, an observation statement disappears, and from then on only one interpretation is accepted by all. Such a closure is not gratuitous, but has far-reaching consequences: it restructures the participants' world. History is rewritten after such closure, and it is difficult to recapture the factual flexibility as it existed prior to the ending of the controversy. (Bijker, 1995: 85)

This brings us back to what has been discussed earlier with regard to the extraordinary perspective we have now, looking at film while it is transitioning from analog to digital technology, and having a privileged point of view on "factual flexibility" as the processes of stabilization and closure are still ongoing. Once the controversy has reached a consensual closure, it will be too late and it will be the historians' task to recapture what film has been before the digital.

3.1 FILM ARCHIVES

In the following pages I will discuss the relevant social group of film archives, related to the four theoretical frameworks discussed in Chapter Two. There I have argued that the frameworks "film as original", "film as art," "film as *dispositif*," and "film as state of the art" are particularly relevant with regard to archival film and even more so in this time of transition to digital. Here I will discuss how film archives adopt such theoretical frameworks in their policies and practices.

As pointed out earlier, although analytically different, relevant social groups empirically overlap. Similarly, archives that in my view represent specific theoretical frameworks do also express characteristics typical of other frameworks, as they are often border crossers. I have highlighted here some evident characteristics of their practice for heuristic purposes.

The four archives are very different from one another. They are all influential in the field, each in its own specific way. Note that it is not my intention to present a complete overview of the background and of the current activities of these archives. I will rather focus on those characteristics and choices that make them exemplary for the specific framework of reference.

In particular I have associated the Danish Film Institute with the framework "film as original," pointing at the radical change in preservation strategy adopted by the Danish archive a few years ago; Anthology Film Archives with the framework "film as art" because of its commitment to film, mainly avant-garde, as an art form; the Nederlands Filmmuseum to the framework "film as *dispositif*" because of its experimental approach to restoration and presentation; and, finally, Sony Pictures Entertainment to the framework "film as state of the art" because of its consistent use of the most advanced techniques available for film preservation and restoration.

In order to give greater scope to the map, outside the relevant social group of film archives, the interaction with other relevant social groups, such as film laboratories and EU-funded projects, discussed later on, as well as the relations with the restoration case studies, central to the next chapter, will be

briefly touched upon for each archive. Note that, although a certain symmetry among archives, laboratories and case studies has been sought, it has not been possible to sustain it entirely: not all archives have been involved in the case studies selected and not all the laboratories involved in the case studies are discussed. For instance, the Danish Film Institute will be discussed within the "film as original" framework because of its remarkable long-term preservation policy, but none of its restorations will be discussed as a case study in the next chapter. Similarly, *The Matinee Idol* will be one of the discussed cases, but the laboratories where it was carried out, Immagine Ritrovata, Cinetech and Sony Pictures High Definition Center, are not among the laboratories discussed in this chapter.

Film as Original

In Chapter Two I argued that, reading Benjamin (1936) through Groys (2002), a film artifact can re-acquire its status as original once it is re-territorialized by entering the film archive. The film artifacts, once they acquired their archival originality, become the original physical objects to be preserved as film heritage within the "film as original" framework.

In general terms, most archives would today subscribe to this framework. Especially in the last decade, keeping original film artifacts as long as possible has become a goal all film archives agree upon (Meyer, 2001 and Enticknap, 2005: 192-194). The original artifact, even when too damaged and fragile to be projected, is still the best source for any new restoration: for reasons explained in Chapter One, no matter what duplication technique is used, the best photographic result will be obtained if the source is the most "original," in other words the closest to the camera negative. This is always the case in the analog domain. For this reason, the "film as original" framework has gained greater significance with the further development of film restoration techniques over the last two decades and, with the transition to digital and its promises of even better restoration results in the future, preserving the original artifacts becomes even more crucial.

But the "film as original" framework should not be reduced solely to a long-sighted approach to film restoration. On the contrary, its most eloquent advocates maintain that the original film artifacts, especially in the case of silent nitrate ones, have a special something, similar to Benjamin's aura (e.g. Cherchi Usai, 1987 and 2002) that acetate, polyester or digital copies cannot recapture, no matter how visually close they can be to the original.

The "film as original" framework underscores a dilemma that was pointed out by Alexander Horwath in a polemical contribution to the 2005 FIAF Congress:

> [...] we might now find ourselves at a moment in time when the newly professionalized archive leaves behind the idea of the museum as a critical tool and turns into a digital image-bank, riding on top of perfectly managed cold storage facilities for untouchable nitrate and acetate films. [...] The other type of organization would be an archive which is also a "critical museum"; a confrontation of concrete artefacts and social practices; an actively and poetically constructed collection; a place in which curatorial thinking and work can be felt and argued with. It would stand counter to the ideology of the market. (Horwath, 2005: 8-9)[139]

The two possible empirical realizations of the "film as original" framework would lead to two diametrically opposite archives: one where the original artifact is considered so precious that it becomes untouchable, the other where the "confrontation" with (access to) the original artifact would bring accelerated deterioration and, eventually, disappearance. In reality, most archives today position themselves somewhere in between these two extremes. If most archives today agree on the importance of the long-term preservation of "original" film artifacts, a number of them seem to privilege the "film as original" framework above others. An example is the George Eastman Museum in Rochester, NY, where preservation of original artifacts is central to the museum's activities and to the world-renowned training program, the L. Jeffrey Selznick School of Film Preservation, that the museum has run since 1996, forming excellent film preservationists who are today esteemed professionals in many archives around the world.[140] The school was co-founded by George Eastman Museum's Curator Paolo Cherchi Usai.

Cherchi Usai is one of those individual actors I mentioned earlier who facilitates interaction between different social groups and, at the same time, carries a personal perspective on the artifact archival film and on its transition to digital. He is probably the best-known representative of what I define the "film as original" framework, and is one of the many actors in the field who moves between various relevant social groups: archives (George Eastman Museum first and the National Film and Sound Archive in Australia later), film festivals (as co-founder of Le Giornate del Cinema Muto), in professional associations (as former Vice President of FIAF and active member of SEAPAVAA and AMIA), Finally, he is one of the few film archivists who have published articles and books that are regularly read by academics and a more general public with an interest in film (among others, see Cherchi Usai, 2000 and 2001). Recently, Cherchi Usai has also made a film, *Passio* (NL/IT/USA, 2007), which has been shown at several important festivals, such as the Adelaide Film Festival and the Telluride Film Festival. A film based on archival footage,

Cherchi Usai has declared that its "original" negative was destroyed right after seven prints were produced.[141]

The "film as original" framework leads to choices that privilege robust long-term preservation policies over active restoration programs. With regard to the digital, in line with best practice indications given by, for instance, the EU project FIRST (Film Restoration and Conservation Strategies), these archives accept digitization mainly as a means of access. In SCOT's terms, relevant social groups adopting such an interpretation of the artifact film privilege the obdurate artifact photochemical film, waiting until digital film has become more stabilized.

Once again, let us stress that archives are often border-crossers with regard to the adoption of frameworks and their translation to practice, and that the examples chosen in this work are "ideal cases," whereas in reality a clear-cut correspondence framework-archive would be impossible to establish. This is certainly the case of the Danish Film Institute, discussed below as an example within the "film as original" framework. In this case the choice for a robust long-term preservation policy of the original artifact has not inhibited the Institute from a rather experimental approach to presentation that, as will be argued later, overlaps with the "film as *dispositif*" framework.

DANISH FILM INSTITUTE[142]

> Preserving and showing are two sides of the same coin [...] Preserving without presenting is an inert activity, and showing without preserving is dangerously short-sighted. (Nissen et al., 2002: 9)

The Film Archive at the Danish Film Institute, founded in 1941, collects, preserves, restores and promotes the Danish film heritage. Also, the archive collects and preserves new Danish films deposited by the Danish State through the legal deposit act, which has been in place since 1964. Danish archival films are regularly presented at the Danish Film Institute Cinémathèque in Copenhagen.

In 2001, the Danish Film Institute organized a seminar for its sixtieth anniversary with the title "Preserve – then show." The papers given at the seminar, and published a year later (Nissen et al., 2002), reflect quite comprehensively the discussions on preservation, restoration, and presentation of archival film collections as they were conducted at that time. During this event, the new plans for the Danish Film Institute's preservation strategy were presented and explained in detail. Such plans were based on surveys and studies carried out on the material state of the film collection and on the storage conditions in which the collection was being kept at the time.

Among others, Jean-Louis Bigourdan from the Image Permanence Institute described the recommendations for a much improved storage environment that would guarantee the survival of the films, including already deteriorating nitrate and acetate ones, for several hundred years (Bigourdan, 2002: 94-114). Such recommendations prescribed keeping the historical collection (including nitrate, acetate negatives and FINE GRAINS and those films already in a state of chemical deterioration) at a temperature of 5°C below zero and at a relative humidity between 20 and 30%. Only the new elements entering the archive and the print collection could be kept at 5°C and at a relative humidity of 35%.[143] In June 2007, the Danish Film Institute completed the construction of the last of the newly planned vaults, a nitrate storage facility able to meet these requirements.[144]

The new long-term preservation strategy adopted by the Danish Film Institute reached the archival community as quite a radical departure from the usual practices, clearly shifting the focus from active preservation through duplication and restoration to passive preservation through improved storage conditions. In addition, it felt like a rather unexpected choice at a time when most archives were focusing on the new possibilities offered by the digital technology rather than improving already existing preservation practices.

Although freezing (historical) films has proven to be the best option to make them last longer, it nevertheless has two obvious drawbacks: it makes films less easily accessible and it is expensive. Mainly for these reasons, most archives, including the other ones discussed here, have not adopted such measures.[145]

In addition to this change in preservation strategy, the Danish Film Institute adopted quite a progressive approach to digital restoration and presentation, at least compared to most film archives. From this perspective, the Danish Film Institute is a unique example within the archival field, as it couples what is quite a conservative approach to preservation with a remarkably progressive approach to restoration and presentation.

This strategy has led the Danish Film Institute to a change in restoration practice as well. As Jesper Stub Johnsen, the Head of the Film Archive at the Danish Film Institute at the time, stated:

> By improving the storage environment the rate of decay will be reduced, which will in turn reduce the need for duplication/digitisation significantly. More precisely, it will be possible to divide the costs of duplication and restoration over a larger number of years. [...] the improved storage climate will make it possible to add more value to the film collection. This means combining work on preserving the original material with intellectual work on the film titles, on identification, history and content

and finally the restoration and presentation of the collection to researchers and the general public. (Stub Johnsen, 2002: 123)

Indeed, if the same budget is shifted to passive preservation, the rate of restorations must be necessarily reduced. Such a shift seems in contrast with the current trend of increasing the accessibility of the collections. Choosing for a robust policy of long-term preservation, on the other hand, in this time of rapid technological transition, allows an archive to make use of the best, still rather expensive, techniques for a few titles, waiting for the new technology to become a viable alternative to photochemical film. In the SCOT perspective: the Danes are waiting for digital film to stabilize and become a new exemplary artifact.

Since 2002, the Danish Film Institute has carried out many restorations, most of them digitally. These projects resulted in restored film prints as well as DVD releases. Also, a number of titles that have not yet been restored on film have been digitized to either 2K RESOLUTION or HD for DVD releases and digital projection purposes. The experience shows that some films, where the only surviving element is a projection print (as the original camera negative and other intermediate film elements are lost), once digitized to HD and projected as such, can result in an image quality comparable with that of a film-to-film restoration from the same source element.

According to the Danish Film Institute's Curator, Thomas Christensen, digital projection at the Cinémathèque in Copenhagen is in use, but not yet on a regular basis. When a film preservation element is digitized and a HD master is produced, sometimes it is projected as such, bypassing a projection film print because of its high cost. Also in other cases, such as when a nitrate negative and a safety duplicate positive (i.e. FINE GRAIN positive) are available but no projection print, making a single print can easily be three to four times more expensive than a HD scan. When the quality on the projection is comparable, this is obviously a better solution, especially when long-term preservation is already assured.[146]

Although his approach to digital restoration and presentation can be considered quite progressive when compared with other archive's policies, Christensen maintains that:

> We have gotten a much better preservation and life expectancy standard, but nothing much has really influenced restoration. Basically, we trust analogue preservation, and restoration is considered a means of giving access, whereas high end is still considered 35mm.[147]

On the other hand, archives where new films must be deposited within legal deposit legislation, as in the Danish case, are dealing more and more with born-digital films. Christensen has been involved in drawing the new terms of such legislation:

> [...] our objective is to adhere to principles of best quality, preservation of the artifact/print and to ensure redundancy. We therefore require a preservation package for films distributed as films that has an intermediate positive, accompanying sound on file, and a new print. Films that only get digital distribution (SD or HD) should be deposited in the highest quality format reasonable. DFI [Danish Film Institute] is the body that stipulates the standards for delivery at any given time, and we will therefore adjust the delivery when it becomes relevant. Until now, we get 35mm pre-print and print, or HD if they are only TV-productions.[148]

Indeed, in the Scandinavian countries and Denmark, where, as discussed earlier, digital film has become the main form of filmmaking since the 1990s, film archives have had an early start in preparing for the transition. And such is the case for the Danish film Institute. As the relevant social groups of filmmakers and film producers are more involved in the formulation of archival policies, because of a legal deposit legislation or because the national archive is part of a broader organ such as a national film institute, their influence is greater than in other countries. In SCOT's terms, the level of inclusion of such relevant social groups in the technological frame "archival film" in countries such as Denmark or Sweden is greater than, for instance, in the Netherlands, where neither a legal deposit legislation is in place, nor is the film archive (yet) part of a broader film institute.[149]

Another important element to consider regards the Danish Film Institute's attitude towards digital tools for restoration, particularly given the proximity of an excellent laboratory, specialized since the late 1990s in digital restoration of archival films, the Digital Film Lab in Copenhagen. This laboratory, discussed in more detail below, has collaborated very closely with the Danish Film Institute's restoration staff over the last ten years. The result of this collaboration is a large number of digital film restorations that have been presented theatrically around the world. The collaboration with Digital Film Lab has also led to an early appreciation of many of the problems related to digital restoration and to the preservation of data, as Christensen remarks:

> [Digital] Restoration has become much more frequent and easy with a digital facility. However, our preservation strategies are not influenced.

> We may be better equipped to respond to the future, once it comes, but we basically don't guess that digital also means trouble, we know it.[150]

The digital work done at the Digital Film Lab by the Danish Film Institute has been moved by goals, which can be retraced to the "film as original" framework. When applying digital tools to restoration projects, the Danish archive has kept digital interventions to a minimum. As Christensen comments on the digital restoration of *Nedbrudte Nerver* (DK, 1923):

> When used with respect for the integrity of the original, it is possible to reach a result that matches a conventional fully photochemical duplication. (Christensen, 2002: 143)

He seems to suggest that digital restoration's performance should be measured by photochemical restoration's standards. Such an approach is very much in line with the recommendations of the EU project, FIRST, in which the Danish Film Institute has had an active role. As briefly touched upon in Chapter One, one of the results of the project was the publication of Best Practice Recommendations with regards to Digital Restoration, Presentation and Access (Mazzanti, 2004). Christensen, who, as chairman of the FIAF Technical Commission, is also a consultant in EU projects related to film archiving, has been involved in the project FIRST. This project, in his view, has led to the conclusion that film remains the best option for long-term preservation. On the other hand, Christensen's personal experience is that "HD is a decent alternative for projection, at least until a DCI standard that includes archival needs comes along."[151] The use of HD masters for projection brings the Danish Film Institute closer to the "film as *dispositif*" framework with regard to its exhibition practice.

The Danish Film Institute is, in my view, a good example for the "film as original" framework because of its long-term preservation policy and its respect for the film original integrity in the use of digital tools for restoration. On the other hand, the Danish archive enables a progressive use of digital means for presentation, something that puts it closer to another framework, that of "film as *dispositif*," than it might seem at first sight. It is in these apparently contradictory directions (film for long-term preservation and digital for presentation) that I recognize the Danish Film Institute's approach to archival film in transition.

DANISH FILM INSTITUTE – UPDATE

The film preservation and restoration practice at the Danish Film Institute (DFI) has developed in line with the policy that was set in place in the previous decade. DFI's below-zero storage strategy for nitrate films, which became fully effective in 2007 is still one of the pillars of its preservation policy. From this perspective, I still consider the DFI a clear example of the "film as original" framework.

As explained by DFI curator Thomas Christensen, the core of the archive's active preservation work is carried out film to film, mainly at Haghefilm laboratory: "The current preservation duplication target is 4-8 features and 20-40 short subjects annually. This is mainly analog work done at Haghefilm."[cxv] In terms of digital restoration, however, a number of things have changed. After the long-standing collaboration with film laboratory Digital Film Lab (discussed later in this chapter) came to an end in 2009 when it went out of business, DFI suspended its digital restoration work until the archive received the necessary funding in 2017 to establish its own in-house digitization and restoration workflow (including hardware, software, and personnel). Digital restoration work is carried out on 2K scans, either created at Haghefilm from new film preservation elements or digitized in house on a MWA Vario scanner. It includes film reconstruction (i.e. recovering the original editing of a film and recreating missing title cards), color GRADING, and dust and scratch removal. Although Christensen still considers film-to-film duplication the best method to preserve film, he believes that "the experiences with digital film work will be both useful and necessary, when digital preservation becomes a reality."[cxvi]

In terms of new digital films deposited with the archive under the legal deposit legislation, DFI now receives approximately 25 feature films and 75 short films and documentaries a year. As Christensen explains: "Born-digital films are stored in a repository consisting of a mirrored digital tape robot with two tape storage robots managed by a FrontPorch DIVA system. The robots use carrier redundancy (LTO6 and T10K) and an off-site third copy on LTO tapes is stored 40 kilometers away at a remote site."[cxvii]

Finally, with regard to (theatrical) presentation, DFI favors the loan of DCPs over film prints, as they are cheaper to distribute and to replace. However, Christensen point out that "there is a tendency to underestimate the complexity and time needed to do digital work sufficiently well."[cxviii]

As for online visibility, DFI has put significant effort in online access to its collection. Since 2015, DFI's online streaming platform Denmark on Film allows users access to approximately one thousand digitized Danish documentary films from its collection.[cxix]

Film as Art

Earlier I argued that the "film as art" framework lies at the foundation of most film archives. In particular, those archives that, free from a national mandate, have focused on a specific mission, for instance, the preservation of avant-garde films, have often based their *raison d'être* on the "film as art" argument. This is the case of archives such as the Austrian Film Museum, the film collection at the Pacific Film Archive in Berkeley, California, the MoMA and Anthology Film Archives in New York. The latter will be discussed below as exemplary of such an approach.

Before zooming in on the selected case, I would like to add a reminder that the "film as art" framework, as discussed in Chapter Two, functions also at a broader level than that of avant-garde films as it can also be associated with the concept of *auteur*, on the one hand, and to the concept of original artifact, on the other hand. These two concepts are often closely related, especially in those cases (very common with avant-garde and experimental film) where the filmmaker/*auteur* is also partial to the medium used. Even more eloquent are those cases where the filmmaker "molds," so to say, his or her own films directly onto the original artifact. Examples such as Oskar Fischinger, Harry Smith, Peter Kubelka, Jürgen Reble, are only a few of the many filmmakers who have worked directly on the film celluloid by etching, painting, etc. the emulsion in order to create a visual effect in motion. Such examples clearly fall in both the "film as original" and "film as art" frameworks as their original film artifacts are, to use Nelson Goodman's definition "autographic" (1976). Although examples such as this would lead to the idea that whomever embraces the "film as art" framework would be adverse to the transition to digital, in archival practice this is proving to be an incorrect assumption. Probably because of the *auteur* approach, where avant-garde filmmakers are more and more often adopting digital film as their medium of preference, accordingly, film archives that privilege the "film as art" framework are also accepting the emerging digital technology, also as a means for restoring and giving access to film-born films.

In a SCOT perspective, the relevant social group of avant-garde filmmakers has in this case a high level of inclusion in the archival film technological frame through those archives whose mission is to preserve and promote their film (as art). In many cases avant-garde filmmakers are indeed active participants to preservation and restoration programs directed to safeguarding their films.[152] An archive with a long and celebrated tradition of close collaboration with avant-garde filmmakers is the one discussed below.

ANTHOLOGY FILM ARCHIVES

Anthology Film Archives presents itself on the Web as follows:

> a chamber museum, dedicated to the preservation, study and exhibition of independent and avant-garde film. It is the first museum devoted to film as an art form, committed to the guiding principle that a great film must be seen many times, that the film print must be the best possible, and that the viewing conditions must be optimal.[153]

Anthology, the short name used by many when referring to this worldwide renowned center for avant-garde film, was conceived in 1966 by a group of avant-garde filmmakers and *cinéphiles*, among whom are Jonas Mekas (Anthology's first Director and currently its Artistic Director), P. Adams Sidney, Peter Kubelka, Jerome Hill and Stan Brakhage.[154] Anthology opened its doors in 1970. The core of Anthology's collection was shaped around the so-called Essential Cinema Repertory, a selection of films based on the idea that film is an art and that the art of film is defined by selected works "which indicate its essence and its possibility."[155] The first selection of films was made by Anthology's Film Selection Committee in the early 1970s and counted three hundred and thirty titles, organized in one hundred and ten programs. The plan was to maintain the Committee as a permanent body within Anthology with the task of updating the original selection and keeping the Essential Cinema Repertory as a growing collection. After Jerome Hill's death in 1973, however, the Committee was discontinued and additions to the Repertory ceased shortly thereafter. As Anthology's Artistic Director Mekas writes:

> As one looks back through the last thirty years of the history of cinema in the United States, one has to admit that even in its unfinished state, the Essential Cinema Repertory collection, as an uncompromising critical statement on the avant-garde film of the period, has dramatically changed perceptions of the history of the American avant-garde film. The avant-garde film has become an essential part of cinema.[156]

The Essential Cinema Repertory is still regularly screened at Anthology and the films belonging to this selection are preserved (by Anthology or by other archives) and, when necessary, restored. In addition, a number of other programs are shown, some adding to the spirit of the original collection, like contemporary avant-garde films, and others in contrast with it, as in the case of the program "Unessential Cinema." Within this program, Anthology's film archivist, Andrew Lampert, presents some of the most obscure ("Orphans," if you wish) film, video and digital material, from the Anthology's vaults.[157] It is

also in the dichotomy of Essential and Unessential Cinema that Anthology's approach to the current transition of film towards the digital resides. As stated in a brief program description from its website:

> They say that film is dead, usurped by new technologies. Downloading is the future and buying tickets the past. At Anthology, we view this era of digital transition as a transcending of film and video, an inevitable step towards a state of pure moving images. With such lofty conceits in mind comes this UNESSENTIAL CINEMA program dedicated to the awesomeness of the Nintendo Wii. For those who quit playing video games with the first Nintendo system, the Wii is an eye-opening, butt-kicking entertainment experience. Tonight we plug-in and play on the big screen, exploring virtual space and also watching films (16mm) about computers, games, video and the technological future.[158]

This short text is in my view more eloquent than a collection policy as it offers a lucid view on the transition to digital where there is room for film and digital, for the cinema and for the mobile console. At Anthology, essentialist about cinema but open to its transitional nature, old and new film *dispositifs* coexist under the same roof, or, in other words, the "film as art" framework coexists with the "film as *dispositif*" framework.

Anthology's approach should not come as a surprise if one looks at the filmmaking career of co-founder and Artistic Director, Mekas. On his website (www.jonasmekas.com) one can follow film's transition from 16mm to video, to digital downloads. Recently, Anthology has shown Mekas' diverse production in the program "From Diaries to Downloads: New Videos and Preserved Films from Jonas Mekas" as "a marriage of the new and the old-made-new."[159]

In line with Anthology's original spirit, Andrew Lampert is also a filmmaker and artist whose installations and films have been shown at the Whitney Museum in New York, at the Getty Museum in Los Angeles and at many film festivals around the world. Lampert has had film preservation training at the L. Jeffrey Selznick School of Film Preservation and has been Anthology's archivist since 2002. With Lampert, Anthology has strengthened its film preservation and restoration efforts. Lampert's and other staff members' understanding of both Anthology's spirit and film preservation and restoration issues has led to a pro-active policy that enables both a better long-term preservation as well as several new restorations.

According to Lampert, Anthology does not have a particular policy with regard to the digital at this point. Digital tools are becoming increasingly valuable and useful for restoration and preservation and Anthology uses them where possible. However, Anthology's goal remains that of matching

master elements and not to "surpass" them in terms of visual and audio qualities.[160]

Apart from one project, *Meditation on Violence* (USA, 1948) by Maya Deren, where parts of the original 16mm film elements were scanned and digitally blown up to 35mm, Anthology's most extensive experience with digital is in the area of sound restoration.[161] Digital work on soundtracks, in particular the transfer from original magnetic tracks to new magnetic and optical tracks for preservation, "has been a very interesting learning curve in that you don't want to make the sound too clean or too modern." An exemplary case mentioned by Lampert refers to the amateurishly produced film, *The Flower Thief* (USA, 1960; Beat Generation-related title by Ron Rice). The soundtrack, mumbled and very hard to hear, was sent to a laboratory for restoration with specific instructions aimed at preserving the "necessarily poor" sound of the film: "do not in your transfer clean or sweeten or do anything other than a straight transfer of the work because it would be false." The laboratory at first was hesitant to have its name associated with something that "would sound that bad." The work was finally carried out, but the result did sound better than the original. Lampert points out that in this case he could not tell if:

> making the work sound better was a failing on our part in trying to preserve it. And it is still for me an ethical issue within digital sound preservation. Are we falsifying the work by putting it through a process that gives it some kind of "modern standard"? [...] Digital is going to be a very useful tool for restoration. The questions are "when is too much?", "what are the standards we are going to set for ourselves when taking on these projects?", "where do we acknowledge that it is a preservation, a restoration or an alternative version?"[162]

Lampert points out the beneficial role of the digital for so-called Orphan films, which lack real economic support for preservation.[163] For such films digitization will probably "become a substitute for preservation." All archives hold a huge amount of

> reels that we could never financially or institutionally get around to dealing with [i.e. preserving photochemically]. If access is one of the goals of preservation, putting films into the digital environment and giving access to material that otherwise would be off limit, it is going to be part of the future.[164]

Lampert thinks that an online Unessential Cinema Repertory would be a good start in this direction. Anthology's collaboration with UbuWeb, a website ded-

icated to avant-garde, is a step for creating awareness about the lesser-known works in the archive's vaults. On UbuWeb Anthology gives access to scans of articles from Film Culture Magazine (1955-1996), providing contextual information (e.g. articles written by and on independent and avant-garde filmmakers) for some of the films available as streaming media.[165] As Lampert points out:

> Once films have been put on this digital terrain, they don't have to be divorced from their historical context. In fact, being in digital gives more opportunity to pull materials together and create links.[166]

Apart from creating context, UbuWeb does also provide information about the original format of audiovisual work. It is worth mentioning UbuWeb's statement:

> UbuWeb is pleased to present dozens of avant-garde films & videos for your viewing pleasure. However, it is important to us that you realize that what you will see is in no way comparable to the experience of seeing these gems as they were intended to be seen: in a dark room, on a large screen, with a good sound system and, most importantly, with a roomful of warm, like-minded bodies. [...] We realize that the films we are presenting are of poor quality. It's not a bad thing; in fact, the best thing that can happen is that seeing a crummy shockwave file will make you want to make a trip to New York to the Anthology Film Archives or the Lux Cinema in London (or other places around the world showing similar fare).[167]

Similarly to the collaboration of the Library of Congress with the Internet Archive discussed earlier, Anthology's collaboration with UbuWeb shows once again that contributing to online digital archives does not jeopardize traditional archives' *raison d'être*. These examples show quite the opposite: a broader access to the collection adds to its value, also because it creates a broader audience, for example, for all those Orphan titles that otherwise would disappear in their tin cans.

With regard to its relation with restoration laboratories, Anthology works regularly with Cinema Arts (Pennsylvania) and Cineric (New York), but also considers different laboratories for specific projects. In cases where the restoration project involves a very complex manual preparation (as for Saul Levine's 8mm film *New Left Note*, 1968-1982, counting more than two thousand splices to be checked one by one), Lampert prefers working with Bill Brand's BB Optics.[168] He feels very strongly that the laboratory technicians he works with have an aesthetic understanding of the films they are working with. This

is certainly the case of people like Simon Lund working at Cineric, who is a filmmaker himself.

In 2002, Anthology, in collaboration with the Harry Smith Archives, commissioned to Cineric, under Lund's technical supervision, the restoration of Harry Smith's multiple projection work *Mahagonny*. This restoration has not only been a very successful project but also a restorer's headache, as will be described and discussed in detail in the next chapter.

One could expect to find at Anthology the most uncompromising approach to "film as art," where film is only photographic and projected in a dark theater. Instead, one finds a program on Nintendo Wii. My opinion is that Anthology will prove, in fact, to be exemplary in the way archives dedicated to avant-garde, and, therefore, closely associated to the "film as art" framework, will cope with the transition to digital. If I am right, the more the digital is adopted by contemporary filmmakers, the more it will enter these kinds of archive, in the collections as well as in the exhibition practices. Anthology leans also toward "film as *dispositif*," as it programs Nintendo Wii next to traditional film projection and encourages access via a website like UbuWeb. Also, in the restoration of *Mahagonny*, as we will discuss later, "film as art" and "film as *dispositif*" coexist. Indeed, in this project, the aim of respecting the artist's intentions is realized through a restoration that creates a new *dispositif* for the performance of the film projection, namely, a multiple 16mm film projection becomes a single 35mm projection.

ANTHOLOGY FILM ARCHIVES – UPDATE

Many things have remained the same at Anthology in the last decade: Jonas Mekas is still its Artistic Director; Anthology continues to screen its Essential Cinema repertory regularly; and since its establishment in 1970, its mission with regard to "film as art" has remained unchanged. In this regard, Anthology continues to be an exceptional example of the "film as art" framework.

However, a few things have changed too. Apart from intensifying its (analog and digital) restoration activities, a major renovation is scheduled to start in 2019 that will create more space, especially for the archive. Furthermore, with Andrew Lampert's departure in 2015, Anthology stopped its Unessential Cinema screenings.[cxx]

In 2012, John Klacsmann joined Anthology as its new archivist, working closely together with Lampert, who became Anthology's Curator of Collections until his departure. Following in his predecessor's footsteps, Klacsmann trained in film preservation at the L. Jeffrey Selznick School of Film Preservation. And like Lampert,

he makes experimental films.[cxxi] Before joining Anthology, Klacsmann worked for the George Eastman Museum on their Technicolor dye transfer-equipment collection and, after that, spent two years at Colorlab in Maryland, working mainly on 16mm projects and some nitrate film preservations.

In today's changing landscape, in which a reduced number of laboratories offer analog services, as discussed in Chapter One, Klacsmann also relies more and more on the DIGITAL INTERMEDIATE process for film restoration projects. He particularly finds that the technology available today for the digital restoration and color GRADING of experimental films (including those shot on 8mm) has become highly competitive with optical duplication. However, Anthology continues to take on many photochemical projects, working with various laboratories like Colorlab, Cineric (especially for blowups from 16mm to 35mm), Cinema Arts in Pennsylvania (for black-and-white processing), Fotokem, and Audio Mechanics (for sound restoration). Furthermore, even when following a DI process, Klacsmann favors a final result on film if sufficient funding is available. In terms of digital preservation, all hybrid projects that result in digital as well as film elements (typically, new negative, sound negative, and print) are kept as uncompressed files for image and sound, a DCP for projection, and a HD copy for access. Digital files are stored on two sets of LTO tapes; one in house and one backup at the Northeast Historic Film archive in Maine.[cxxii]

In terms of presentation, Anthology screens all its new restorations in its theater for which a new 16mm projector has recently been acquired. The planned renovation of Anthology's landmark building (a former courthouse) will make room for a new floor dedicated to library collections storage, reading room, and librarian offices; more space for the archive, including new film vaults, a viewing room, a digitization suite, new film inspection area and offices; a café on the ground level; and a gallery space.[cxxiii] Set for 2020, the opening of the expanded Anthology coincides with the archive's 50th anniversary.[cxxiv]

Film as Dispositif

In Chapter Two I have argued that within the "film as *dispositif*" framework archives promote the practice of showing films by way of *dispositifs* other than the original, historical one (i.e. the film projection in a dark cinema). From this perspective I have given the example of a silent film viewed on an iPod as one of the many possible *dispositifs* that can take shape within the "film as *dispositif*" framework.

In this time of transition, the possibilities offered by the digital technology to create new *dispositifs* seem to multiply by the day. On the other hand,

it should not be forgotten that old media were also able to offer alternative *dispositifs* to classical cinema. Examples such as kaleidoscopes as a pre-cinematic, and pre-digital form of a virtual reality *dispositif*, or small gauges home viewings (e.g. Pathé Kok, Pathé Baby and Super8), or early digital *dispositif*s, such as Fisher-Price's PixelVision or, to come nearer to the classic cinema *dispositif*, Kubelka's "invisible cinema," can also be considered manifestations of a "film as *dispositif*" framework. Kubelka's "invisible cinema" is from this perspective peculiar, since it originates from a film archive, namely Anthology Film Archives, where it was realized in 1970, and it has been reconstructed or imitated in other archives as well, such as the Austrian Film Museum and the Nederlands Filmmuseum (today Eye Filmmuseum).

Back to a SCOT perspective, it can be said that, thanks to the relevant social group of film audiences, the framework "film as *dispositif*" is becoming ever stronger within film archives. Indeed, as mentioned earlier, the relevant social group of film audiences is changing dramatically and is gaining an ever-growing level of inclusion in the technological frame of (archival) film. If film audiences in the past would flock to the cinema or to the *cinémathèque*, today's audiences expect to be able to experience old and new films on their PC, TV, iPod, mobile phone, etc. As I have also discussed in Chapter One, with the greater variation and segmentation among distribution channels, audiences expect and demand that film archives would give an opener access to their collection and a more varied one. If for "film as art" filmmakers represent the social group capable of pushing the archive further in the transition because of their high level of inclusion, for "film as *dispositif*" it is the audience, and the individual users, whose level of inclusion is reaching a critical mass.

The case of Eye Filmmuseum will be discussed below as a fitting example of a film archive that already for twenty years now has privileged the "film as *dispositif*" framework in its policy and practice.

EYE FILMMUSEUM (FORMERLY KNOWN AS NEDERLANDS FILMMUSEUM)

The decision to discuss Eye Filmmuseum is certainly influenced by my personal experience since I have been working there for more than ten years. Nonetheless, Eye Filmmuseum is undeniably a very influential actor in the film archival field, with an international reputation, thanks also to its experimental approach to film restoration and presentation.

Eye Filmmuseum is a non-profit foundation, and, differently from most European film archives, it is state funded, but not a state institute. Its scope goes beyond national film production since it collects, preserves and restores Dutch as well as non-Dutch films, even though the latter is on a selective basis. This aspect has contributed to the museum's international recognition.

In the brief overview of Eye Filmmuseum's history that follows, I will point out some of the historical elements that have made this archive influential in shaping the emerging technological frame around digital film. In particular, I will focus on those choices that make Eye Filmmuseum a good example of the "film as *dispositif*" framework. However, I would like to stress once again, that all archives taken as examples in this chapter do not necessarily represent one single framework, in any case not explicitly, and that they should be considered as border-crossers in terms of the conceptual frameworks they adopt in the everyday practice.

Eye Filmmuseum, founded in 1946 as the Dutch Historical Film Archive, has known three main phases in its history. The first thirty years, mostly under the direction of Jan de Vaal, have been the founding years during which the archive moved from a small collection hosted by the Stedelijk Museum, the Contemporary Art museum in Amsterdam, to a full-fledged institute with its own facilities for screening in the Vondelpark and with its own vaults, outside the city limits, west of Amsterdam.[169] In those years the main archival activities were shaped by a very small staff and with very limited means. Jan de Vaal built strong international relations with the archival community through FIAF. And, most importantly, the core collection of Eye Filmmuseum was donated to the archive during this first phase, including among others the Uitkijk collection and the Desmet collection.[170] Finally, especially in the 1970s and early 1980s, the bases were laid for ambitious preservation and presentation plans to come.

If, in the first phase, Eye Filmmuseum shared the same sort of history of most Western film archives, things changed in the 1980s. In the second phase it dedicated itself to a very active restoration practice (thanks to quite regular funding granted by the Ministry of Culture starting in 1980) and shaped both a collection and a presentation profile that since then has been associated with this institute internationally. Mainly under the direction of Hoos Blotkamp, Eye Filmmuseum defined its mission as a center for the Dutch cinematographic heritage, where film is considered a museum object and not merely a historical document (Lameris, 2007: 59). Furthermore, Deputy Directors Eric de Kuyper first, and Peter Delpeut later, encouraged restoration and presentation practices that were mainly moved by the aesthetic value of films rather than by their historical relevance. "The institute led in this way the development of a new film historical canon," as Bregt Lameris writes (2007: 75 – my translation).

From this perspective, the focus of Eye Filmmuseum shifted from the celebrated centerpieces of official film history to its margins. Examples of this are the compilations of film fragments, restored and presented in programs known as *Bits & Pieces*, the unprecedented attention given to non-fiction films

from the 1910s and the restoration of silent films with their original added colors (i.e. tinting, toning, stenciling).[171]

During this second phase Eye Filmmuseum started experimenting with a new exhibition practice, in which silent films were presented in unexpected settings with contemporary musical accompaniment. The "film as *dispositif*" framework can be retraced to such experiments. These endeavors led to a mature practice, and, with it, a more conscious policy that found its highest expression in the Museum's own film festival, the Filmmuseum Biennale. In the first edition of the festival, curated in 2003 by Mark-Paul Meyer and Martin de Ruiter and promoted under the theme "see and hear," several recent restorations were shown with newly composed scores performed live in various Amsterdam locations. The second and third editions (2005 and 2007) followed a similar set up with a richer program and growing audience. As Lameris points out, the idea behind this kind of original presentation was to

> [...] create a situation similar to the one experienced by the film audience in the past. The Filmmuseum tried in this way to (re)create the fascination of a silent film program. The intention was not to recreate authentic programs, but mainly to stimulate a feeling in the audience similar to the one felt by early cinema audiences. [...] The Filmmuseum allowed itself room for free interpretation for the musical accompaniment of silent films, by inviting well known musicians such as Henny Vrienten, Joost Belinfante and others and giving them carte blanche. This resulted in experimental programs, which place such film presentations in the domain of experimental arts. (Lameris, 2007: 143-144 – my translation)

One of the most extreme examples of such an experimental film presentation practice is *Zeemansvrouwen*, one of the cases discussed in the next chapter. With the collaboration of Dutch composer Henny Vrienten, not only was a new score added to the film, but a completely new soundtrack was created that includes sound effects and dialogues. Note that, being one of the last silent films produced in the Netherlands, *Zeemansvrouwen* never knew a sound version. Such presentation practice can be (and in fact is) questioned on the ethical grounds on which archivists often debate, as discussed in Chapter Two. Questions such as "is this a proper model for archival film restoration and distribution?" or "should a film archive endorse such a practice?" are often posed and not only from outside Eye Filmmuseum. An easy way out is given by the practice of restoring the film to its original form along with that of creating a new distribution version. Nevertheless, the new distribution version is more widely seen (through theatrical distribution) than the more accurate restoration version (shown at specialized festivals with live

music accompaniment). It cannot be denied that the archive, in this case Eye Filmmuseum, nominally the custodian of the film in its original form, opted for a creative addition to the original artifact on the one hand to make it more accessible for a larger audience, on the other hand to reinterpret it.

The third phase of Eye Filmmuseum's history, still on-going, was initiated under the direction of Hoos Blotkamp at the end of the 1990s with the first steps to get Eye Filmmuseum ready for the future. From 1996, Eye Filmmuseum started experimenting with digital technologies for access and restoration purposes. In particular, a first project was carried out which led to the digitization and encoding of one thousand hours of film material, a considerable effort at that time.[172] Simultaneously, the search was started for a new and larger location to finally bring together the different departments and match Eye Filmmuseum's ambitions. Blotkamp saw a chance for the realization of this plan in a move to Rotterdam, but the museum's board opposed it. The conflict between board and direction came to such extreme consequences that Blotkamp and Deputy Director Ruud Visschedijk stepped down. It was only a few years later, with Director Rien Hagen, that a new concrete possibility for the Filmmuseum's ambitions for a new housing solution became reality. In 2008, under the new Director Sandra den Hamer, Eye Filmmuseum is preparing to move to its two new locations: a futuristic building with four theaters, an exhibition space and a library, and a less imposing but highly functional collection center, both in Amsterdam North. Both locations are expected to be operational in 2012.

Together with the finally concretized perspective of new housing, the third phase of the Filmmuseum's history is also seeing an unprecedented opportunity for preserving and digitizing a large part of its collection. With the project *Images for the Future*, mentioned earlier in Chapter One, the Filmmuseum was granted a budget in 2006 of about 30 million euros for preserving, digitizing and giving access to more than five thousands hours of film and a large part of its film-related collection. *Images for the Future* is probably the most challenging project in Eye Filmmuseum's history, enabling the museum to assess, preserve, restore, digitize, describe, and making accessible its own collection in the period 2008-2015. As Director Den Hamer puts it:

> *Images for the Future* is the pillar under our metamorphosis into a new museum. Digital access to audio-visual heritage is as important as our actual re-housing.[173]

Eye Filmmuseum, thanks to the imminent re-housing and the project *Images for the Future*, has been forced to look ahead, and not only at the next few years. The need for imagining a future film museum able to attract a consist-

ent audience in a few decades from now has driven the choices that are being made today with regards to all its traditional activities and its new plans for the future. The new Filmmuseum will have the possibility of hosting large exhibitions and to make its collection available (once digitized in the framework of *Images for the Future*) in a much more flexible way, or, to use a concept discussed earlier, in many different *dispositifs*. As pointed out on the Filmmuseum's website, "[t]he digital availability of this heritage leads to innovative applications in the area of new media and to the development of new valuable services for the public."[174]

Let us look at Eye Filmmuseum's ambitious plans from a SCOT perspective and, in particular, to the framework for decision making that has led to the concretization of the project *Images of the Future*. Obviously, the means granted for such an impressive preservation and digitization effort could not have been obtained without the combined effort of broader social forces, i.e. relevant social groups, other than Eye Filmmuseum.

There are here at least four relevant social groups that have played an important role in the decision-making process that has led to *Images for the Future*: the Dutch archives in charge of audiovisual heritage at a national level (besides Eye Filmmuseum, the Netherlands Institute for Sound and Vision, the National Archive and the Centrale Discotheek in Rotterdam), the Dutch government and its advisory groups (e.g. the Ministry of Culture and the Council for Culture), the service providers aspiring to realize the preservation and digitization tasks foreseen in the project, and, finally, the (Dutch) users.

It should, however, be noted that, as discussed in Chapter One, users' active role is something new for film archives used to a chaperoning attitude towards their audiences. In the new media environment, where audiences are being replaced by individual users, film archives are slowly realizing that the chaperone model, still suitable for educational purposes, needs to be partly replaced by a more open and direct model. From this perspective, also in a project like *Images for the Future*, the intention of giving a voice to the users still needs to find concrete ways of implementation.[175]

The interaction between the audiovisual national institutes and the policy makers has been a direct one. Through formal and informal consultations, memoranda, surveys and yearly reports, the Dutch audiovisual institutes have lobbied towards the realization of such project. Note that a list of questions posed by the Council of Culture to Eye Filmmuseum and to the Netherlands Institute for Sound and Vision in 2005, with regard to the backlog of film, video and audio preservation and digitization, led to a first draft of the project plan for *Images for the Future*. The project funding was finally granted in September 2006. With 154 million euros coming from the Dutch Fund for the Reinforcement of Economic Structure, the budget was the largest ever grant-

ed by a European government to an audiovisual preservation and digitization project.[176]

Along with the coordinated action for lobbying of the various institutes, the research and development activities of Eye Filmmuseum and of the Netherlands Institute for Sound and Vision have also been instrumental for inspiring and convincing policy makers. In the previous decennium, Eye Filmmuseum had gone through a feasibility phase, experimenting with digital technology for access and for restoration. The participation in European-funded projects such as Diamant and PrestoSpace, discussed later on, have helped Eye Filmmuseum to create a network with other relevant social groups at the European level. The contacts via worldwide organizations such as FIAF, ACE and AMIA have also been important. From the side of the Netherlands Institute for Sound and Vision, the experience in digitization of television content, together with the participation in projects like PrestoSpace and the Institute's affiliation to FIAT/IFTA (International Federation of Television Archives), should also be considered as part of a feasibility phase that strengthened the proposal for *Images for the Future*.

Whereas heritage institutes have the obvious common goal of preserving and showing their collections, the motivations behind the decisions of policy makers in the cultural sector are less transparent since they have many priorities to be kept in balance. Between 2005, when the *Images for the Future* plan was submitted, and 2006, when the budget was granted, there has also been an election and a change in ruling coalition and in the Ministry of Culture. Nevertheless, the project's main aims (digitization of audiovisual heritage to be accessed by the educational sector, the creative industry and the public at large) have proved to be high enough on the political agenda.

Another relevant social group that has contributed to the granting of *Images for the Future* is that of the service providers, which will carry out the huge preservation and digitization tasks of the project. It is difficult to ascribe to specific actions the influence of this group in the decision-making process. It is the industry at large, from worldwide corporations such as Sony or Thomson, to local providers such as the Dutch film laboratory Haghefilm, that in many different ways have influenced policy makers by confirming the viability of digitization. The relevant social group of service providers started to become visible in the last part of the preparation phase, when calls for tenders were to be issued and providers were preparing to bid. In this phase, a number of providers worldwide reached a high level of inclusion in the technical aspects of the project. Finally, the providers that got the commission became real partners in the realization of the project.[177]

Also the relevant social group of the users should be mentioned. In the case of *Images of the Future*, the main target users are the educational system

(e.g. teachers and students) and audiovisual professionals. In the decision-making process, pressure has indeed come from the educational system with a specific request for readily available audiovisual content; similarly, the creative industry, from television makers to film producers, have pleaded for more digitized historical content. Users at large have also indirectly played a role by demanding more accessible audiovisual content. This demand is one of those results of the rapid change of the audience into users, already discussed several times in the previous pages.

The choices made by Eye Filmmuseum from the very beginning of the project are in line with both the "film as a *dispositif*" and the "film as original" frameworks, discussed previously. With regard to the "film as *dispositif*" framework, one of the most challenging decisions within the renewed digitization strategy has been the choice of RESOLUTION (2K) and of the compression format (JPEG 2000). These allow a viable high quality of digitization, which is in accordance with the intention of exploiting digitized content also for digital projection, e.g. within the classic cinema *dispositif*. With regard to the "film as original" framework, the film-born artifacts to be digitized will still also be preserved in their original form (i.e. film) and those born-digital will be preserved as such (i.e. data). There might be instances in the future where the only projectable copy will be the digital one, as the film artifact is too damaged and fragile to be shown and, within the new policy, a new film print will not be made for every title. This would be the case if the source material would suffer a greater loss in photographic quality when duplicated via photochemical means, rather than via digital. The choice of RESOLUTION and compression format are also to be seen as a step towards long-term preservation of digitized films, and towards the possibility of digital projection on a large screen without noticeable quality loss and, in general, for flexibility in data management. Any kind of access format can be derived from such high RESOLUTION data without any loss of information whatsoever.

Also considering the above, Eye Filmmuseum is becoming a museum for the users, more than it has ever been before. However, before this will be a reality, the Filmmuseum will first have to "let go" of its collection, adding a new mode of access to its chaperone model. If the common tradition of film archives finds its root in clubs for *cinéphiles*, the film museums of the future need to open their vaults and make their collections accessible in ways as diversified as their users. This seems to be the policy Eye Filmmuseum is currently embracing.[178]

The two restoration projects discussed as case studies in this work, *Zeemansvrouwen* and *Beyond the Rocks*, are in different ways representative of the experimental approach, practiced by Eye Filmmuseum since the late 1980s. The restoration of *Zeemansvrouwen* was carried out together with the Danish

laboratory Digital Film Lab, while *Beyond the Rocks* was restored in collaboration with the Dutch Haghefilm. Both laboratories are discussed further on.

How Eye Filmmuseum will further give shape to its plans is yet to be seen. In particular how the archive will cope with the challenges posed by the new digital archive and its related collaborative culture is not yet visible. And the same is true with regard to the new forms of *dispositifs* Eye Filmmuseum will embrace.

EYE FILMMUSEUM – UPDATE

In the last decade, Eye Filmmuseum has undergone a radical transformation. Under the auspices of museum Director Sandra den Hamer, the previously discussed projects and plans, including the relocation of the museum and archive and the completion of the project *Images for the Future*, have all been realized, resulting in an unprecedented metamorphosis.[cxxv]

In this update, I will just briefly touch upon the most important aspects of this metamorphosis as an in-depth discussion would require significantly more space and could be better done by someone who has been involved with it less closely.[cxxvi]

In 2010, the Nederlands Filmmuseum merged with three smaller organizations, namely the Dutch Institute for Film Education, Hollands Film (responsible for the international promotion of contemporary Dutch films), and the Filmbank (engaged in the distribution of Dutch experimental films). This merger, promoted by the Dutch Ministry of Culture, led to a rebranding of the newly born organization into what has since been known as Eye Filmmuseum.[cxxvii]

In April 2012, the museum's new landmark building opened its doors on the northern bank of the IJ river, facing Amsterdam's Central Station. Designed by the Austrian firm Delugan Meissl Associated Architects, the white futuristic building houses four cinemas, two exhibition spaces (one for a permanent interactive exhibition; the other for temporary shows), and a large communal area with a bar and restaurant. With a steady flow of approximately 700,000 visitors a year, Eye's presentation activities have increased significantly to include curated and archival programs, as well as contemporary art house titles, three to four thematic exhibitions a year (mainly alternating the focus on international filmmakers with that on the crossovers between film and other arts), and various displays of the collection (fragments from 120 years of film history, posters, apparatus, etc.). Furthermore, with the significant expansion of Eye's digital presentation, both online and on site, the focus on experimenting with new ways of accessing the collection (Fossati, 2012 and Ingravalle, 2015) has remained an important guiding principle. Based on its efforts to present its collection in innovative ways, in line with the tradition

that has been described above, the association of Eye with the "film as *dispositif*" Framework is still pertinent.

In October 2016, on the occasion of the 70th anniversary of the archive (four years later than originally planned), the new Eye Collection Centre opened its doors at walking distance from the museum building in Amsterdam North. For the first time in its history, the Dutch film archive could bring together its entire collection under one roof (with the exception of the inflammable nitrate films still housed outside the city center) in state-of-the-art climatized vaults, including a sub-zero depot, similar to the one at the Danish Film Institute, for color negatives and masters, 70mm prints, and some black-and-white negatives. The Collection Centre also houses Eye's Collection Department with a team of more than forty specialists (e.g. curators, restorers, information specialists, digital film technicians, and digital access experts).[cxxviii]

The aforementioned *Images for the Future* project, which started in 2007, came to an end in 2014 after its budget was significantly reduced in 2011, which led to a number of targets being reviewed and contracts being prematurely terminated. Despite the budget revision, the project, aimed at preserving and digitizing Dutch audiovisual heritage and making it available online, met most of its objectives and notably impacted all partner organizations and their everyday practice and workflows.[cxxix]

In many ways, *Images for the Future* has been a prime example in the field for similar large-scale digitization projects that followed. By employing the services of a number of providers, including two of the laboratories discussed in this book, namely Haghefilm (for film and sound restoration) and Cineric (for the creation of BLACK-AND-WHITE SEPARATION MASTERS for a number of color negatives of Dutch feature titles), it has positively influenced the film archival field at large.

The consequences of the *Images for the Future* project for Eye Filmmuseum have been numerous. During the project, the archive acquired in-house expertise for film digitization, digital restoration, and digital asset management, and purchased the hardware and software to set up a workflow to carry out these tasks as part of its daily activities. Also, the high volume of collection items digitized at 2K resolution during the project (approximately 10,000 film titles) together with the steady number of digitized items that have been carried out after the end of the project (approximately 200 titles a year) have allowed for the deployment of high-resolution projections for new presentation activities in the museum, including interactive installations, temporary exhibitions, and film screenings. Guided by the ambition to bridge analog and digital in its collection and presentation activities, alternating digital means with analog ones in the restoration and presentation of its collection, Eye managed to realize one of its most challenging projects.[cxxx]

Film as State of the Art

As discussed in Chapter Two, film, transitional in nature, has always been accompanied by an attempt to push the limits of the existing, sometimes obdurate, technology. Within the relevant social group of filmmakers (and cinematographers, special effects engineers, etc.), there has always been a guiding effort for developing new technological means capable of turning visual ideas into moving images. This has always been the case, for instance, in so-called pre-cinema as in early cinema, in commercial film production as well as in avant-garde and experimental filmmaking.

A similar kind of drive can be retraced in the intentions of film archivists when confronted with an old film in need for restoration. I have called the theoretical framework in which such an approach to filmmaking and film restoration can be inscribed "film as state of the art."

The archives that more than others can be associated with this framework are commercial ones, and, in particular, those where film production is part of the enterprise. Hollywood studios are the example *par excellence* of the "film as state of the art" framework.

There is one aspect that makes Hollywood studio archives a more fitting relevant social group within this framework than any other film archive, and that is the fact that they can afford state-of-the-art technology for their preservation and restoration work. On top of their financial means, which may vary significantly from archive to archive, depending on the commitment to preservation of the management, another advantage is their proximity to the film industry. Studios (similarly to broadcasters) combine film producing, rights-holding and archiving in one body. While non-profit archives must actively fetch and collect the films that fall in their scope, often facing the mistrust of rights-holders, studio archives can in principle simply ask their colleagues from the production department to deliver the most original film elements once they are done with them.[179] Proximity to the industry also means a shorter line to laboratories, film stock manufacturers and software developers. Indeed, the concentration of service providers (e.g. film laboratories and post-production houses) in Los Angeles makes it possible for studio archives to choose the most suitable partner depending on the challenges posed by the project at hand. As Grover Crisp, Senior Vice President of Asset Management and Film Restoration at Sony Pictures Entertainment, confirms:

> We are always looking at the newest tools that we can find. It is an ever-evolving technology, however. Lately, we have been giving particular manufacturers some test footage (all the same footage to each) with specific examples of problems with older films that are very difficult to

> solve. Flicker, image instability, severe fading, solid vertical tramline scratches are but a few of the issues that are difficult to fix. We have been challenging the manufacturers to come up with the best solutions. We then compare the results to see what is the current best solution for our needs. Then things change again as the technologies advance. What we used six months ago is not what we would necessarily use now. As the technology increases, we will more and more move into a digital restoration workflow, which emulates that of the current Digital Intermediate process.[180]

Hollywood studio archives also have a particularly high degree of inclusion, to use SCOT's terms, in the field at large (not only the archival one) as they form one of the biggest film industries in the world. Their connection with, and influence on manufacturers is bigger than that of non-profit film archives. Indeed, a professional organization like DIGITAL CINEMA INITIATIVES (DCI), which represents Hollywood Studios, discussed in Chapter One, is much more influential than that of the International Federation of Film Archives (FIAF).[181]

The archive I have associated with the "film as state of the art" framework is that of Sony Pictures Entertainment. In the past twenty years Sony has led a transparent and consistent preservation and restoration policy, always using the most advanced technology.

SONY PICTURES ENTERTAINMENT

Columbia Pictures was purchased by Sony Corporation from the Coca-Cola Company in 1989. The studio moved to the former MGM lot in Culver City, and, under the new name of Sony Pictures Entertainment, initiated a preservation and restoration program for the Columbia Pictures library and for all newly produced Sony Pictures films. Led by Crisp, this program covers the entire Columbia Pictures library and includes both long-term passive preservation as active preservation, through the creation of protection materials (either duplicates or BLACK-AND-WHITE SEPARATION MASTERS in the case of color films), as well as restoration and the creation of new prints for theatrical screenings and digital masters for distribution. About two hundred titles are tackled by Sony every year, and half of the library was already preserved by 2007.[182]

It should also be noted that Crisp, as an actor in the field, is not just a member of the social group "archives," but also has an important role as co-organizer, together with Michael Friend (former Director of the film archive at the Academy of Motion Picture Arts and Sciences and currently one of Crisp's collaborators at Sony) of the technical symposium The Reel Thing, mentioned earlier. He also co-curated the last two editions of the Joint Technical Symposium, where a large number of professional organizations in the field of

audiovisual archiving meet to discuss new technical possibilities and share their knowledge. Crisp and Friend have also been actively involved in projects such as FIRST and Edcine, discussed below, and have often invited members of these projects to discuss on-going research at The Reel Thing. In Crisp's case it should be pointed out that, although we can draw distinctions regarding institutional players, in fact the people involved sometimes have multiple affiliations and identities, and it is precisely these cross-over positions that help to coordinate views and agendas (e.g. by putting the need of digital standards for archival films on the agenda of Hollywood studios). As pointed out earlier, actors who move between various relevant social groups are many and they add to the dynamics within a field drawn according to relevant social groups and relevant theoretical frameworks.

According to Crisp, the "key collaborators are the laboratories. They are the unsung heroes of film restoration." Since no two films are the same, each one must be approached as a separate case, sometimes by trial and error. The challenges are often daunting and the technology continues to change rapidly, one of the main challenges being the instability of the new digital technology.[183] This is why it is particularly important to build good working relationships with several laboratories specialized in different aspects of the restoration workflow, analog as well as digital. Sony works on a regular basis with, among others, Cineric, and Chace Audio for digital sound restoration, and Cinetech/Ascent Media for photochemical duplication. The relation between Sony and the laboratories is exemplary of its state-of-the-art approach towards preservation and restoration. Crisp, and Sony with him, seems determined to ride and lead the technological change, in close collaboration with film laboratories.

In SCOT's terms, Sony is a case of an actor influencing others to achieve consensus and stability. An example worth mentioning of the stimulating input by Sony is that on Cinetech and Cineric for the development of analog color correction techniques for faded color films. Thanks to these techniques, a number of restorations were carried out as in, for example, *Bell, Book and Candle* (USA, 1958). Note, anyhow, that these analog techniques, as a result of the on-going stabilization process of the digital, have already been replaced in the last two years by digital color correction. In SCOT's terms, these have been examples of "non-working machines" that have been replaced before reaching stabilization in spite of their good results.

The choice of laboratory in the case of Sony, as we have also noticed for Eye Filmmuseum and for Anthology, depends very much on the kind of restoration problem at hand:

> We work with specific laboratories on specific types of issues. Certain labs can work better with shrunken nitrate, for example, than other labs. Some labs prefer to print contact, some optically. In terms of digital technologies, it is following the path somewhat of the traditional photochemical approaches, meaning that some labs can do things digitally that others cannot. [...] Right now, choosing a specific lab depends on the particular problem we want to solve, if the problem is unique to a particular section of a film. [...] If, however, we are planning to scan the entire film and restore every frame, then the choice of the lab might be a third choice. In other words, just as with photochemical choices, the kind of issues that need to be dealt with digitally will determine the lab or labs we will go to for the work.[184]

This attitude seems to stimulate the development of highly specialized and differentiated laboratories, rather than of uniform and standardized ones. In a way, it can be seen as an incentive to destabilization, as the opposite to SCOT's idea of stabilization. In Chapter Two I have touched upon this phenomenon while discussing the concept of convergence/divergence and later on, in the section dedicated to the relevant social groups of film laboratories, I will further develop this line of thought by arguing that convergence/divergence are relevant concepts within which laboratory work is carried out at this time of transition to digital.

It is in the frame of Sony's collaboration with Cineric that a recent restoration has been carried out that is extremely relevant for this work, Kubrick's *Dr. Strangelove*, the first fully 4K RESOLUTION restoration of a black-and-white feature film.[185] The restoration of *Dr. Strangelove* has resulted in a master for digital projection, which, according to Crisp, will eventually become the norm, also for archival (film-born) titles:

> Currently, for new titles, even if the film has a traditional shot-on-film, posted-on-film finish, the studio still has to create a digital master and files for digital projection. While not pervasive, the digital projection of films is widespread enough that we need to do this on all films currently being produced. I also think, based on requests and feedback from theaters and festivals, that legacy titles in the future will be requested on digital formats rather than traditional 35mm prints. Digital projection will at some point overtake film projection at many levels, not just traditional consumer theaters.[186]

Since the first Columbia Pictures film made through a DIGITAL INTERMEDIATE, *Panic Room* (USA, 2002), Sony has been working on a program for archiving

data from new DIGITAL INTERMEDIATE films. This digital storage and asset management program was outsourced to Ascent Media in 2005, known with the name ViiA.[187] While building digital storage and asset management systems is the norm for companies working with born-digital content (e.g. internet and broadcasting), it is quite a unique undertaking in the film production and the film archival fields. ViiA is a first step towards a new form of archiving and distribution, and it will help set new standards for other programs to come:

> [...] we are using the technology with Ascent Media to help develop workflows using ViiA that will allow for us to "ingest" the data into the system, verify the integrity of the data, open and view the imagery for QC [quality control] in its native resolution, make multiple copies of the data, store the copies in geographically separate locations. We have, at the moment, a plan to revisit the data every two generations of advancement in LTO [Linear Tape-Open] tape storage, because of the limits to the backward and forward compatibility of the tapes. We are also looking for other processes or systems that might be of use for archiving.

However,

> In this period in which there are no particular standards in place for preservation of digital files from the DI [DIGITAL INTERMEDIATE] process, we are going forward with what we would consider to be a best practices policy. Which is to say that in lieu of agreed-to standards by sanctioning bodies such as SMPTE or ISO [International Organization for Standardization] or ANSI [American National Standards Institute], we are working with commonly accepted practices throughout this industry (and other industries, I believe), to preserve data on LTO data tapes. This may or may not be a process that is the best for long-term preservation of DI data, because it is not proven one way or another, but it is the de facto standard by which this data is currently being archived and accessed simply because it is the predominant process that is being followed throughout the industry – which is, in a way, a best practice.[188]

Such an approach is in line with the "film as state of the art" framework. A clear choice is made here to co-determine the development of technology for the entire field. This of course involves risks in a way similar to those taken by Eye Filmmuseum with *Images for the Future*.

Despite the fact that Sony is taking significant steps in the use and improvement of digital tools and is in the position of applying state-of-the-art digital techniques for preservation and restoration (Sony has been applying

digital technology for restoration since 1990), Crisp points out that most of Sony's restorations are still photochemical. It may sound surprising, but each old and new film is still duplicated onto film preservation elements. Even for those obtained via a DIGITAL INTERMEDIATE (all films nowadays), a film back up is always created in the form of BLACK-AND-WHITE SEPARATION MASTERS, the technique that best preserves colors for the long term. This is an example of the integrity of Sony's current approach to preservation and restoration, which is by no means in contrast with its choice for experimentation. The use of technology in Crisp's vision is always at the service of the two principles of best possible restoration results and guarantee for long-term preservation, both widely held parameters in the field. The former can be obtained today by a combination of analog and digital tools, while the latter can still best be achieved by creating preservation elements on film.

Sony, as an example of an archive that can be associated with "film as state of the art," embodies the framework in transition as it adopts both analog and digital, in restoration as well as long-term preservation. In such hybrid practice this transitional moment becomes, once more, evident.

SONY PICTURES ENTERTAINMENT – UPDATE

At Sony Pictures Entertainment, many of the policies and practices with regard to preservation and restoration that were adopted a decade ago are still in place today. Still heading the archive and its preservation and presentation program, Sony's Executive Vice President of Asset Management, Film Restoration & Digital Mastering Grover Crisp has been known to keep up with the latest advances in technology.[cxxxi]

When asked what the biggest changes in the field are that have influenced his archival work, Crisp points to the introduction of 4K resolution for television display and theatrical exhibition.[cxxxii] Similarly to what DVD distribution did for restoration in the 1990s as a new market for high-resolution content was opening up, the potential of 4K home cinemas has prompted Sony to invest in 4K restorations of its archival titles. If a decade ago only a selected number of films were restored in 4K, this has become standard procedure after 2010. Currently, Sony has restored more than 150 films at 4K, including some titles that had previously been restored photochemically and/or at 2K. The latter has been the case for *The Bridge on the River Kwai* (USA, 1957), *The Guns of Navarone* (USA, 1961), and *Taxi Driver* (USA, 1976). Even a contemporary series such as *Breaking Bad* (USA, 2008-2012), which was originally shot on 35mm and broadcasted in HIGH DEFINITION, has been digitized at 4k by Crisp's team for 4K UHD (Ultra High Definition) release and streaming.[cxxxiii]

Crisp also points out that today's film scanners provide a sharper image and that digital restoration tools have significantly improved in terms of effectively cleaning up the image by removing scratches and dirt as well as undesired DIGITAL ARTIFACTS. Crisp and his team work closely with software developer MTI on image restoration tools that at times are custom-made to tackle new problems encountered in a specific title. According to Crisp, the new challenge for digital film restoration is undoubtedly HIGH DYNAMIC RANGE (HDR) as it offers new powerful tools that enhance image quality, bringing a specific quality of film to television displays. Recently, Sony restored two titles in 4K and created HDR versions, namely Francis Ford Coppola's *Bram Stoker's Dracula* (USA, 1992) and Steven Spielberg's *Close Encounters of the Third Kind* (USA, 1977), and the results were very satisfying. Crisp reports that Spielberg's reaction to the new restoration was that "a veil had been lifted" compared to the previously restored version in Standard Dynamic Range.[cxxxiv]

At present, Sony has created (analog and digital) preservation elements for most of the feature films in its collection and continues to work on short films and animation films. In terms of long-term preservation, BLACK-AND-WHITE SEPARATION MASTERS are still being made for all new films, as was the case a decade ago. How long this policy will remain viable mainly depends on the survival of photochemical laboratories that offer this service and on the availability of appropriate film stock. For this reason, and because of the reduced need to restore and preserve new Sony titles photochemically (fewer original film negatives exist), Sony considers moving away from its standard practice of creating preservation elements on film for each title (either film-born or born-digital content) toward favoring a digital copy as the primary means of preservation for born-digital titles.[cxxxv]

As discussed above, Sony's long-term digital preservation policy has maintained the same strategy over the last decade (since 2005): three digital copies of every version of a film or a television program are created and stored in three geographically separated locations. In 2017, a third cycle of migration to new LTO tapes was carried out without encountering any problems.[cxxxvi]

Crisp points out that the theatrical distribution of Sony's restored films remains very productive as there is a steady international demand to screen these titles at festivals and *cinémathèques*, mainly as DCPS. A recent exception has been the international distribution of the 70mm version of *Lawrence of Arabia* (UK/USA, 1962). Having been restored by Sony at 4K RESOLUTION for the film's 50th anniversary in 2012, it was re-recorded on 65mm negative for a 70mm release in 2017.[cxxxvii] Finally, in terms of non-theatrical access to the collection, Crisp underlines that most restored titles are available for streaming via Netflix or Amazon Prime and a few are available on 4K UHD disks.[cxxxviii]

In view of Sony's continued effort to restore its collection by applying cutting-edge technology and relying on the most up-to-date equipment and services avail-

able in the field, I still consider the association of its approach to film preservation and restoration with the "film as state of the art" framework grounded.

The archives discussed here are actors that give a different meaning to the same artifact, film, within the same technological frame, that of archival film. However, these examples, although analytically different, are often empirically overlapping (Bijker, 1995: 194), as archives often lean on more than one framework at a time. Therefore, more frameworks along with the privileged one may be applied when dealing with them. This is in my view a clear symptom of the transitional phase, where not only the technology, the practices and the perspectives are changing, but the whole framing, if you will, is in motion. Because frameworks of reference are changing, archives, even those that identify more explicitly with one particular framework, are today shifting between them. This is not necessarily a sign of confusion but rather a characteristic of the transitional logics.

The restoration work of archives depends on the execution carried out in film laboratories. What is the role of these laboratories in the projects? Is it possible to recognize a coherent approach in their work that contributes to shape the final result of archives' restorations? In the next section I will address the relevant social group of laboratories.

3.2 FILM LABORATORIES

The relevant social group of film laboratories will be discussed in the following pages. In particular I will focus on the ways this relevant social group is changing with the transition to digital and how this change is contributing to reshape film archival practice.

There are of course many more laboratories that either specialize in film restoration work or offer restoration as one of their services. In the last decade restoration has become a significant business, as more commercial parties have realized the potential of turning sleeping audiovisual assets into valuable and accessible collections, as in the case of Hollywood studios. Recently a number of film laboratories specialized in film restoration have also been taken over by larger companies. This has been the case, for example, with Cinetech in California and with Soho Images in London, which have both become part of Ascent Media, and with Centrimage in Paris that is now a sister company of the Éclair Group. Although these larger companies are also clearly part of the archival film field, in my work I have chosen to focus on three of the most

important film restoration laboratories in the world, that have also managed to preserve their autonomy. Therefore, it will be easier to assess their agency and, with it, their role in shaping the field. There are of course many more laboratories in Europe and North America that are dedicated to film restoration and that could have been taken as examples within this work. In particular, I would like to mention a few that in the past twenty years have produced very interesting, important, and at times innovative restoration work: the laboratory of the Cinémathèque Royale de Belgique (led by Noël Desmet), Immagine Ritrovata in Bologna, Prestech in London, the laboratory at the National Film Archive in Prague, Triage in Los Angeles, Cinema Arts in Pennsylvania, AV Preservation by reto.ch in Switzerland, and the already mentioned BB Optics in New York.

It should be added also that, even though the most renowned film restoration laboratories are still located in Western countries, an increasing part of their digital work is being outsourced, mainly to Asian laboratories. Discussing their agency here would be too big a detour from my line of reasoning, but it seems plausible that these laboratories, competitive with Western laboratories both in services and prices, will play a major role in the future shaping of the field. One case certainly worth mentioning here is that of Prasad Corporation in Chennai, India, which has already become one of the largest digital restoration facilities in the world with its two hundred and more dedicated workstations, doing digital restoration work for Western laboratories and archives.[189] For the time being, the aesthetic contours of these outsourced digitization processes are set by Western laboratories and archives that commission the work. However, because I believe laboratories do have more agency than they are credited for, in the future this outsourcing practice will inevitably influence the practice of film restoration.

Laboratories' contribution in reshaping film archival practice is subtler than the one exercised by film archives. Indeed, although film laboratories have a high level of inclusion in the film technological frame, as pointed out earlier, they are in the first place service providers. They offer services, like film editing, processing, GRADING, restoration, and products, like film prints, digital copies, to name a few, and comply with someone else's wishes. In the case of laboratories specializing in film restoration, film archives are the ones defining the assignment. Because of this somehow ancillary position, film laboratories in most cases cannot be associated with the frameworks defined earlier in this work. They must first of all be flexible and adapt to the framework of their clients. The same laboratory might provide restorations that are very close to the original artifact for an archive that embraces the "film as original" framework, but also restorations with a high degree of interventions, with regard to damage, color correction, and even re-formatting, for an archive that embraces a "film as *dispositif*" framework.

On the other hand, laboratories express strong agency in influencing the way the new technology is applied in film restoration practice. They do so through the selection of their employees, the sort of hardware and software they acquire and, in the case of old analog equipment, in their policy for technical maintenance and retro-engineering. Also, and most importantly, they influence the field by bringing into the discussion their perspective on technology. I think that the agency of laboratories cannot be described in terms of frameworks, but rather in terms of theoretical concepts.[190]

In Chapter Two I identified three concepts, derived from new media studies, which I believe to be particularly relevant and useful in discussing the transition to digital in the archival field. These concepts are convergence/divergence, remediation and simulation, and they are used here to point out and discuss differences and similarities among the relevant social group of film laboratories. As I have done with frameworks and film archives, I have selected one example for each concept. This is again a heuristic attempt, as laboratories, even more than archives, are typically border-crossers and flexible by necessity.

Within convergence/divergence – two inversely related concepts elaborated from the idea of convergence proposed by Pool (1983) and further resumed by Thorburn and Jenkins (2003) – I discuss those laboratory practices that lead to specialization on the one hand and differentiation on the other. As schizophrenic as it may sound, the process of technological convergence is also causing a divergence. Analog and digital, one next to the other, are producing highly hybrid restorations, like the ones discussed in Chapter Four. Past and future media (from equipment for obsolete film formats to trial versions of image manipulation software still in development) become all equally important in this time of transition where there is no longer (or not yet) one standardized way to do things. I have chosen Haghefilm as the ideal example of convergence/divergence in practice, although many laboratories could be associated with this concept nowadays.

The concept of remediation, as discussed in Chapter Two, has been derived from Bolter and Grusin's seminal book (1999). When applied to the case of archival film, it characterizes the practice that remadiates old restoration technologies attempting to "rival or refashion them in the name of the real," using Bolter and Grusin's words (1999: 65). The "real" in our case indicates the film artifact to be restored (as argued in Chapter Two). The example discussed within the concept remediation is that of the Danish laboratory Digital Film Lab, which, more than others, appears to me as a champion of the remediation concept in the application of digital techniques to film restoration.

Finally, the capacity for simulation has been defined earlier as an attribute of media in general and, in particular, of digital media, which have the great-

est ability to simulate photographic images. From this perspective, digital comes with the promise of better restoration tools. Nevertheless, in this transitional phase from analog to digital, it is the combination of the two technologies that provides the best results for restoration. Although all laboratories are necessarily associated with the concept of simulation as I understand it, because laboratory work is quintessentially simulation work, I have chosen Cineric as the example for this concept. Because of its background as an optical house, specializing in special effects and various optical works (e.g. opening titles and superimpositions), Cineric has a tradition in simulation work by means of both analog and digital techniques.

All three concepts can be functioning within any of the four frameworks identified in this work. A few examples of this relation between frameworks and concepts in practice will be touched upon in the following pages. Others will be discussed in detail in the next chapter.

Convergence/Divergence

I will discuss here how the inversely related concepts of convergence/divergence function within the relevant social group of film laboratories. As encountered earlier in the discussion of the archives, laboratories seem often to be chosen because of their specializations. Lampert at Anthology considers different laboratories for specific projects, and similarly Crisp at Sony targets laboratories for specific tasks. Also, within the same laboratory there might be divergent specializations. Cineric, for example, as will be discussed later, applies both highly specialized optical work (e.g. for the production of BLACK-AND-WHITE SEPARATION MASTERS from shrunken archival material) and the DIGITAL INTERMEDIATE process with comparable success.

Convergence/divergence well defines technological stabilization as a socially constructed process rather than a linear development. Convergence/divergence underlines the dynamics of transitions in film restoration practice in a field pulled between two forces: on the one hand, the convergence of technology, standards, means and, on the other hand, the divergence of analog and hybrid multi-specialized means. Indeed, when it is not yet known where the transition is leading, the process moves back and forth. One way to deal with such uncertainty is simply to get the best out of the all available technologies and tools. From this perspective, Haghefilm is certainly a good example of convergence/divergence put into practice.

HAGHEFILM (AMSTERDAM)[191]

Haghefilm is one of the largest European film laboratories dedicated to film restoration. Established in 1984, Haghefilm laboratory owes its name to a much older film establishment, the production company founded in 1926 in Den Haag by Dutch filmmaker Willy Mullens.

Mullens made a number of scientific films and documentaries in the 1920s, applying all kinds of film techniques, both in shooting and in post-production. His Haghefilm was also a film laboratory, where Mullens experimented with different kinds of tinting and toning effects, adding to his film some of the most surprising color combinations from the period. Many of Mullens' films are preserved by the Nederlands Filmmuseum and have been restored at Haghefilm, which still shares with Mullens' original laboratory the spirit of experimenting with film during post-production. As a result, Haghefilm has become in the last thirty years the playground for a number of film archives in their search for improved restoration techniques. In this respect the collaboration with Eye Filmmuseum is emblematic.

As recounted by Juan Vrijs, the last founding member of Haghefilm laboratory still working at Haghefilm today, he, together with technicians Johan Prijs, Max Berg, Wim Kerkhof, and Livio Ricci, founded Haghefilm from the ashes of Color Film Center, the successor of the original Mullens' Haghefilm, and became directors of their own business. After acquiring the rights to the Haghefilm name from Mullens' heirs, they started a laboratory devoted primarily to the restoration of archival films. Between 1984 and 1995 the laboratory expanded its staff from five to twenty people and acquired several international clients, such as the George Eastman Museum (Rochester, New York) and Lobster Films (Paris). Such expansion coincided with the bigger volume of restoration work commissioned by Eye Filmmuseum that, as discussed earlier, started receiving an important structural funding for preservation from 1980 on, and also with the newly acquired international clients. In 1995, Haghefilm merged with Cineco, becoming the last Dutch film laboratory, equipped for both archival restoration and new film production. This combination makes it possible for the laboratory to keep up with new development in film production without losing touch with traditional film technology. As pointed out by Gabriel Paletz:

> Labs like Haghefilm not only invent new methods of treating movies, but they accumulate and adapt techniques, most of which have been discarded in modern film production. [...] A lab's livelihood rests on the manipulation of machinery and processes from all of movie history. Restoration labs regularly put technologies to uses not intended by their inventors, in order to recover the effects of past films. (Paletz, 2006: 8)

Although this applies also to other restoration laboratories, including Cineric, discussed below, Haghefilm has been particularly successful in developing new ways for restoring silent films by combining well-established and new technologies. This is the reason why I have chosen Haghefilm as the example for convergence/divergence.

Since the late 1980s, Haghefilm has been working together with Eye Filmmuseum on finding the most suitable methods for preserving, in particular, silent films' original colors. Tinted, toned and stenciled films, previously duplicated onto black-and-white film also by film archives, finally regained their original colors.[192] Such effort was recognized in 1991 when Eye Filmmuseum was awarded the Jean Mitry prize for its contributions to the preservation of silent films, during the film festival Le Giornate del Cinema Muto. This recognition cannot but be shared with Haghefilm, as most color restorations by Eye Filmmuseum were carried out at the Dutch laboratory. (See figs. 9, 10 and 11 in the color insert).

The mutual influence between Haghefilm and Eye Filmmuseum originates from the regular, weekly, and often daily meetings between the Filmmuseum's curators and restorers and Haghefilm's technicians.[193] In the last few years restorations by Eye Filmmuseum carried out at Haghefilm have also led to joint presentations at International Conferences and Festivals. The regular meetings between the two managements have also had quite an obvious influence on shaping people's choices and mindsets. It is interesting to mention in this respect that Eye Filmmuseum, in its application for the funding period 2004-2008 to the Ministry of Culture, pleaded for a structural solution to the problem of safeguarding Haghefilm's technical know-how with regard to photochemical restoration, in danger because of the developments towards the digital in the market.[194] With the project *Images for the Future*, a temporary solution has been provided: thanks to the funding, and thanks to the fact that Haghefilm has been one of the laboratories winning the tender for part of the preservation work to be carried out within the project, a new chance has been given to train young technicians and pass on crucial know-how with regard to photochemical restoration. On the other hand, this new situation, enabled by the seven-year *Images for the Future* project, can also be seen as a chance for both Eye Filmmuseum and Haghefilm to find their ways into the transition to digital by making the best use of the obdurate photochemical medium while refining the stabilizing digital one. As Vrijs points out, the new generation of technicians is acquiring a combination of photochemical and digital knowledge, an extremely useful asset in this time of technological transition. With regard to the earlier discussed issue of actors moving between relevant social groups, it is worth mentioning that, among the people employed by Haghefilm in the framework of *Images for the Future*, there are two former

employees of Eye Filmmuseum and two graduates from the L. Jeffrey Selznick School of Film Preservation at the George Eastman Museum. The collaboration with Eye Filmmuseum has not been the only factor that has influenced Haghefilm's approach to the technological transition. Other archives are also playing an important role. In particular the George Eastman Museum, already mentioned in relation with the "film as original" framework, has a longtime connection with the Dutch laboratory. In the unique restoration of a number of Charles Urban's Spirograph discs, commissioned by the George Eastman Museum and realized in 2003, Haghefilm succeeded in bending both analog and digital techniques to the purpose of restoration:

> Setting the Spirograph on the animation table, De Haan [R&D technician at Haghefilm] had the rostrum combine horizontal and vertical movements (on the *x* and *y* axis) to move from frame to frame. Above the rostrum, a digital camera with a macro lens rotated 3.6 degrees with every pair of movements to photograph each frame in turn. This system integrated an apparently obsolete tool from animation to recover the Spirograph onto film. (Paletz, 2006: 7 – see figs. on page 190)

Haghefilm's restoration of the Spirograph discs is an example of convergence/divergence in practice, as a mix of old (the rostrum camera) and new (the digital camera applied to the rostrum) technologies were used for the restoration of an obsolete film format.[195]

Also, the personal connection of former George Eastman Museum Curator, Cherchi Usai, with Haghefilm and its Director, Peter Limburg, could be seen as influential. As an actor moving between social groups, Cherchi Usai has involved Haghefilm in many relevant initiatives in the last two decades. Haghefilm technicians, for instance, teach a workshop at the L. Jeffrey Selznick School of Film Preservation (the archival training organized by the George Eastman Museum and discussed earlier) on a regular basis. In addition, every year one of the Selznick students is awarded a one-month internship at the Dutch laboratory. Also, on a different level, Haghefilm has sponsored Cherchi Usai's film, *Passio*. The longtime connection between Haghefilm, the George Eastman Museum and Cherchi Usai is an example of how the convergence/divergence concepts, expressed by the Dutch laboratory, can fit within the "film as original" framework, privileged, as earlier argued, by both the George Eastman House and by Cherchi Usai.

One example of the relation between Haghefilm's convergence/divergence and the "film as original" framework is given by the restoration of a stencil-colored nitrate print of the film *Les Pyrénées Pittoresques* (FR, 1910), carried out under my supervision for Eye Filmmuseum. In this case, after

Image of the rostrum camera used by Haghefilm to digitize Spirograph discs (courtesy of Haghefilm).

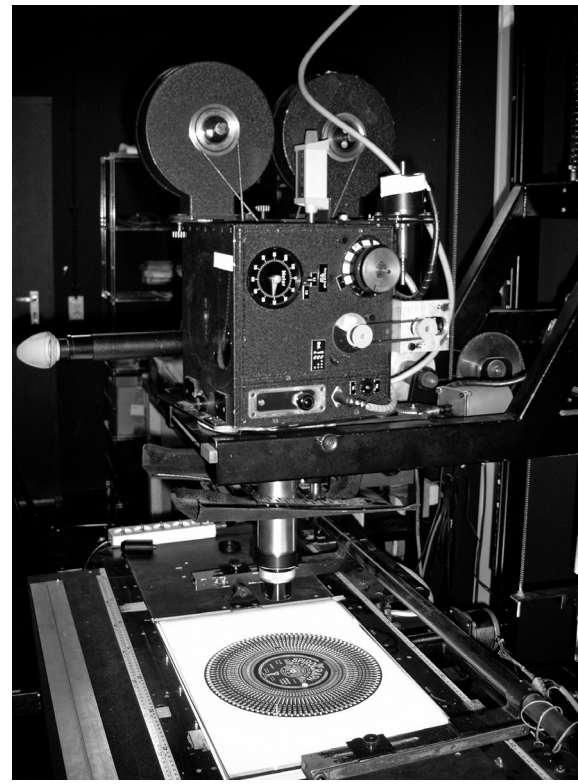


Image of a Spirograph disc (courtesy of Haghefilm).

digitization the data were restored with the Diamant software, by applying stabilization, de-flickering and dust removal. Upon color GRADING and proper calibration, three BLACK-AND-WHITE SEPARATION MASTERS were produced by printing the data on three separate black-and-white positive films (one for the red, one for the green and one for the blue information). The separation masters were then printed in registration (a perfect alignment of the three masters is vital for the success of this process) on intermediate film stock, and from there a color projection print was made photochemically. Note that this technique, already discussed above with regard to Sony's long-term preservation policy, offers a unique long-term preservation method for the colors as they have survived and are still present today on nitrate stencil-colored films. Indeed, preserving colors by way of BLACK-AND-WHITE SEPARATION MASTERS reduces enormously the major problem of color fading. For such reasons, this technique is in my view strongly related to the "film as original" framework. (See figure 12 in the color insert).

A different example is the restoration of *Beyond the Rocks* (USA, 1922), carried out in 2005 by Eye Filmmuseum in collaboration with Haghefilm. For this project the possibilities and limits of digital restoration tools were fully explored and exploited, in accordance with convergence/divergence, and within the "film as *dispositif*" framework. Other than the two cases described above, where the search for keeping the original film's characteristics as an artifact intact were the leading motivations, the final presentation was the guiding spirit of this project. How this was translated into practice will be further discussed in the next chapter.

Apart from the already mentioned Eye Filmmuseum, the George Eastman Museum and Lobster Films, Haghefilm also counts among its clients the National Film Center (Japan), Friedrich Wilhelm Murnau Stiftung (Germany), Cinemateca Portuguesa and the Danish Film Institute. Some of the projects in which Haghefilm is currently involved are the restoration of Dutch Experimental films, under the supervision of Eye Filmmuseum restorer Simona Monizza, and the digitization of Frank Borzage's *Lucky Star* (USA, 1929) and Abel Gance's *J'Accuse* (FR, 1919), both commissioned and supervised by Eye Filmmuseum.[196] Especially in these last two cases, Haghefilm benefits from the experience of its staff and from its dedicated equipment in tackling problems specific to silent films from a convergence/divergence perspective. Indeed, for these restorations the best solution is to combine photochemical duplication (e.g. via a DEBRIE TAI PRINTER equipped with WET GATE and suitable for heavily shrunken film) with digitization (e.g. via the shrunken film-friendly Oxberry scanner with WET GATE).

Haghefilm in its convergent/divergent character meets one of the most evident aspects of this transition, that of hybridism. The Spirograph restora-

tion, where old (the rostrum camera) and new (the digital camera applied to the rostrum) technologies have been modified and bent in order to restore an obsolete film format, is probably the clearest example of convergence/divergence in practice. It is in the idea of choosing divergent technologies for digitization and restoration that I see most clearly the concept in place. While another laboratory could have chosen a more straightforward digitization of the Spirograph frames, Haghefilm has looked to old film technology for the solution. By adopting a convergent/divergent approach to film restoration, Haghefilm offers to many archives the possibility of opting for digital means without leaving behind one century's worth of film technology. This is probably one of the main reasons for Haghefilm's success in a field that is profoundly bound to old film technology.

HAGHEFILM DIGITAAL – UPDATE

In October 2012, the Dutch film laboratory Cineco, owner of the film restoration laboratory Haghefilm, filed for bankruptcy. One of the reasons it ceased operation was the budget cut of the project *Images for the Future* (2007-2014) announced in 2011 and already discussed in relation to Eye Filmmuseum.[cxxxix]

In December 2012, a new company by the name of Haghefilm Digitaal rose from the ashes of Cineco/Haghefilm. Led by Erik Vrolijk and Wibo de Groot, who already owned other film-related businesses, Haghefilm Digitaal took over the name, location, and equipment of the bankrupt laboratory as well as a core team of seven experts on film preservation and restoration that had been working at Cineco/Haghefilm for many years.[cxl]

As pointed out by Peter Roelofs, the company's Commercial Director, in the first two years of its existence, Haghefilm Digitaal also merged with other film-related businesses owned by Vrolijk and De Groot which specialized in post-production work, in particular the making of DCPs and subtitling. Thus, with a staff of twenty-five people, post-merger Haghefilm Digitaal's main objective entailed combining film restoration work with the creation of DCPs and subtitling for contemporary feature films. Today, Haghefilm Digitaal works with numerous international archives, including Eye Filmmuseum, a partner since the establishment of the first Haghefilm preservation laboratories in the 1980s. In the spirit of their long-standing collaboration, Eye Filmmuseum and Haghefilm Digitaal have recently launched a joint Film Restoration traineeship program.[cxli] Haghefilms Digitaal's unique ability to combine old and new technologies to restore film has been recognized worldwide. Some of their clients include: George Eastman Museum, which also has a long-standing working relationship with Haghefilm that includes the exchange of knowl-

edge between laboratory technicians and students at the museum's L. Jeffrey Selznick School of Film Preservation;[cxlii] Éclair laboratory, for photochemical work; the Danish Film Institute; the National Film and Sound Archive of Australia; Lichtspiel in Switzerland; the San Francisco Silent Film Festival; the Museum of Modern Art in New York; the British Film Institute; and Dutch museums such as Boijmans Van Beuningen, Kröller-Müller, and Stedelijk. Furthermore, the Dutch Film Academy relies on Haghefilm for the post-production of its students films.[cxliii] The exchange of knowledge that results from collaborations between Haghefilm and the George Eastman Museum and Eye Filmmuseum is crucial at this point in time, when many photochemical laboratories have closed their doors and many film laboratory technicians are approaching retirement. With the widespread closure of film labs and processing plants, the risk for analog film expertise to disappear altogether is very real indeed.

Following in its predecessor's footsteps, Haghefilm Digitaal continues to offer all the (digital and analog) services that it used to offer its archival clients. Juan Vrijs, one of the founders of the previous Haghefilm, who is still active at Haghefilm Digitaal, works on and regularly performs photochemical duplications of fragile nitrate films. While there are still archives that prefer a fully analog workflow, he notices that archives today more often than not opt for a hybrid workflow (e.g. a photochemical duplication from the nitrate original followed by the digitization of the new preservation element). As specific types of restoration issues require different machinery, Haghefilm often combines traditional and new technologies to obtain the desired result. Luckily, the equipment that was in use a decade ago at Haghefilm is still operational today. Well-equipped for archival restoration, Haghefilm uses the Debrie Matipo 16 and 35mm contact printer for the duplication of experimental films, especially the most fragile ones; while the optical DEBRIE TAI PRINTER equipped with WET GATE is typically used for nitrate films. For obsolete film formats that do not fit in a standard printer, Haghefilm uses the rostrum camera, discussed earlier with regard to the restoration of the Spirograph discs in 2003, which, just recently, was used for a project commissioned by the George Eastman Museum. The project in question concerned the newly acquired collection of twenty 35mm films shot by the Lumière brothers around 1896-1903. Because of the peculiar Lumière perforation, the films could not be threaded in a printer's tracking system and had to be photographed, frame by frame, with the rostrum camera.[cxliv] Also, a selection of films from the Mutoscope and Biograph 68mm collections, held by the British Film Institute and Eye Filmmuseum, has been digitized at 8K RESOLUTION with the rostrum camera. To make sure that these special devices – necessary for the duplication of analog film – continue to function, an internal technical department has been set up to carry out maintenance and repair. Indeed, most of today's equipment for photochemical duplication has become obsolete and thus laboratories such as Haghefilm can no longer rely on the maintenance

service offered by the manufacturer. Vrijs points out that because of its long-standing experience with very fragile obsolete film material, Haghefilm is known in the field as the lab that provides the best results when it comes to rescuing heavily damaged films.[cxlv]

In terms of digital restoration, Haghefilm still uses its Oxberry scanner equipped with WET GATE, but has also acquired alternative scanners (an Arriscan and a Scanity with WET GATE) for more recent film material. Recently, Gerard de Haan, Haghefilm Digitaal's Research & Development Manager, has worked on innovative techniques for the digital restoration of stencil-colored films in which a customized LOOK UP TABLE (LUT) allows the restorer to reproduce the colors' original characteristics. De Haan also worked on a unique digital process for the color GRADING of digitized original camera negatives, using the analog grading information (when available) that was used at the time of production.[cxlvi]

In conclusion, in its new configuration Haghefilm Digitaal still offers the possibility of combining traditional (and often obsolete) analog means with new digital techniques in film restoration. In view of its consistent approach to film restoration in the past twenty years, as illustrated above, I think that Haghefilm still fulfills the necessary conditions to be associated with the convergence/divergence concept as suggested a decade ago.

Remediation

The concept of remediation associated with film laboratories results in a practice that remediates old restoration technologies by means of new ones. As discussed in Chapter Two, such remediation is done in the name of the "real," which in this case is the film to be restored. I think that the remediation concept with regard to film restoration suits in the first place those laboratories that look at new digital media as the most suitable means for restoration. Hence, I believe that the most appropriate example can be found within those laboratories that have started out as post-production houses rather than photochemical printing and processing facilities. Post-production houses are specialized in all those stages that film and video undergo after shooting, from editing of image and sound to color GRADING and special effects, and were, in the 1980s, the first ones to start moving into digital.

Based on the above, I have chosen the Danish laboratory Digital Film Lab as the case to be discussed within the concept remediation.

DIGITAL FILM LAB (COPENHAGEN)

Digital Film Lab (formerly known as Copenhagen Post House) was founded in 1993 and is among the first post-production laboratories to have developed in 1998 the DIGITAL INTERMEDIATE process, which has become the standard workflow today for new film production.[197] Among their DIGITAL INTERMEDIATE and digital post-production work there are films like *Wisconsin Death Trip* (UK/USA, 1999 – Digital Film Lab's first full DIGITAL INTERMEDIATE film), *Bloody Sunday* (UK/IE, 2002), parts of *Lagaan* (IN, 2001) and of *Lara Croft: Tomb Raider* (USA, 2001), and many Scandinavian feature length and short productions.

From 1998, Digital Film Lab also started experimenting with a digital workflow suitable for the restoration of archival films. Ten years later some thirty restorations via DIGITAL INTERMEDIATE have been completed for clients including the Danish Film Institute, Eye Filmmuseum, the Cineteca Nazionale (Italy), the Imperial War Museum (United Kingdom) and the Academy of Motion Picture Arts and Sciences (USA).

Thanks to its state of the art digital equipment, e.g. a Spirit datacine able to scan up to 4K and a digital projector at 2K used for GRADING and previewing, Digital Film Lab carries out a great scope of digital interventions for restoration at a very high quality. Some of the restoration specialties offered by this laboratory include color restoration of faded films, recombination and realignment of BLACK-AND-WHITE SEPARATION MASTERS, such as those used for three strips Technicolor films, and all kinds of digital restoration, including complex manual image reconstruction.

Different from the other two laboratories discussed here, where digital technology has found its place in a pre-existing photochemical environment, at Digital Film Lab digital technology has always been the core competence. The necessary knowledge on film has been brought to the laboratory at an early stage by the professional advice of Paul Read, who has worked with Digital Film Lab as a consultant from the early days of their DIGITAL INTERMEDIATE process, and has also served as a valuable contact for the laboratory with the archival community. Note that Read is another good example of those actors moving between relevant social groups. After a long career as a film engineer, first at Kodak, later as Technical Director of Soho Images, a renowned film laboratory in London, Read has worked since the 1990s as a consultant for several film and digital laboratories. He has also been an expert on film restoration issues since the 1980s and has published several articles and one seminal book on the subject.[198]

In 1998, when Read came into the picture, Digital Film Lab:

> had just installed a Spirit Datacine with a Pogle controller and could scan and save at 2k, scanning at 14bit, grading and saving at 8 or 10bit. And

they were using an early Celco recorder for making small special effects, and, they hoped, for trailers. They had already calibrated the scanner with the monitor and understood what they needed to do to calibrate the film out to the monitor. The quality was better than anything I had seen before anywhere. They were posting one feature film, a typical Scandinavian children's film and the director wanted a few little effects in the last reel. Instead of making these as short film negative clips to insert into a cut negative, they asked the director if they could make an entire 16min double reel as a "digital film", what today we call a digital intermediate, and record the entire reel back to a single roll of film on their Celco. This was revolutionary, and no one (except those that knew!) could see that the last reel was different from the rest of the film. So they had conquered the digital calibration [...] The driving force behind this whole process was Kris [Krzysztof Morten Kolodziejski, one of the founders and currently CEO of Digital Film Lab].

[...] I was just as interested in the possibility of using the technology for restorations, for two reasons – one was the 14bit scan and the very great range of grading control the Spirit / Pogle combination had. The other was the fact that they were using an Inferno for editing, conforming and carrying out the clever manipulations needed for effects.[199]

The current practices of Digital Film Lab reflect by necessity the hybridism and the transitional nature of film, as even a laboratory whose technical means are mainly directed to digital film must deal with film-born film and historical film formats. As Read points out, Digital Film Lab reacts to satisfy the demands of its clients. For instance,

> Kris [Krzysztof Morten Kolodziejski] and his staff very quickly became experts on Techniscope so that they could do *Akenfield* [UK, 1974] and then were able to do others e.g. *Fistful of Dollars* [IT/ES/DE, 1964]. Similarly he [Krzysztof Morten Kolodziejski] commissioned a software for registering separations – and it is very good! – only because he realized he could even compete with Soho Image analogue prices to reconstruct Technicolor.[200]

The approach of Digital Film Lab is that of remediating obsolete formats by means of digital technology, in the above-mentioned case by writing software capable of handling Techniscope negatives or registration problems typical of three-strips Technicolor.

It is in this context that Eye Filmmuseum commissioned its first digital restoration to Digital Film Lab, *Musica eterna 1452-1952* (NL, 1951), a Philips

commercial, of which only two color-faded prints had survived. The digital color correction was carried out in 2002 after the film was scanned at a RESOLUTION of 1,920 x 1,440 pixels.[201] (See figs. 13 and 14 in the color insert).

The main problem with *Musica eterna 1452-1952,* as is often the case with faded films, was that no reference material was available where colors were not faded. In such cases the only option for a restorer is to interpret what the original colors might have been. In this case it is not a matter of remediating an obsolete frame format, as in the case of Techniscope, but of remediating the colors produced via an obsolete color system.

A few years later, in 2003, Eye Filmmuseum worked together again with the London office of Digital Film Lab for the digital restoration of *Zeemansvrouwen*, to be discussed in the next chapter as an example of how the remediation concept works within the "film as *dispositif*" framework.

Another very important collaboration between Digital Film Lab and a film archive is the one mentioned earlier for the Danish Film Institute. This collaboration has led to many important restorations where digital technologies have been applied. The success of this collaboration has had a role in the new preservation strategy adopted by the Danish archive since 2002.

One of the first of the many titles restored digitally by the Danish Film Institute at Digital Film Lab was *Nedbrudte Nerver* (DK, 1923), restored in 2001 under the supervision of Thomas Christensen, Curator at the Danish Film Institute. The aim of the restoration was to create a print as close as possible to the one that was shown at the film's premiere in 1923. In my view, this project can be associated with the "film as original" framework, as I have already argued while discussing the case of the Danish Film Institute. The source material was the original camera negative, which was still in a surprisingly good shape (Christensen, 2002: 138). Since a photochemical restoration of this title already existed, it was decided to experiment with a fully digital workflow (i.e. the DIGITAL INTERMEDIATE process that Digital Film Lab had been using for several years for new film production). At the time, a fully digital restoration was definitely more expensive than a photochemical one. Still, as Christensen points out:

> [...] it is nevertheless very possible that the ease and preview possibilities in the digital intermediate process save the archivist so much time that it is highly competitive with a conventional photochemical restoration process. (2002: 141)

Indeed, this and other considerations, discussed in detail in Chapter One, make the DIGITAL INTERMEDIATE process a very appealing alternative to a fully photochemical workflow. This is true even in a case like that of *Nedbrudte*

Nerver, where no image damage needed to be addressed digitally and only the editing and the addition of new title cards had to be done in the digital domain. In such a case the main advantage is that via a DIGITAL INTERMEDIATE process, a generation can be skipped between the original negative and the new preservation duplicate negative, namely that of a FINE GRAIN positive. This extra generational step is not only necessary in a photochemical route because of the negative-positive-negative sequence, unavoidable in photochemical duplications, but also because carrying out the editing and the addition of the title cards in the FINE GRAIN positive is preferable to ending up with a preservation duplicate negative full of splices and, therefore, more fragile.

The DIGITAL INTERMEDIATE process can be seen as one of the most eloquent examples of the concept of remediation in film restoration practice, as it completely remediates a photochemical process with a digital one. Although by now most laboratories involved with film restoration provide the DIGITAL INTERMEDIATE process as a restoration workflow, Digital Film Lab has chosen such a process early on as their way to restoration.

Digital Film Lab, by looking at the digital as the most suitable means for restoration, adopts remediation as its favored key to this transition. Differently than with convergence/divergence, the key to film restoration of remediation is that of the digital. This does not mean ignoring traditional film technology, but, rather, incorporating it in the new digital means. It leads to a practice, well exemplified by the DIGITAL INTERMEDIATE process, that still brings with it many questions that film archives need to address before plunging the restoration of film heritage into the digital realm. Nonetheless, a number of archives are already looking at remediation for the restoration of their films. If the case of *Nedbrudte Nerver* is an example of remediation within the "film as original" framework, *Zeemansvrouwen*, discussed in Chapter Four, illustrates how remediation works within the "film as *dispositif*" framework.

DIGITAL FILM LAB – UPDATE

The Danish laboratory Digital Film Lab filed for bankruptcy in 2009. As explained by its founder and owner Krzysztof Morten Kolodziejski, the main reason why the company could not survive the effects of the 2008 economic crisis was the major loss in revenue as a result of the decrease in commissions for advertisement films.[cxlvii]

After an effort to restart the company under a new name, New Digital Film Lab, the company collapsed again in 2013, shortly after Kolodziejski's premature death in 2012.[cxlviii]

Some of the laboratory's staff members were absorbed by the Danish Film Institute, as in the case of former Digital Film Lab's employee Claus Greffel, who was rehired by the DFI to be its Digital Restoration and Mastering Engineer. As touched upon earlier, the closing of the Danish Film Lab had a very severe impact on the digital restoration activities of the Digital Film Institute. Indeed, DFI had no choice but to suspend its digital restoration work only to resume it years later when it finally secured the required funding to set up an in-house workflow for digitization and restoration.

Outsourcing the type of work a fully digital laboratory such as Digital Film Lab, associated here with the remediation concept, offers, comes with many advantages as these kinds of laboratories provide highly specialized services; however, as the disbandment of Digital Film Lab has shown, it does come with a certain degree of dependency some archives would rather do without. That is why a number of archives have set up in-house digital workflows in the last decade. A case in point is of course the Danish Film Institute, which resumed the kind of work it used to commission to the Digital Film Lab internally; but also Eye Filmmuseum, as seen earlier, as well as many other Western archives, as discussed in Chapter One. We could therefore speculate that remediation may be the most likely concept to be embraced by film archives when specialized film restoration laboratories are no longer able to offer alternatives to exclusively digital workflows.

Simulation

In Chapter Two I defined the capacity for simulation as a general characteristic of media, and the ability to simulate photographic images as one of digital media's strongest potentials (in accordance with Manovich, 2001 and Rodowick, 2007). From this perspective, if one accepts that restoration is simulation, whether through analog or digital tools, as I have argued earlier, digital offers better tools for restoration than analog technology. The combination of the two technologies, in this transitional phase, though, can still provide the best results.

I have selected the case of Cineric to illustrate the concept of simulation especially because of its background in special effects. As argued in Chapter Two, special effects are a good example of media's capacity to create realistic images of something that was never there by simulation; the same ability enables film restorers to recreate images that used to be there and now are gone.

CINERIC INC.[202]

Cineric Inc. is based in New York, where it was founded in 1982 by Balázs Nyari as an optical effects post-production house (when COMPOSITING was purely an analog printing matter).[203] Since the 1990s Cineric has offered film restoration work using both digital and photochemical tools. Cineric's specialty grew directly out of the visual-effects expertise:

> Most restoration and preservation companies come from a lab background. [...] Our approach to restoration is a direct outgrowth of our experience in the Star Wars-era of visual effects [during the late 1970s and early 1980s]. As an optical cameraman, you had to know how to perfectly line up a matte and precisely register [multiple film elements].[204]

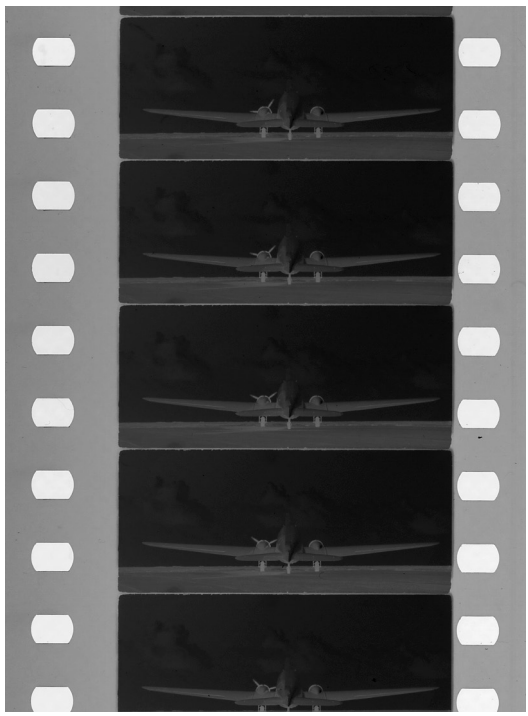
Being involved in creating the special-effects for *Tron* (USA, 1982), Nyari and colleagues realized that the same techniques could be applied for film restoration purposes. It is this association between special effects and restoration of films that makes Cineric in my view a particularly well-suited example for the simulation concept. In other words, Cineric seems to place the simulation potential of technology as the main perspective in its practice.

This approach led, for instance, to the development of a proprietary analog color-fading restoration technique that has been mentioned here already when discussing Sony Pictures Entertainment's projects carried out at Cineric:

> To correct serious color fading, Cineric focuses on the yellow emulsion layer. "The yellow layer is the first to fade," Nyari explains, adding that such fading gives deep shadows a blue cast and turns the whites and highlights yellowish. "If it is faded 50 percent or less, we can make a color mask that recreates that missing information."[205]

The colors of *The Man from Laramie* (USA, 1955), *My Sister Eileen* (USA, 1955), *Bell, Book and Candle* (USA, 1958) and *The 7th Voyage of Sinbad* (USA, 1958) were restored with this technique for Sony a few years ago.[206]

Cineric is also one of the few laboratories in the world specializing in the restoration of the widescreen format Techniscope, which was widely used in the 1960s and 1970s, for example, by Sergio Leone for some of his westerns and by George Lucas for his early films. The format was discontinued in the 1980s. It is for Lucas' *American Graffiti* (USA, 1973) that Cineric created new prints in the 1980s from the original Techniscope film elements by adding a WET GATE and writing software for running the now obsolete Techniscope printer.[207] More recently, Cineric restored more Techniscope titles, including *Alfie* (UK, 1966), *The Curse of the Mummy's Tomb* (UK, 1964) and *Gambit* (USA, 1966).



Example of a Techniscope negative (*Dakota*, Wim Verstappen, NL, 1974 – courtesy of Eye Filmmuseum).

Optical work for special effects can be partly automatized and Tom Heitman, Director of Preservation and Restoration and with Cineric from the early days, developed software for this task. From this perspective, Cineric has accepted the hybridism of film technology early on using analog and digital tools in a complementary way for obtaining the desired results.
It should be noted that Cineric has its own in-house workshop where Bernard Klevickas, a metal sculptor when he is not working at the laboratory, practices some brilliant retro-engineering to recreate gates for the optical printers or the scanner. Such customized gates are necessary to accommodate obsolete formats, as has been the case with the restoration of *The King and I* (USA, 1956), carried out mainly photochemically for Twentieth Century Fox from the original 55mm negative.[208]

Although the examples given above also fall within convergence/divergence, as they are cases where old media are adapted in order to restore faded films or obsolete formats, I think that they should be primarily associated with the simulation concept as the main drive here is that of recreating by simulation what it is gone: the faded colors or the obsolete widescreen formats Techniscope and Twentieth Century Fox's CinemaScope 55.

Cineric's affinity with the simulation concept in my view has become stronger as the laboratory has further developed its digital facilities. Cineric's first digital restoration was carried out in 1997 for Sony on the film *Lost Horizon* (USA, 1937). A decade later, Cineric set up a large digital department equipped with state-of-the-art hardware and software, including a scanner (an Oxberry scanner equipped with WET GATE that can scan at up to 4K RESOLUTION), a complete digital imaging workflow with a color correction suite (Lustre), digital restoration software (DaVinci Revival and Pixel Farm), a data center holding up to 380 terabytes of files, and machines for re-recording data back onto film.

Daniel DeVincent, Director of Digital Restoration, oversees the digital color imaging and has been Cineric's digital timer (a.k.a. grader) since 2002. Although DeVincent works with digital on a daily basis and seems to enjoy it, his background is in film and he will not hesitate admitting that:

> Film is still a marvelous medium and we should not get too anxious to get rid of it. Compared to digital film, [analog film] is so much more elegant. Frames do not disappear and each frame holds an enormous amount of data. The digital ability to handle that is improving everyday.[209]

Among many projects, Cineric has carried out a number of important digital restorations for Sony and Twentieth Century Fox. Before restoring *Dr. Strangelove* for Sony, a project discussed in detail in the next chapter, which, according to DeVincent "all the technology available was thrown at," Cineric had already applied a full 4K workflow for the restorations of *Carousel* (USA, 1956 – commissioned by Twentieth Century Fox in 2004) and *The Gang's All Here* (USA, 1943 – also for Twentieth Century Fox). More recent 4K restorations are *Olympia* (DE, 1938) for the International Olympic Committee and *From Here to Eternity* (USA, 1953) for Sony.

In 2002, Cineric restored Harry Smith's *Mahagonny* for Anthology and Harry Smith Archives, whose complex optical work was overseen by Simon Lund. While this project, discussed in the next chapter, was entirely carried out by photochemical means, the main conceptual reference for its realization is in my view that of simulation, as I will discuss further on. Since simulation is a characteristic of media in general, an analog restoration can also rightly be placed within this concept. For a similar project, a new film by Bill Morrison *Outerborough* (UK, 2005), also supervised by Lund, although analog could have been used, digital was preferred by the filmmaker. In this case, the same archival footage was superimposed onto itself, once from the beginning to the end and once backwards, and the same superimposed image was doubled in a split screen (see figure below). The source material was a travelogue shot with an obsolete 68mm format without perforations, a single tracking

Image of the film *Outerborough* (Bill Morrison, UK, 2005 – courtesy of Hypnotic Pictures).

shot taken from the front of a train crossing the Brooklyn Bridge. For Morrison's new film a 4K scan of the duplicate negative was chosen, made from the original 68mm footage, *Across the Brooklyn Bridge* (American Mutoscope and Biograph, 1899), held at the British Film Institute.

The examples above have been carried out partly within the "film as state of the art" framework, as in the case of *Dr. Strangelove*, which will be discussed in the next chapter, and within a combination of "film as art" and "film as *dispositif*," as in the case of *Mahagonny*, also discussed in Chapter Four.

But Cineric counts many restorations also within the "film as original" framework as for those obtained via BLACK-AND-WHITE SEPARATION MASTERS, the already discussed analog practice for creating long-term preservation elements. A number of Hollywood studios commission the making of separation masters to Cineric on a regular basis, both for archival and new films. Recently, Eye Filmmuseum has also selected Cineric, at the end of a tendering procedure in the framework of the project *Images for the Future*, for producing separation masters for several important color Dutch feature films.

Because of its background in special effects and its specialization in optical COMPOSITING techniques, I consider Cineric one of the most suitable examples of a laboratory adopting simulation as its main strength in the transition from analog to digital. Through projects as diverse as *Dr. Strangelove*, *Mahagonny* and *The King and I*, one common interpretation of the technology available for restoration surfaces, which takes advantage of the simulation potential of both analog and digital technologies for (recreating what was there but is now gone, namely, colors, image details, obsolete formats or even projection *dispositifs*, as in the case of *Mahagonny*.

CINERIC INC. – UPDATE

The New York-based laboratory Cineric has successfully survived the digital rollout and the economic crisis that has impacted so many (film) businesses since 2008. According to Balázs Nyari, Cineric's founder and President, the most notable change in the field in the last decade has been the gradual disappearance of

analog film and its related (post-production) services. As a consequence, Cineric has radically downsized its analog department. Today, their work is almost exclusively digital. Only a few experimental films commissioned by the Anthology Film Archives and the Museum of Modern Art have been restored film to film in 2017. In terms of digital workflow, on the other hand, few things have changed since 2008. A pioneer of the 4K restoration workflow, Cineric has maintained its status as a cutting-edge laboratory that continues to provide high-end 4K restoration to its international clients, including Hollywood studios such as Sony and Twentieth Century Fox. At the same time, the in-house digital storage capacity has increased considerably in order to store temporarily the high volume of data that is handled on a daily basis. To cope with the rapid disappearance of analog services, Cineric's Director of Technical Operations Simon Lund develops custom-made analog and digital equipment to improve workflows and accommodate obsolete film formats. Another important change for Cineric has been the establishment of a European branch in Lisbon, Portugal. In collaboration with the photochemical laboratory Arquivo Nacional das Imagens em Movimento (ANIM), part of the Cinemateca Portuguesa – Museu do Cinema in Lisbon, Cineric has set up a fully digital laboratory for film restoration that serves European, Latin American, and Asian clients. The collaboration with ANIM is mutually beneficial and complementary as Cineric provides digital restoration services to the Portuguese archive while ANIM provides photochemical work to the laboratory. The new branch in Lisbon has also created new opportunities for the training of a new generation of young professionals in analog and digital restoration.[cxlix]

In recent years, Lund has adapted a number of scanners at both the New York and Lisbon location. This modified equipment allows for a better digitization of the high-density ranges that characterize historical film stock such as Kodachrome. Also, customized gates are required to digitize obsolete film formats and extremely fragile material; this has been the case with a number of tools recently developed by Lund such as a 9.5mm gate (made with 3D modelling tools), a 68mm WET GATE, and a sprocket-less scanner suitable for heavily shrunken material. According to Lund, adapting analog equipment to be used for digital work serves two goals; it recovers the analog look in a digital restoration workflow while ensuring that the best of both technologies are employed, which is not only very beneficial in this time of transition but also keeps analog film expertise from becoming obsolete.[cl]

In view of the consistency of work carried out by Cineric in the last two decades and the continuity of approach (e.g. repurposing and improving equipment to achieve original analog looks with digital means), even when significantly more work results in digital deliverables, I think that associating it with the simulation concept is still pertinent today.

In conclusion, new practices for film restoration are shaped by the synergy between archives and laboratories. These new practices derive from and, in turn, contribute to reassessing the theoretical frameworks and concepts I propose as productive analytical tools for revealing deeper forces at play in the film archival field. This underlying dynamic between theory and practice is at the basis of my theorization of archival practice, which also intends to be a new platform for further reflection.

Although film restoration laboratories have a high degree of inclusion in the current archival film technological frame and exercise a strong influence in shaping the emerging technological frame around digital film, from a SCOT perspective, they are in the first place service providers, and, therefore, they have to work within the frameworks of reference of film archives. In my opinion their agency with regard to the transition from analog to digital can therefore be better described in terms of theoretical concepts rather than specific frameworks. Indeed, concepts are part of the larger constellation that is a framework and they can function within more frameworks. It should be noted, however, that like in the case of archives, the agency of laboratories is also many-sided and they often do embrace different concepts at the same time.

In addition, concepts typically move from one relevant social group to the other. This exchange contributes to their acceptance throughout the field and leads to the emergence of a new technological frame around digital film. For a better understanding of how concepts move within the field, one should consider also the role of individual actors who literally move from one social group to the other. But single actors moving around are, again, not all there is to the refinement and strengthening of new ideas, and, more specifically, frameworks and concepts, across the field. Also entities such as professional organizations and international projects facilitate this process by promoting communication and exchange among actors and, ultimately, relevant social groups. European-funded projects are discussed next as such an example of platform for the exchange of ideas and (re)definition of frameworks and concepts.

3.3 EUROPEAN UNION FUNDED PROJECTS: POLITICS IN PRACTICE

Here I will focus on a number of European-funded projects in the field of archival film and digitization, with the aim of complicating the snapshot I have revealed thus far. I will show other important lines of connection that, other than the institutional ones, exist only for a short time frame (typically two to four years) and put together actors from different backgrounds, countries and affiliations.

In the last fifteen years, the European Union (EU), which can itself rightly

be considered one of the most relevant members of the social group of policy makers in the field of audiovisual media, has funded a large number of projects aimed at promoting technological development for a sustainable use of digital media. This is part of an explicit political strategy to support the growth of a European digital infrastructure and its related economic sector. With regard to film and media, in particular, the EU aims at creating a production-distribution-exhibition chain as much as possible independent from other markets, Hollywood studios and North American film companies in particular.

Recently, European Commissioners Neelie Kroes and Viviane Reding, responsible respectively for Competition and Information Society and Media, have stated the following in a memorandum:

> We firmly believe that whatever State aid there is for film should have the cultural aim of ensuring that Europe's national and regional cultures and creative potential are expressed in the audiovisual media of film and television. At the same time, though, it should also aim to lead to a sustainable European film sector. ("State aid: future regime for cinema support" – 22 May 2008) [210]

Among the many EU projects funded in line with this strategy, I have selected four that are exemplary of the link between political agendas and technological development in the field of film archiving. This political dimension works on at least two levels: the implicit politics of any negotiation among social groups and the explicit politics, national, European and global, expressed by governments and policy makers. Examples from both levels have already been encountered in this chapter. In particular, with the example of the Dutch project *Images for the Future*, the agendas of a number of relevant social groups and that of official politics have been sketched to illustrate how such a project could come to life. Here, I will look at projects at a European level that have had a significant role in influencing relevant social groups within the archival field, in particular in reassessing their views on digital technology. From this perspective they have fulfilled the EU goal of facilitating a sustainable European (digital) film sector.

These four projects have already been mentioned in the previous chapters: Diamant, FIRST, PrestoSpace and Edcine. They have all been funded in the framework of the Information Society Technologies (IST) program of the EU. Edcine is the only one still running at the time of writing, while the rest have already been completed. IST projects fall within the responsibility of the Commissioner for Information Society and Media, currently the British Viviane Reding. According to her personal website:

> The Information Society and Media portfolio represents an economic sector which is crucial for prosperity and quality of life in the European Union. This portfolio stretches from the underlying communications infrastructures to the content and services they deliver. It encompasses telecommunication networks, broadband internet access and satellite communications, new communications technologies such as "3G" mobile communications and Internet telephony, and digital material as diverse as cinema releases and advanced eHealth services.[211]

All four projects operate within this wide context, with partners stretching from broadcast to film archives, from academic research groups to industrial partners.

Diamant, acronym for Digital Film Manipulation System, was a project with a budget of 2.29 million euros (of which 1.34 million was EU funded), which ran from 2000 to 2002, and counted among various partners three IT research centers, two commercial companies, one producing hardware and one producing software, one film laboratory and one film archive.[212] The main objective of the project was to develop digital film manipulation software for high-speed manipulation of uncompressed digitized film, to be operated by means of commercial off-the-shelf computation hardware (i.e. Personal Computers). Thanks to the participation in the project of a film archive (Eye Filmmuseum) and a film laboratory specializing in film restoration (Laboratoires Neyrac Paris, since recently part of the Éclair group), it was possible to carry out usability tests that helped to improve the system to fit the requirements of the end users, namely laboratories and archives. The role of Eye Filmmuseum was also that of vouching for the integrity of the data throughout the whole digital manipulation process and of improving the usability for film archivists. The success of Diamant can be measured, also commercially, by the number of archives and laboratories that adopted the new software; together with Eye Filmmuseum, there were also six more archives and nineteen laboratories.[213] In addition, Diamant's archivist-friendly approach influenced the development of other similar software such as MTI and DaVinci Revival, already mentioned in Chapter One. Note that many laboratories, including Haghefilm, Cineric and Digital Film Lab, usually have more than one software package for digital restoration as each of them excels in specific applications.

According to SCOT theory, actors with a low degree of inclusion in a technological frame "identify other problems than would actors with a high inclusion" (Bijker, 1995: 278). This was also the case for Diamant with respect to both the archival film technological frame (where software developers had a low inclusion) and the image manipulation software frame (where archivists had a low inclusion). One remarkable achievement of the Diamant project has

indeed been that of bringing together IT professionals and film archivists in finding a common language and influencing one another.

FIRST (2002-2004), acronym for Film Restoration and Conservation Strategies, with a budget of more than 700,000 euros, was an exploratory project focused on researching various matters related to digitization and digital restoration of film collections (Mazzanti, 2004). Led by the Association of European Film Archives and Cinémathèques (ACE), the other partners included the Belgian French television (RTBF), and the French National Audiovisual Institute (INA). FIRST has produced a report on state-of-the-art (year 2003) digital tools for film digitization and restoration, and a first systematic set of guidelines and recommended practices for film archives regarding digitization, digital restoration, data storage and asset management. FIRST's recommendations were aimed at laying the basis for further research in the field and to promote standardization. As discussed in Chapter One, FIRST showed very clearly that traditional film, notwithstanding some disadvantages, still offers the best long-term preservation medium for film-born material. FIRST's final report, though, also indicates very useful best practices with regard to digitization of film collections, which have guided further research since the end of the project in 2004. Thanks to FIRST and the seminars held throughout the project, a larger segment of the film archival community has been drawn into the discussion on film transition to digital, and exchange of know-how and experience with the digital has taken place. Probably the project's most important result has been to put on the agenda some of those issues that many film archives were still avoiding acknowledging on the transition to digital. In SCOT's terms, FIRST's final report is the product of actors with high inclusion in the archival film technological frame who become sensitive to "*functional failure* as an incentive to generate variants" (Bijker, 1995: 278 – emphasis in the original). According to Bijker: "A functional failure may occur when an artifact is used under new, more stringent conditions" (1995: 278). The functional failure in our case is that of photochemical celluloid film when confronted with the new conditions created by the transition to digital within a film technological frame that is becoming more and more digital (with the implication of an easier and more open distribution), leading to a growing demand for accessible archival content.

The project PrestoSpace (Preservation towards storage and access. Standardised Practices for Audiovisual Contents Archiving in Europe), with a budget of 15.75 million euros, of which nine million was funded by the EU, ran from 2004 to 2008 and aimed to develop technical solutions for digitization, preservation and management of audiovisual collections.[214] PrestoSpace counted, among its thirty-four partners, a number of large national broadcast archives (e.g. BBC, RAI, INA, the Netherlands Institute for Sound and Vision), many

academic research departments, and several commercial partners (e.g. HsArt Digital Service, the developers of the Diamant software, and Media Matters, a company based in the US specializing in transferring magnetic tapes to digital on a large scale). Also, Eye Filmmuseum participated in the project as the only representative from the film archival community. The participation of a film archive to a project directed to broadcast archives was at first perceived with suspicion by the film archival community. However, it became clear from the beginning that a constructive dialogue between broadcast archives and film institutes is absolutely necessary in this transitional time when digital technology is bringing actors from the technological frame of (archival) television and from (archival) film increasingly closer to each other.

PrestoSpace's ambition was that of developing technical solutions for digitization, preservation and management of all types of audiovisual collections within an integrated factory-like system. The project addressed all steps in the chain: from digitization to rights clearance and rights management, from digital restoration to data storage, from training to end-user delivery. The project's slogan was:

> an accessible item is more valuable than an item stuck on a shelf. Integrated process provides this access, releasing the value that funds the activity.[215]

It is worth mentioning that PrestoSpace came to quite different conclusions with regard to digitization as a means for audiovisual preservation than the project FIRST. PrestoSpace's conclusions represent a step further in the stabilization process of digital film (or in the de-stabilization of photochemical film) compared to FIRST's. Although acknowledging that film offers a more robust preservation medium, also compared to magnetic video, the conclusion of the partners in PrestoSpace was still that there is no viable non-digital alternative for audiovisual preservation in the long run, also considering that the commercial production of film will most probably be discontinued in the not so distant future. They warned, though, about the necessity of constant maintenance to keep a digital archive viable, i.e. readable and usable (Wright, 2007: 5-14). As discussed earlier, this is one of the main issues film archives transitioning to digital will have to deal with.

The last project mentioned here is Edcine (Enhanced Digital Cinema, 2006-2009), with a budget of 17.43 million euros, of which 9.38 million is funded by the EU.[216] Among its sixteen partners there is one film archive, the Cinémathèque Royale de Belgique, a large German research center specializing in digital audiovisual formats, Fraunhofer, and a number of commercial partners involved with the technical development of digital projectors (e.g.

Thompson) and film distribution (e.g. the French distributor XDC). Edcine's objective is that of refining the DIGITAL CINEMA specifications as they have been formulated by DCI in 2005 and partly standardized by SMPTE.[217] In particular, Edcine takes into account issues typical of the European film exhibition context and those aspects characteristic of archival films once digitized that are not yet included in the current specifications. Interestingly, this is not a purely European issue, but it concerns also American Independent films as well as archival films on a global level. For this reason also American archives will benefit from Edcine's results:

> EDCINE will demonstrate that interoperable solutions between the DCI requirements and the European digital cinema needs may be found. [...] The EDCINE project will do more than putting Europe at the forefront of the race to standardise the world's digital cinema, it will also push the whole European D-Cinema industry to the front line with solutions compliant with Europe's needs.[218]

The Edcine working group, dedicated to issues related to archival films, has suggested a number of major amendments to the existing DCI specifications, in particular with regard to historical frame ratios and projection frame rates of silent films, which are lower than the 24 frames per second typical of sound films, foreseen by DCI. Also, Edcine introduced a so-called "digital film archive system" that:

> provides a platform for long-term preservation of digital movie data in the highest possible quality and for automated access and dissemination of the stored material. (Nowak, 2007: 1)

This system would not only serve as a base for creating DIGITAL CINEMA PACKAGES and other forms of digital access to film content, but it would also provide a platform for long-term preservation of digital (or digitized) films.

However, Edcine points out, as strongly as FIRST and PrestoSpace have done before, that:

> Any digital film archive system has to provide solutions for these two crucial problems. The obsolescence of storage media and equipment can only be minimised by data migration at regular intervals; copying the old files to new media formats and systems. Degradation of storage media is usually a smaller problem compared to obsolescence and that too can be minimised by migration. Thus until the storage industry presents new solutions for long-term preservation of digital data any digital film

> archive system must provide tools to facilitate migration processes. (Nowak, 2007: 3)

Although Edcine could be seen as the following step, after FIRST and Presto-Space, in the stabilization process of digital in the (archival) film technological frame, its members still confirm the field's main concern, that of long-term preservation of digital data.

The examples addressed here exemplify the role of international projects in reshaping the field and realigning film archives' agendas with regard to the transition to digital. These projects have a high priority for the European Union, as the European film market's competitiveness is at stake, but they are no less important for the whole audiovisual archival field, for which much more is at stake, namely the survival of non-digital collections in a (future) digital environment.

International projects express the agency of their funding entities, vetting committees, and their members, all relevant social groups in the audiovisual field. But they also cross the borders of relevant social groups, interconnecting the field at large, facilitating communication between actors belonging to different relevant social groups, including also those with a low inclusion in the technological frame. Thanks to their multinational character, they cross geographical borders and, from this perspective, they serve as an alternative to the national cases, described in the previous pages. In conclusion, they embody the international political dimension in the social construction of technology.

In moments of transition in particular, these kinds of platforms have the fundamental role of promoting exchange of agendas, ideas and know-how. They facilitate the adjustment of technological frames around, for instance, the archival film in a moment when it is becoming more and more a hybridization of analog and digital technologies. From the perspective of my theorization of archival film, such platforms are instrumental to the further fine-tuning of frameworks and concepts within the film archival field.

Based on this analysis of the film archival field, it can be concluded that today practices related to the obdurate analog technology are being challenged by digital, which in turn seems to be moving towards stabilization. Relevant social groups within the archival film technological frame, driven by their own interests and agendas, adapt and contribute to reshaping the new technological change. They work together, as shown for archives and laboratories, helped also by actors moving between groups, who contribute to improved communication and increased efficiency. In this chapter, both patterns of coherence and differentiation within the field have been highlighted, and a

spectrum of different archival and laboratory practices have been described and put in relation with theoretical frameworks and concepts.

I have argued that archival practice can be associated with four main theoretical frameworks, identified and described in Chapter Two, namely, those of "film as original," "film as art," "film as *dispositif*," and "film as state of the art." Within the "film as original" framework, a film artifact re-acquires its status of "original" once it enters the film archive, becoming the original physical object to be preserved as film heritage. Although the centrality of the "original" within the policy of an archive can vary significantly, most archives nowadays embrace this perspective in terms of long-term preservation of original film artifacts. Also the "film as art" framework lies at the foundation of many film archives, especially of those focusing on avant-garde films and on specific filmmakers/*auteurs*. Here, the status of the medium is very much related to the way filmmakers/*auteurs* look at it. Differently, with the "film as *dispositif*" framework, it is the exhibition aspect that takes a central role, both as recreation of historical *dispositifs* (i.e. the film projection in a dark cinema) and as creation of new ones (i.e. from digital projection in a museum-like context to iPod formats). Finally, the "film as state of the art" framework joins the spirit of certain filmmakers to defy the limits of technology in order to translate ideas into moving images with that of restorers willing to push technology to realize restorations that are closer to the (ideal) image of what the film had once been.

I have associated the practice of film restoration laboratories with theoretical concepts rather than frameworks, as laboratories have a different kind of agency than archives. They are service providers and must therefore follow archives' requests in realizing restoration work. However, laboratories do express a concept of choice in the way they interpret technological change that also has an impact on the whole restoration practice. The concepts that I have chosen as the most representative for the agency of the laboratories are those of convergence/divergence, remediation and simulation. The inversely related convergence/divergence concepts define a process where media are pulled, at the same time, towards digital convergence and divergent specialized techniques. Here past (analog) and future (digital) media are both important as they are used in combination, producing highly hybrid results. The remediation concept characterizes the practice that remediates old restoration technologies attempting to "refashion them in the name of the real" (Bolter and Grusin, 1999: 65). The "real" in this case indicates the film artifact to be restored. Finally, the simulation concept represents one of the strongest potentials of digital media, namely, the ability to simulate photographic images. If restoration is simulation, as I have argued earlier, from the perspective of the simulation concept, digital will be able to provide better results in the field of restoration than photochemical restoration did in the past.

The present analysis shows that film archives and laboratories are changing dramatically, together with the meaning they confer to the film artifact, also within the frameworks and concepts they privilege. Film archives are adapting their framework of choice in the transition to digital, although probably not yet in a systematic and completely conscious manner. An archive such as Anthology, for instance, traditionally devoted to the "film as art" framework, points at digital as a viable means for allowing a future to Orphan films. In the case of Sony, within the "film as state of the art" framework, the search for improving available restoration tools accompanies the search for a viable storage solution for new digital films. Similarly, for a state archive like the Danish Film Institute, which benefits from a legal deposit system, the best practices must be adopted for taking care of the historical film collection, as well as the newly-produced digital films, both within the "film as original" framework. Finally, Eye Filmmuseum seems to have found in digital technology an ideal tool for realizing its framework of privilege, that of "film as *dispositif*." Laboratories move within the different frameworks, depending on the archive they work for, and they further redefine their concepts of choice along the way. It is clear, thus, that even though each player tries to bend and mold digital technology to its own assumptions, purposes and necessities, the changes emerging in the film archival practice in this moment of transition are the result of the interaction and mediation between the relevant social groups. And, finally, thanks to the exchange of know-how and ideas facilitated by international projects, another dimension is added to the dynamics of interaction and mediation among social groups. It should not be forgotten that, through the same projects, the agendas of policy makers at an international level, like the EU, also become directly part of the equation.

As pointed out earlier, the conceptual tools I recognize in the policies and practices carried out within the film archival field are my proposal and not an explicit choice by the archives and the laboratories examined. The usefulness of these tools resides in the first place in their capacity to facilitate a dialogue among archivists and scholars. They can serve as a reference for scholars to reflect on the status and the role of archival practice in relation to the theoretical discourse. Not less importantly, they are an invitation to archivists to reassess (the significance of) their practice, from preservation and restoration to access and exhibition, based on a new theoretical reflection.

By looking at the film archival field through the tools proposed, I have emphasized in this chapter some of the dynamics at play that facilitate the exchange of ideas between the different relevant social groups, and contribute to (re)shaping archival practice in transition. This process leads to the further definition of the very frameworks and concepts I have proposed. Still, the analysis of the field reveals only two dimensions of the film archival

technological frame, namely that of the relevant social groups and that of the conceptualizations around the artifact archival film. The third crucial dimension to be considered is that of the artifact itself, namely, the archival film in transition from analog to digital. In order to investigate this dimension, a number of film restoration case studies taken from the everyday film archival practice will be analyzed in the next chapter in view of my theorization. This investigation will show the proposed frameworks at play, how they interact with each other, and how the proposed concepts function within the different frameworks. A comparative analysis of the three dimensions, the relevant social groups and the frameworks and concepts discussed in this chapter, with the addition of the film artifact in transition (i.e. the film restorations) discussed in the next chapter, will show that my theorization leaves enough room for those variations and contradictions that should belong to a theory aimed at investigating an artifact and its related practice, which are inherently in transition.

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CHAPTER FOUR

Restoration Case Studies: Theorizing Archival Practice

The case studies discussed in this chapter are relevant for a number of reasons. As historical cases, they reflect on the restoration practice as it was carried out at the turn of the millennium when digital tools were being introduced. Alongside the traditional photochemical workflows, restorers could also resort to digital or hybrid workflows to restore these projects. Ten years on, it is interesting to note that these three workflows are still regularly adopted by film archives and laboratories. Indeed, although archives apply digital tools more frequently today than they would have ten years ago, film restoration is still very much a hybrid practice. Therefore, the cases analyzed here are still useful examples for bridging theory and practice through the frameworks and concepts introduced in this book.

Of course, in the last ten years, the number of restorations that have been carried out using digital tools far exceeds those included here. While these numbers would certainly show the significant progress digital archival practice has made in the last years – digital tools have increased the workflow efficiency and reduced collateral damages such as DIGITAL ARTIFACTS – they would also show that photochemical workflows are still adopted when possible, especially in case of experimental and silent films and films in which the original negative has remained in fairly good condition. A case in point is the recent restoration of Stanley Kubrick's *2001: A Space Odyssey* under the auspices of Christopher Nolan, presented at the 2018 Cannes Film Festival.[cli]

In Chapter Two, I discussed some of the benefits of adopting a new "film as performance" framework. Here, I would like to examine how this new framework bears on current archival practice by discussing one case study in particular. I have decided to include the restoration of Nicholas Ray's last long-feature film, *We Can't Go Home Again* (1973), since it exemplifies how this new framework can productively accommodate the "performative" aspects of the film as a dynamic object in relation to the concept of remediation. Furthermore, as a number of photochemi-

cal and digital tests were made before proceeding, the restoration project of *We Can't Go Home Again* illustrates very effectively how the restoration could have led to different results depending on one's interpretation of what film, and specifically this film, essentially is.

In the previous chapter I associated archives and laboratories with frameworks and theoretical concepts and I pointed out how different frameworks and concepts can be retraced in their policy. It is in the everyday practice of film restoration that frameworks and concepts get mixed and combined. Film restorers are confronted with many choices, driven by both ethical questions and technicalities, and it is often difficult to interpret a restoration work from one theoretical perspective only. Furthermore, it would be artificial to do so. Indeed, to quote Bruno Latour, we should refrain from transforming film from a "factual artefact" into an "artefactual artefact" (1987: 106), a theoretically coherent concept that has lost the link with its empirical life. In the restoration of a film, theory and practice should meet eventually and result in a new artifact, ready, once again, to be (re)interpreted.

Starting from the new artifacts, resulting from restoration processes carried out in the last decade, I intend to record and interpret those variations and tensions that characterize a practice in transition from analog to digital. Once again, a practice in transition analyzed from a transitional point of view.

In this chapter, five film restoration case studies will be discussed, which are all connected to the archives and laboratories analyzed in Chapter Three and they all bear a relation with the frameworks and concepts defined in Chapter Two. These cases are spread across the first decade of digital technology used in film restoration. Although many examples of digital restoration have been realized in the 1990s, most of them were experiments carried out on short fragments of otherwise photochemically restored films.[219] The decade 1997 to 2006 opened with the first silent film fully restored in the digital domain, *The Matinee Idol*, and it was closed by one of the most discussed recent digital restorations, that of *Dr. Strangelove*. Both projects were carried out by Sony Pictures Entertainment and both employed some of the most advanced technologies available at the time of their realization. The restoration of *The Matinee Idol*, in collaboration with the Academy Film Archive, was carried out by different laboratories (Cinetech for the photochemical part and Sony Pictures High Definition Center for the digital part), while *Dr. Strangelove* was carried out by the film laboratory Cineric. These two projects will be the first to be discussed, also in light of the "film as state of the art" framework and of the concepts of simulation (*The Matinee Idol*) and remediation (*Dr. Strangelove*). The third case will

be that of *Mahagonny*, restored by Anthology Film Archives and Harry Smith Archives. For this restoration, realized in 2002 also at Cineric, a fully analog process was chosen based on a complex optical split screen technique. I have decided to include this project since it exemplifies how technical possibilities, as well as conceptual questions, usually associated with digital only (e.g. change of *dispositif* and simulation), also exist within the analog domain. The case of *Mahagonny* will be put in relation with the framework "film as art" and the concepts of convergence/divergence and simulation. The last two cases will be *Zeemansvrouwen* and *Beyond the Rocks*. Both films have been restored by Eye Filmmuseum under my supervision. The former was restored at Haghefilm and Digital Film Lab and the latter at Eye Filmmuseum, where part of the digital restoration was done, and at Haghefilm. Both cases will be discussed in light of the "film as *dispositif*" framework, while the concepts of reference will be remediation for *Zeemansvrouwen*, and convergence/divergence and remediation for *Beyond the Rocks*.

For each project, the general workflow will be described, focusing on the technical solutions, both analog and digital, presented in the second part of Chapter One. Also, the ethical issues that arise from certain choices will be discussed, case by case. The case of *Beyond the Rocks* will be discussed in greater detail since I have been involved in it personally as both supervisor and restorer and, therefore, I have much more detailed information at my disposal.

In the conclusion of this chapter a comparative analysis of the five cases will be done, based on the theoretical frameworks and concepts, to show how theory finds its way into the practice of film restoration.

4.1 *THE MATINEE IDOL* (USA, 1928 AND 1997): "FILM AS STATE OF THE ART" AND SIMULATION

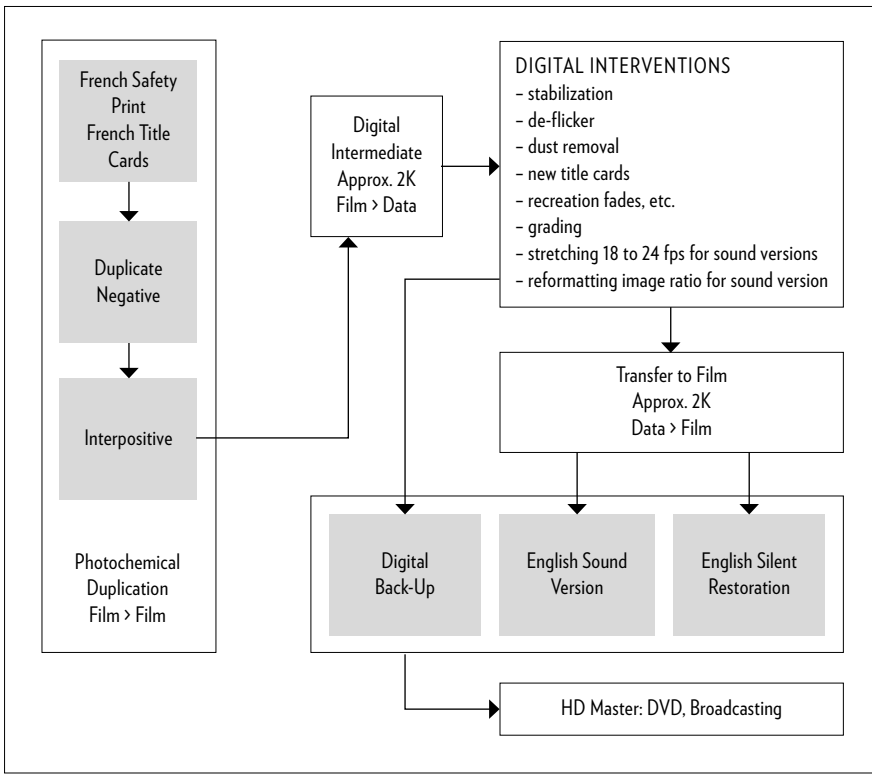
On the occasion of Frank Capra's centennial (1997), Sony Pictures Entertainment and the Academy of Motion Picture Arts and Sciences, in collaboration with the Cinémathèque Française, presented the restoration of one of Capra's most important silent films, *The Matinee Idol*. This restoration was important not only because the film was considered lost, but also because it was the first live action film restored entirely using digital tools. The case of *The Matinee Idol* is particularly relevant as a benchmark for assessing the developments in the use of digital restoration after a decade since its first application in the archival field. Grover Crisp (Senior Vice President of Asset Management and Film Restoration at Sony Pictures Entertainment) supervised the restoration, together with Michael Friend (Director at the Academy Film Archive at the time).

The only surviving film element of *The Matinee Idol* was found in the vaults of the Cinémathèque Française, "hidden" under the French title *Bessie à Broadway*, which refers to the leading actress Bessie Love. This print was first restored photochemically in the French version (that is with the French title cards and main title, *Bessie à Broadway*, as it was found) at the Italian film laboratory Immagine Ritrovata, before it was repatriated to the Academy Film Archive and Sony Pictures Entertainment. There it was decided that the film would be restored to its American release version. The source material of *The Matinee Idol* posed the biggest limitations to the restoration process. Being a later generation safety print, made sometime after 1950, it was already damaged and suffered a loss through photographic duplication. Indeed, as discussed in Chapter One, photochemical duplication brings a loss of photographic detail with every new generation. The restoration of the American release version required the recreation of the English title cards, based on the still surviving continuity script. It was also decided that all the optical effects would be recreated, such as fade-ins and fade-outs, which were truncated by inserting the French titles when the film was released in France in the 1920s. Both the recreation of the English title cards and the optical effects, in addition to the desire to correct the damage on the image of the surviving print (e.g. scratches, embedded dirt, both in the actual print and duplicated from previous film generations), led to the choice of a digital restoration, quite an experimental choice for the time.

The restoration's workflow included photochemical duplications, digitization (i.e. scanning), automatic and manual digital restoration, re-recording back to film and creation of digital masters.

An intermediate positive made from the French source at Cinetech laboratory in Burbank, California, was digitized into the Sony digital HIGH DEFINITION format (1125 video lines or a RESOLUTION expressed in pixels of 1,920 x 1,080, that is roughly 1K) at the Sony Pictures High Definition Center (SPHDC) in Culver City, California.[220]

The damage in the image, including embedded dirt, abrasions and patches, was cleaned digitally. Some of the larger patches or spots had to be corrected manually by way of paint box-like software. Removing vertical emulsion line scratches was one of the biggest challenges. As discussed in Chapter One, this is still one of the hardest tasks today for digital restoration software since line scratches are usually in the same position, frame after frame, and they are therefore easily mistaken for original elements of the image by computer programs. Many scratches of this kind had to be cleaned manually on each individual frame. Different solutions had to be tested to find the best way to address specific problems with the goal of finding an "acceptable compromise between damage and artifice" (Crisp and Friend, 1999).



Restoration workflow of *The Matinee Idol* (Frank Capra, USA, 1928).

GRADING problems due to inaccurate duplication, which could not have been solved photochemically, were also addressed digitally. This part of the work had to be conducted in real-time motion and not frame by frame. Indeed, many restoration results can be accurately judged only in motion. In particular, de-flicker, stability, GRADING and density adjustments need to be previewed in real-time, or at least in slow motion, before final approval. The newly made title cards were edited in the film in the digital domain. The original font used for recreating the title cards was recovered from a non-translated exclamation (i.e. "A-ha!") that was left unchanged in the French print.

Finally, the DIGITAL INTERMEDIATE was approved and printed back on 35mm intermediate positive with Sony's Electron Beam Recorder at a RESOLUTION twice the one used for scanning (i.e. 2,250 lines, that is roughly 2K). From there a black-and-white duplicate negative was produced at Cinetech laboratory. The restoration of *The Matinee Idol* is about one hour long, probably only

five minutes shorter than the version that was originally shown to the American audience in 1928.

This was the first restoration of a live action film performed via DIGITAL INTERMEDIATE. This means that, for the first time, the photochemical information of every grain in the film was turned into pixels at one step of the process. Even though, a decade later, many aspects of digital workflows for film restoration have been modified and improved, still Crisp points out that:

> [...] the work on this film, though some years ago, holds up pretty well. We would take a different approach now, probably scanning the film at 2K and restoring at a 2K workflow. What I think about the cleanup work that was done, which was manual in some ways, but automated in others, is that it was truly ground-breaking for the time, which began I think in 1994 or 1995. Engineers in the SPHDC [Sony Pictures High Definition Center] invented automated processes to deal with some of the issues, especially vertical tramline scratches. As I look at the work now, there are certain things that have not improved so much over the years, while others have (for example, automated small dirt). But, considering the source material, I think it is still mostly acceptable work.[221]

As will be discussed with regard to other more recent cases later and as described in Chapter One, 2K RESOLUTION is indeed considered today to be the very minimum required RESOLUTION for scanning a film to be restored digitally.[222] On the other hand, the level of damage removal performed for *The Matinee Idol* is still comparable with any current digital restoration today. The same level of digital image repair would nowadays require less manual intervention thanks to the hugely improved efficiency of the automated dust removal software. Note that back in 1997, dust removal was still usually done frame by frame. Still, if DIGITAL ARTIFACTS are to be avoided only careful supervision and a great deal of manual correction are needed, even today.

The goals of the restoration of *The Matinee Idol* were described by Crisp and Friend, who supervised the project on behalf of, respectively, Sony Pictures Entertainment and Academy Film Archive:

> Throughout the restoration process, the goal was always to protect the integrity of the original image while removing only those defects that were clearly produced by damage, severe wear, misuse or deterioration. In cases where the repair of a defect resulted in an artifact more perceptible than the defect, the decision was made to leave the defect. [...] The goal of the work was always to restore the original achievement of the director; to return the film to a condition as close as possible to the

> original without changing, "improving" or otherwise denaturing the film. This philosophy was the basis of all of technical and aesthetic decisions taken in the course of the work. (Crisp and Friend, 1999)

Protecting the integrity of the original image and restoring the original without denaturing the film are considered general goals for any restoration carried out by archives and institutes that relate to the professional archival field. All archival restorations, therefore, address at some level the "film as original" framework, even though in some cases this framework is not the leading one. Two fundamental issues posed by the restoration of *The Matinee Idol* were which was the original to be restored and to what extent defects and damage should have been corrected.

The only surviving print of *The Matinee Idol* had already led to the restoration of the French version (*Bessie à Broadway*) by the Cinémathèque Française and it seems obvious that Sony and Academy would want to restore the American version. Besides this, the goal was to "restore the original achievement of the director," supposedly the film as it was intended by Capra and released in the US in 1928. Because of the focus on the director's achievement, the "film as art" framework also had an important role here. In this respect, Friend shows the centrality of Capra's status as *auteur* from the restorers' perspective, by pointing out the importance of the original English title cards in the restoration:

> It was a revelation to see how much of the character of the film depends on the interaction of words and pictures. This text also gives significant information that was lost in the French translation that makes the film much more intelligible in its social context, and also reveals much more of the auteur's hand. Without the correct English titles, this film is far less of a Capra film.[223]

Clearly, from the restorers' point of view, Capra's version was the original to be restored.

The extent of correction largely depends on the techniques chosen for restoration. With a photochemical duplication route, the reconstructed English title cards could have been added easily, but the rest of the interventions would have been almost impossible.[224] Indeed, as discussed extensively in Chapter One, damage to the emulsion (e.g. tears, embedded dirt, scratches, line scratches and patches) cannot be corrected via photochemical means. Also, defects in the lighting and density could have only been corrected partially via photochemical means, leaving most of the unevenness still visible. Flicker and unsteadiness could have not been corrected at all. Up to 1997, all restorations of silent films were done photochemically and, therefore, they all

contained a great deal of visible damage. The choice of digital restoration in the case of *The Matinee Idol* falls, in my view, within the "film as state of the art" framework, especially considering that it was made within, in SCOT's terms, a photochemical technological frame. This choice was based on the attempt to push the technology beyond its known limits. In this respect, Friend's account of how they approached the project and how they proceeded day by day reveals the explorative character of this undertaking:

> We tried various techniques in data and recorded out some sections using the electron beam recorder, largely to confirm what we were seeing in HD with respect to resolution and tone scale. In this process, we encountered the (now) well-known phenomenon of removing one layer or class of problems only to discover that the next level of problems appear visually more disturbing. We came to realize that the archival mode of seeing has its own gestalt, and that the balance of dirt, scratches, flicker, instability, dupe replacements and so forth, formed a kind of visual ecology that cannot be disturbed without producing a disproportional visual stimulus. As a result of our initial modifications, we were more or less compelled to go further and address deeper problems in the film. We would sometimes work for an entire day on image clean up, and the next day we would watch the HD and conclude that almost nothing had been done. [...] Occasionally, we would discover that problems were the result of how the equipment had been calibrated, and there were moments when we were not clear about where the actual film data ended and digital interpolation began. The restoration of *Matinee Idol* was as much an experimental process for Grover and I as curators and spectators as it was for the equipment and software.[225]

Besides showing the experimental nature of the project and its link with the "film as state of the art" framework, the above also shows how challenging and subjective it can be to determine whether the repair of a defect resulted in a so-called DIGITAL ARTIFACT more perceptible than the defect itself, and whether it should be preferred to it.

Ethical issues emerge as digital repair can result in DIGITAL ARTIFACTS (also discussed in Chapter One). The perception of this has greatly changed from 1997. At the time many archivists and restorers were quite distrustful of digital possibilities and they would be much less tolerant of the risk of DIGITAL ARTIFACTS than they would of "photochemical artifacts" (i.e. all those defects that are caused by photochemical restoration). Indeed, the archival film technological frame, in SCOT's terminology, has changed a lot in the last ten years and actors' perceptions have changed with it. In Friend's words:

Images before and after restoration of *The Matinee Idol* (Frank Capra, USA, 1928 – courtesy of Sony Pictures Entertainment).

> The restoration status of this film is best characterized as bi-modal. We continue to conserve the best remaining film element with the understanding that we will re-scan the film periodically and improve the quality of the digital image we can display, or the film element we can record out from data. To a great extent, film preservation itself has moved from a static model (duplicate the film once and for all time) to a dynamic model (conserve and re-scan the film, reprocess or migrate the data). It is hard to say whether preservation of media will ever go back to the static model, but at this time, no restoration work is ever terminal, and one day or another we will have to revisit *Matinee Idol*.[226]

This is indeed an important mindset shift within the entire archival community, which clearly underscores the transitional phase addressed here and rhymes well with the dynamic approach I advocate in this study. Indeed, if the static model was still quite dominant in 1997, today archives are quickly moving towards the dynamic model. This transformation in the film archival technological frame has also changed the field's perception with regard to digital interventions: the level of digital clean-up applied to *The Matinee Idol* in 1997 was unseen before. Ten years later, it would be the norm for most films that are restored digitally.

The dominant concept behind this restoration is in my opinion that of simulation, as it was chosen to apply digital intervention extensively with the main goal of simulating what the film must have looked like. This restoration project can of course also be associated with other frameworks and concepts. Apart from the "film as art" framework named above, the "film as *dispositif*" framework emerges testified by the choice of releasing *The Matinee Idol* also in an alternative theatrical sound film version, as well as for the DVD version.[227]

The restoration of *The Matinee Idol* is particularly relevant as a realization in practice of the "film as state of the art" framework, and it can be associated also with the remediation concept. It should be noted, however, that some of the choices taken along this and many other restoration projects can be traced back also to different frameworks and concepts. For instance, the choice of respecting Frank Capra's intention can be considered in line with the "film as art" framework. As I intend to show also in the following case studies, a dynamic interplay connects theory and everyday practice. *The Matinee Idol* and *Dr. Strangelove,* two restoration cases both associated with the "film as state of the art" framework, separated by ten years, also show very clearly how technology is evolving in the practice. The choice of the elements to be digitized (ten years ago a new intermediate film element, today the oldest available archival film element) or the choice of the RESOLUTION for digitization (ten years ago less than 2K, today at least 2K, and preferably 4K) clearly reflect the rapid change in the assumptions on the restoration practice by the archival field.

4.2 *DR. STRANGELOVE OR: HOW I LEARNED TO STOP WORRYING AND LOVE THE BOMB* (USA, 1964 AND 2006): "FILM AS STATE OF THE ART" AND REMEDIATION

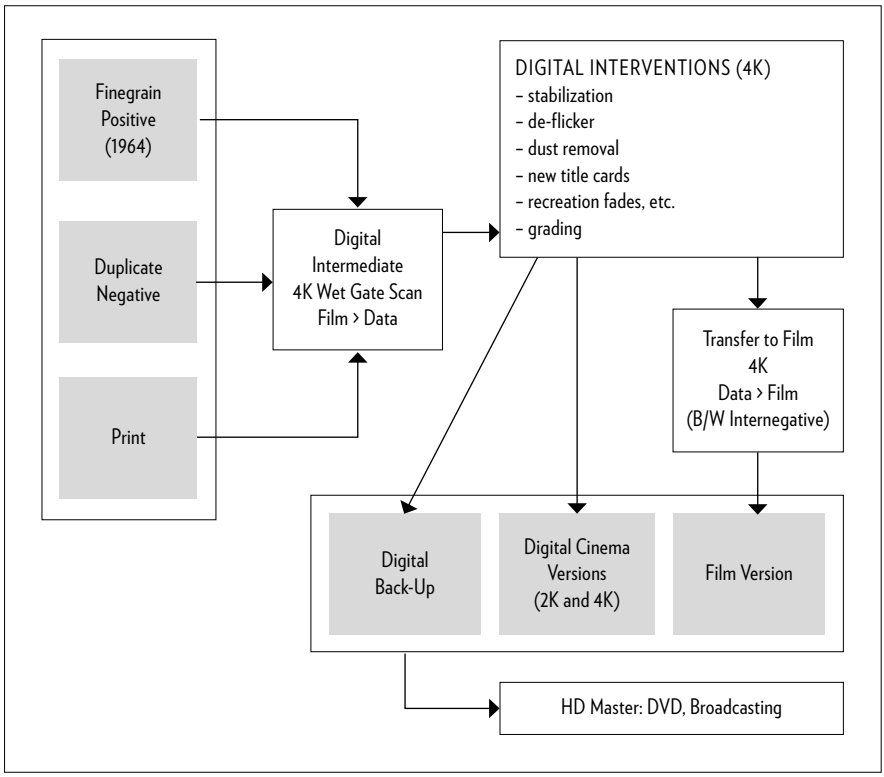
Dr. Strangelove is one of the many films of which only damaged prints and low quality duplicate film elements still exist since the original camera negative was destroyed. According to Grover Crisp, like other Hollywood studios, Columbia Pictures, for many years into the early 1970s made release prints directly from their original camera negatives. The more popular the film, the more prints were made and, as a consequence, the greater was the damage to the original negative. This was also the case with *Dr. Strangelove*, whose original negative, shortly after the film's release, was destroyed by the laboratory holding it because it had been damaged irreversibly while making prints.[228]

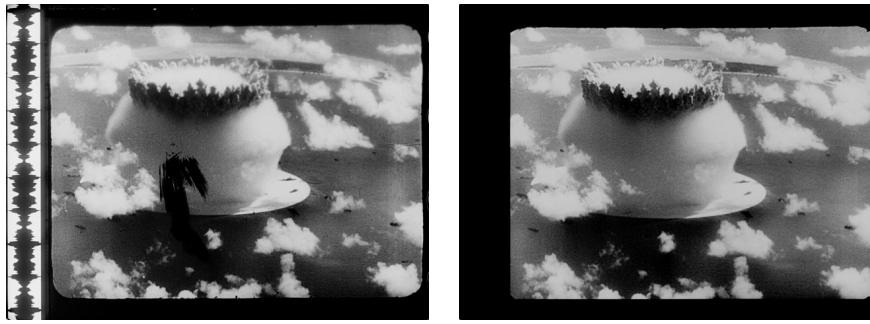
In the 1980s, Kubrick had all the remaining film elements of *Dr. Strangelove* moved to London. Over the years he had several duplicate negatives made from two surviving FINE GRAIN positives from 1964, trying to get a perfect print. When Columbia Pictures needed a new release print, Kubrick would have sev-

eral made before he would get one he could accept. After Kubrick died in 1999, all the material was shipped back to Sony Pictures Entertainment in Los Angeles where it was carefully analyzed. All existing elements contained chemical stains, scratches and dirt, both embedded in the emulsion and photographed from an earlier generation. The best film elements for the restoration were a 35mm FINE GRAIN positive, a 35mm duplicate negative and a 35mm print, and these were used for the restoration.

Sony intended to restore *Dr. Strangelove* in 2004, for the fortieth anniversary of its first release, and Crisp, based on the challenges posed by the surviving elements, decided to restore the film digitally, at **4K RESOLUTION**. It was the first time that a black-and-white film was going to be restored at this RESOLUTION throughout the complete workflow, from scanning through image restoration to printing back on film. In addition, the final restoration was intended to be presented in DIGITAL CINEMA projection at **4K RESOLUTION**. Finding a laboratory equipped for a full **4K RESOLUTION** restoration in 2004 was practically impos-

Restoration workflow of *Dr. Strangelove* (Stanley Kubrick, USA, 1964).





Images before and after restoration of *Dr. Strangelove* (Stanley Kubrick, USA, 1964 – courtesy of Sony Pictures Entertainment). See also figs. 15 through 18 in the color insert.

sible. Cineric Laboratory in New York only developed a fully 4K workflow in 2005. Crisp decided then to do the restoration at Cineric as they:

> can scan film at 4K with a WET GATE process, while I am not aware of others that can. Cineric has, for the most part, been in the forefront of creating digital workflows, at both 4K and 2K resolution, among the traditional restoration laboratories.[229]

At first the best scenes from the three film elements were scanned on an Oxberry Cinescan 6400 scanner, equipped with a WET GATE. With this technique the film is scanned while immersed in a fluid. This allows for the removal of the most superficial scratches already during the scanning process. The film was scanned at 10 BIT DEPTH logarithmic to DPX files. Daniel DeVincent, Cineric's Director of Digital Restoration, created LOOK UP TABLES (LUT) designed to optimize the scan of each element in order to achieve the DYNAMIC RANGE of 35mm black-and-white film. It should be noted that most of the equipment for scanning and printing back on film is designed for color film stock, as this is the stock commonly used by the industry today. As discussed in Chapter One, film restoration technicians often need to adapt available equipment to deal with archival film elements that have different characteristics (especially with regard to color and density) compared to contemporary film stock.

After scanning, the digitized film, stored as some hundred thousand individual frames (136,800 to be precise) at a RESOLUTION of 4,000 pixels per horizontal line (i.e. 4K), was digitally restored using various software, e.g. DaVinci's Revival.[230] Spatial problems (typical of a single frame or not adjacent frames)

like dirt, scratches, and stain were addressed at times automatically, but they often needed a frame by frame approach using paint box-like software, as in the case of *The Matinee Idol*.

In a second phase temporal problems (typical of adjacent frames, evident when watching frames in a moving sequence) such as flicker, unsteadiness and density fluctuations were addressed. Crisp pointed out that, at each phase of the restoration, there was a careful examination of the results to check for DIGITAL ARTIFACTS that may have been created, and for anomalies left untreated in the image. More than sixteen hundred hours were spent at Cineric to restore the film in the digital domain.[231]

The GRADING was carried out by DeVincent on an Autodesk Lustre, a digital GRADING software. One of Kubrick's assistants, Leon Vitali, was involved in the project by helping to assess the results of the digital restoration. Vitali's input was especially valuable in achieving the look that Kubrick was always after when he was making his prints.

Once the restored DIGITAL INTERMEDIATE was approved (approximately nine terabytes of uncompressed data), it was printed back on film using a Lasergraphics Producer 2 film re-recording system. As for the scanner, the recorder had also been originally designed for use with color film, and for these reasons the process had to be adapted for a black-and-white film. The same DIGITAL INTERMEDIATE was also used for creating the DIGITAL CINEMA MASTER for cinema projection and the HD master for broadcasting and DVD release. The goal was to obtain the exact same look, whether the film was projected either as a film print or digitally.

The restoration of *Dr. Strangelove* premiered at the London Film Festival in 2006, as a film projection. The first public DIGITAL CINEMA projection took place in June 2007 at a Landmark Theater in Los Angeles, equipped with a Sony SRX-R110 projector with a 4K RESOLUTION (4,096 x 2,160 pixel). The digital projection was very well received, although Crisp points out that:

> the 4K Sony projector at the time was having trouble showing black and white as it should, so that was a bit disappointing. The sharpness was present, but not the proper densities. [This projector], as are all digital projectors, is calibrated for color images, not black and white, and there was an impression of bleed-through of certain colors on the screen, but I understand they are working on improving the capability for black and white projection. Therefore, we could not get a true black and white image that replicated that of the 35mm print.[232]

The main reason for showing *Dr. Strangelove* as a digital projection was that of keeping the number of generations between the surviving source and the

projection to a minimum and, herewith, reducing the loss in detail typical of each new film print generation. As Crisp explains:

> Part of my goal in creating a DCP [DIGITAL CINEMA PACKAGE] for projection was to enable audiences to see the highest resolution image possible on a theatrical screen. Since the source material was a second-generation master positive, the image at 4K is, at least theoretically, equal to that in the master positive. Whereas, the new 35mm prints are from the recorded out negative, also at 4K, but there is inherent loss through the printing process.[233]

A relevant feature of *Dr. Strangelove*'s digital projection is that of its ASPECT RATIO (1.66:1). The specifications for DCP, as defined by DCI and standardized by SMPTE, do not comprise other ASPECT RATIOS than 1.85:1 or 2.40:1, which are also the most common ratios for current commercial films. When *Dr. Strangelove* is projected digitally, it is a 1.66:1 image within a 1.85:1 frame.[234] This is particularly annoying as it is the result of inappropriate standards and not a technological limitation. Whereas a digital projector could easily simulate any historical frame ratio, the creation of DIGITAL CINEMA standards defines the number of ASPECT RATIOS to the two most commonly used today (i.e. 1.85:1 and 2.40:1). As discussed in Chapter One, archives are today trying to include specifications suitable for archival films in the existing DIGITAL CINEMA standards.[235] Also, in the previous chapter, the EU project Edcine has been discussed, which is proposing alternative solutions that can facilitate the digital projection of archival film with an obsolete frame rate or ASPECT RATIO.

There is one particular aspect of this restoration worth discussing, related to the digital cleaning and the subtle line between what is a defect to be removed and what is an inherent aspect of the film. While Crisp points out that no digital attempt was made to reduce the grain structure of the film to preserve its semi-documentary look, on the other hand,

> [i]n discussing what to remove and what to leave, especially with Leon Vitali who knew what Kubrick would have wanted, we decided to remove as much scratches and dirt as we could. [Including when they] were part of the original film [namely in the stock footage sections] – but we did not remove wires holding miniature airplanes.[236]

A general rule for digital restoration is that of not removing those defects that are inherent to the original film, in other words those "problems" that have always been there. However, the decision on where the line should be drawn is subjective. An example could be that of a film negative that got scratched in the

camera while shooting. Such a scratch was never intended to have been there, still it would have become part of the film's history and it would have been copied onto every print of the film, as photochemical tools were not capable of removing it. Digital tools can easily remove a scratch like this today. Most film productions are even insured for this kind of accident. Restorers, however, are divided between those who would erase something like this during restoration and those who would not. A compromise is that of preserving the artifact with the scratch and documenting its existence but removing it digitally from the restoration. The case of *Dr. Strangelove*'s stock footage sections, where all scratches were removed irrespective of their origin, is a borderline example, and I am sure that today there would be no consensus among film restorers about what to do in similar cases. On the other hand, most restorers would agree with Crisp in not removing the wires holding miniature airplanes. These are to be considered the state of the art of special effects at the time the film was made, and removing them digitally would mean "improving" the film by means of current special effects' techniques. In Chapter One I have discussed this technique, referred to as digital effacing, by which undesired elements of the image are erased in post-production. Such intervention would, for most restorers, go beyond what is ethically acceptable since it would erase the signs of the film's original means of production and aesthetic appearance. Note that there have been restorations where the removal of similar wires has been carried out and justified as something that the director himself would have done if he had the chance. This is the case, for instance, of the final shot of the restoration of Vittorio De Sica's *Miracolo a Milano* (IT, 1951).[237] However, Crisp points out that people (and in particular broadcasters) are becoming less willing to accept damage on the image even when they were used to it in a photochemical restoration. He has even been criticized for not removing the wires from *Dr. Strangelove*.[238]

I associate the restoration of *Dr. Strangelove* mainly with the "film as state of the art" framework, once again, because of the choice for an experimental workflow (i.e. a full 4K RESOLUTION for a black-and-white film, including a DIGITAL CINEMA MASTER) that pushed the limits of technology to achieve the best possible result. I associate it also with the remediation concept due to the use of the new digital technology to remediate the photochemical technology in the name of the film to be restored. *Dr. Strangelove*, because its original camera negative had been destroyed and because all its surviving elements suffered severe damage that could not have been helped photochemically, called for a remediation approach to its restoration. Indeed only by remediating it by means of digital (and all the way to digital projection), it is possible to recreate the film at its highest possible photographic quality, that of the last surviving elements.

As for any other case, other frameworks and concepts are also part of the overall picture. For instance, the "film as art" framework plays a role, since nobody would question Kubrick's status as *auteur*.[239] Restoring *Dr. Strangelove* to what Kubrick would have wanted was one of the main goals of the project and for this reason his assistant, Leon Vitali, was also involved. Also, the simulation concept can be put in relation to the efforts made to obtain a digital projection that would faithfully reproduce the image characteristic of the film, namely its black-and-white look and its original ASPECT RATIO.

In my view, *Dr. Strangelove* represents the clearest example within the archival practice of "film as state of the art" at this point of the transition to digital. Similarly to *The Matinee Idol*, which was the first archival film fully restored by digital means, in this case also the latest techniques were employed, ten years later. In the meantime technology has changed dramatically. For instance, the RESOLUTION for digitization has risen from less than 2K to 4K. Also, the possibility of projecting the restored data at a quality comparable to that of a film projection, available for the restoration of *Dr. Strangelove* was not yet an option for *The Matinee Idol*. Discussing both projects offers a very clear view on how the technological frame around digital film is being reshaped, and with it the assumptions about the application of digital technology to film restoration.

4.3 *MAHAGONNY* (USA, 1970/1980 AND 2002): "FILM AS ART," CONVERGENCE/DIVERGENCE, AND SIMULATION

Avant-garde filmmaker Harry Smith's Film Number 18, *Mahagonny*, is in many ways different from the other four cases discussed in this chapter. First of all, it is not a traditional film in terms of *dispositif*, as it was originally meant as a multiple projection performance to be shown on a screen split into four quadrants. Two projectionists would operate four 16mm projectors following Smith's notes on how to synchronize projection and soundtrack, the 1930s opera "Rise and Fall of the City of Mahagonny" by Kurt Weill and Bertolt Brecht. Secondly, it is an avant-garde film for a selective audience, while the other cases discussed here had a commercial distribution. The 221-minute long *Mahagonny* was shown only ten times at the Anthology Film Archives in 1980 and never again until its restoration in 2002. Thirdly, the restoration of *Mahagonny*, by the Harry Smith Archives and the Anthology Film Archives, carried out at Cineric, was a fully analog project. However, because of the reasons mentioned above, this restoration is a very relevant piece of work for this study as it presents a number of issues that are usually related to the use of digital in film restoration, as, for instance, the change of film and screening format, and of *dispositif*.

Rani Singh, Smith's former assistant and current Curator of the Harry Smith Archives, led the restoration of *Mahagonny* and was instrumental to its realization in many ways. She took the lead to find the necessary funds and she recovered Smith's notes and several photographs and slides taken during the ten performances at Anthology in 1980. This documentation was very valuable during the restoration process. Michael Friend, former Director at the Academy Film Archives and currently working at Sony Pictures Entertainment, was involved in overseeing the project on behalf of both Anthology and the Harry Smith Archives, while Simon Lund supervised the work at Cineric.[240]

Even though most of the original film elements of *Mahagonny* were still available and in good shape, the reconstruction needed some prior investigative work. The existing film material consisted of several rolls of incomplete unedited 16mm camera original and a 16mm INTERMEDIATE POSITIVE that was edited by Harry Smith into the final work. The latter was used by Smith to make reversal prints for the performances. As Lund explains, they decided to use the INTERMEDIATE POSITIVE for the restoration as:

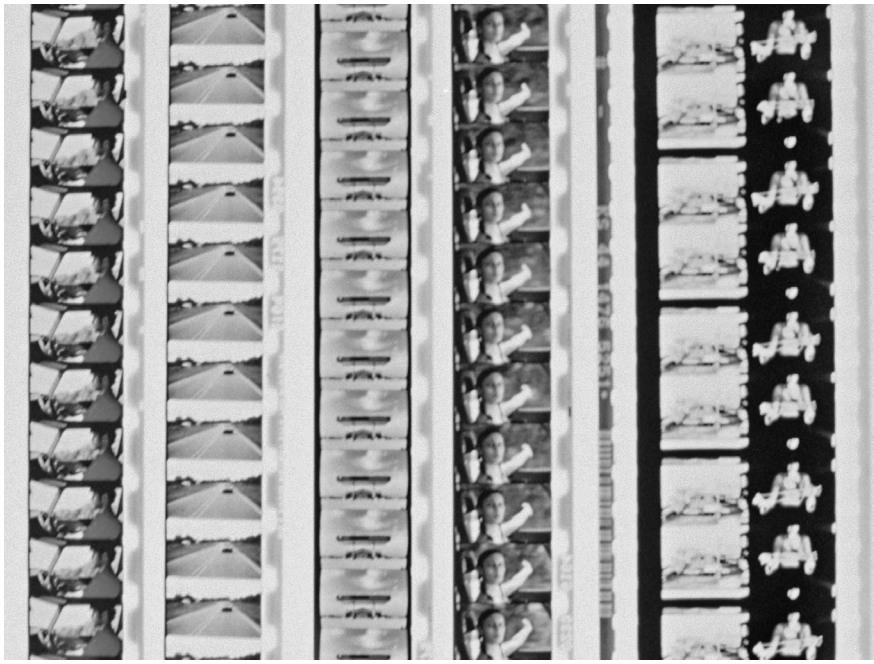
> the camera original was never cut and he [Harry Smith] then recycled it into other films and some is lost. It is a strange case where the original cut film is not the original. We could have tried to go back to what camera original existed but it would have made a patchwork and definitely would have changed the way the film looked from the way it was originally projected [...][241]

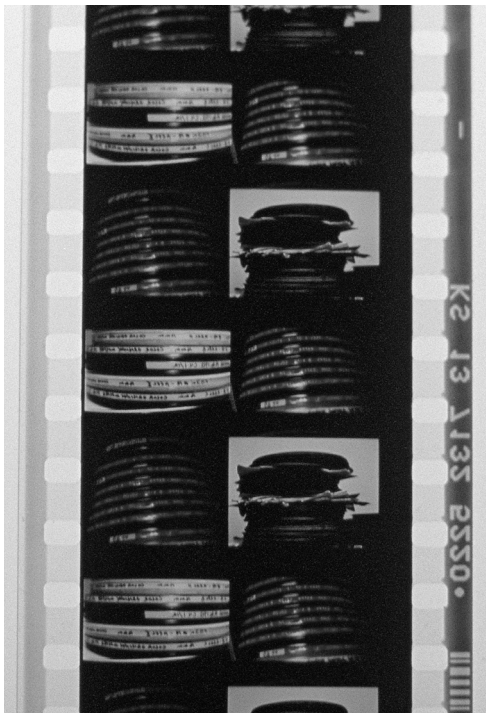
With respect to the sound, instead of the ¼ inch tape Harry Smith had made from an LP of a specific recording of *Mahagonny*, with lots of warble, hiss and dirt crackle, Lund explained that they used:

> a remastered CD of the same performance and used it as the audio source. It has been a while but I seem to remember we time stretched it to make sure it matched the exact running time of the ¼ inch tape.[242]

This was the basis for the restoration, together with Smith's paperwork, which recorded a decade of work on this project, in particular on the assembly of the film and different reels and sound tapes to be synchronized during projection. Also, photos taken off the screen during the ten performances in 1980 were of great help to the restorers.

The greatest challenge posed by the restoration of *Mahagonny* was its presentation format. To reconstruct the 16mm multiple projection performance the restorers chose a different format, namely that of a 35mm sound print with the four 16mm original films printed as a split-screen composition. This





Above: The four 16mm original prints of *Mahagonny* (Harry Smith, USA, 1970-1980) next to the 35mm composited restoration (on the right end side – courtesy of the Harry Smith Archives; photograph courtesy of Cineric).

The 35mm composited restoration of *Mahagonny* (Harry Smith, USA, 1970-1980 – courtesy of the Harry Smith Archives; photograph courtesy of Cineric). See also figs. 19 and 20 in the color insert.

solution turned *Mahagonny* in a film that could be projected in a regular cinema from a single standard 35mm projector, and, as a consequence, a film that could be shown everywhere and to a broader audience.

The restored *Mahagonny* was shown in 2002, at the Getty Research Institute in Los Angeles during a two-day symposium celebrating Harry Smith's film. After that it played at Anthology and it was also screened at several festivals, including the International Film Festival Rotterdam, Il Cinema Ritrovato in Bologna and the Nederlands Filmmuseum Biennale. Since 2002, the restored *Mahagonny* has been regularly programmed by *cinémathèques* around the world.

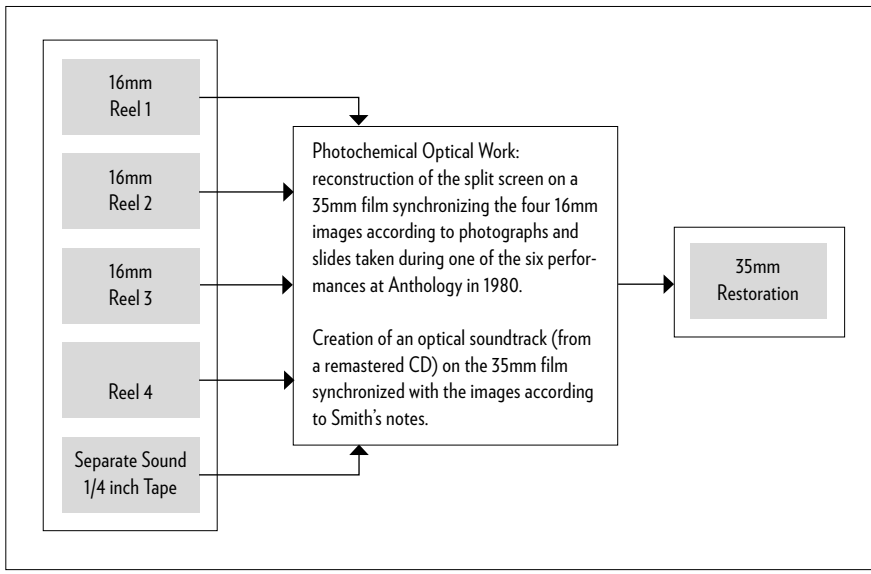
It is undeniable that Mahagonny has been changed dramatically by the restoration process. Not only as a film artifact, as it has been turned from four 16mm films and ¼ inch tapes into a single 35mm sound print, but also as *dispositif*, as from a multiple projection performance it has become a cinema film projection.

With respect to the choice of format, Singh feels that the right decisions were taken based on the technology available at the time. Also:

> After seeing the film many times, I think that all of the essential information is there. But when you speak with people who were at the original screenings, even though the film was supposed to be the same every night, I know that it wasn't. The static nature of the mirroring bothers me somewhat. Then later on in the film, when we add a few second differentiation, I, as the restorer, feel my hand in it more than Harry Smith's. That is a serious concern. But I feel like this was the best we could do when we worked on the project. Let's even surmise I could do it again, how many frames would you put the image off kilter? How many times? When and where? It might be less obvious if it wasn't so regular, but still, it's not Smith's hand at work. So all those issues remain, no matter who or what is at work. Once the filmmaker is no longer there to make the decisions.[243]

But, even when the filmmaker is there to make the decisions, they would not necessarily be easy ones to make. In addition, the interaction between restorer and filmmaker can be a difficult one, as was discussed in Chapter Two with regard to the "film as art" framework.

As Friend points out, *Mahagonny*'s restoration takes into consideration Smith's design as "a rather open sense of interaction between the four images and the soundtrack." Based on Smith's acknowledgement of such an intent, the restorers consider their



Restoration workflow of *Mahagonny* (Harry Smith, USA, 1970-1980).

> "version" or "performance" of the film as fixed in the restoration to be authorized by this intent. Our restoration in fact presents this latitude without extending it any further by contingencies that might have happened in other four-screen presentations. It contains the randomness and the latitude of the original Harry Smith presentation, but it presents this feature in the same way every time the film is presented.[244]

It is with regard to the work's inherent randomness fixed to one of the many possible variations that Andrew Lampert, Film Archivist at Anthology, argues that the restoration of *Mahagonny*:

> is a success in its own terms but it is not what I would necessarily consider to be a real preservation. The work itself is inherently unpreservable. [...] At each performance you had reel changes, but also sound tape changes. There is no way on earth that any of the ten performances were the same. In the preservation it was essentially fixed into a rigid solid work and called "Harry Smith's *Mahagonny*." I believe that it is a film that is 75% of Harry Smith's *Mahagonny*: it is trying to follow the route that Smith took with the piece. But, in its transferred form, in its fixed form, it is substantially changed. I am definitely not against it, however I think it is a very different piece.[245]

Indeed, although the general visual effect of a 35mm projection with a screen split in four synchronized images might be very similar to that of four 16mm projections onto the same screen, still the inherent autonomy of each image from the other three and, consequently, its random character is lost. This is also true when considering the relation to the soundtrack. As Lund points out, the version they restored was an accurate recreation of one of the performances. They could have perfectly matched Smith's instructions, but, by looking at the photographs taken during the performances, they figured out that the projections were always out of synch. Furthermore, they could reconstruct the drift between the four projectors so that the restoration is a reasonable recreation of one of the performances. In a sense it recaptures some of the aspects of the performance better than if it would have been a perfect match of Smith's notes.[246] With regard to the projectors asynchronism and other aleatory factors in the presentation, such as the skill of the projectionists in changing reels, focusing, etc., Friend points out that:

> This is not a dimension that we sought to replicate because it would have meant fixing more of the subjective intervention of the archivists into the work; it would have produced a kind of palimpsest, an overlay of interpretation that we sought to avoid. Clearly, we made an interpretive decision in fixing the performance of *Mahagonny*, but we chose to impose the least amount of interpretation possible. There will always be a difference between the actual remnant of *Mahagonny* and the universe of possible *Mahagonny*s that were conceived by Harry Smith.[247]

These kinds of decisions in the restoration process place this project, in my view, within the "film as art" framework. A number of reasons justify this association, first of all, the nature of the work, more a performance than a cinema projection. *Mahagonny* belongs to that terrain between visual arts and avant-garde where the art-label is usually not questioned. Secondly, the strong historical link with its creator, Harry Smith, puts it in the category of *auteur* works that, in Chapter Two, have been argued to be part of the "film as art" framework. Also, the association of this restoration, and of Harry Smith himself, with the Anthology Film Archives brings it back to Anthology's framework of preference. Finally, the goal of this restoration, as emerged from interviews and correspondence with the people responsible for it, was unquestionably that of restoring Harry Smith's *Mahagonny*.[248] This project should also be put in relation to the "film as *dispositif*" framework, as *Mahagonny* has been transformed from an avant-garde performance via multiple projection, which could be shown only in few equipped theaters to a selective group of viewers, into a cinema single projection *dispositif*, suited for any theater and a broader audience.

I associate this restoration with the concepts of convergence/divergence and that of simulation. The choice for the latter comes from the route followed by the restorers to recreate one of the performances. Film's ability to simulate photographic images, in this case, has been put literally into practice by simulating a multiple projection performance that has one taken place. Interestingly, though, this was not done via the digital medium, which, as argued earlier, has the highest potential for simulation, but via photochemical duplication, through a complex work of optical printing. The choice for the photochemical route, in my view, can be best associated with convergence/divergence, as a highly specialized technology quickly becoming obsolete, that of COMPOSITING a split screen via optical printing, was preferred to digital. Indeed, the same result could have been obtained digitally but, as Lund points out, it would have been more expensive and, in the end, there was no real advantage in it. In addition, since optical printing is not as precise as digital COMPOSITING in lining up frame lines between the four tiled images, a certain amount of instability became part of the split screen effect, adding even more to the simulation aspect. Indeed, when more films are projected onto a single screen from different projectors, as in the original performances of Harry Smith, some instability among the different projections cannot be avoided.

Singh and Lampert, when asked, consider the possibility of a simulation of the *Mahagonny* performance by means of digital projection. Singh "would really like to do [...] a live version, digital presentation with a real time mix."[249] Lampert comments with regard to this that:

> I would definitely test it out and see how it would look like. We would need to have a well written caveat to explain our intentions and discussing the original formats and more educational aspects so that people would not assume that Harry Smith was creating digital video in the 1970s.[250]

The difference with such an approach would be that the performances would always be different as they were also originally, rather than fixed to the one recorded on a single 35mm restored film. It would also move the restoration approach from convergence/divergence towards the remediation concept. The intentions and methods of the restoration should be explained to the audience, indeed, as they should always be for any restoration. This is something that the digital might help us with in the future, as discussed in Chapter One, thanks to its great potential for providing contextual information or metadata. *Mahagonny*, as with the other cases discussed here, shows that more frameworks and concepts can be at play, in this case, in particular, those of "film as art," convergence/divergence and simulation. The cases of *Dr. Strange-*

love and of *The Matinee Idol*, discussed earlier, although very different from *Mahagonny* in many ways (e.g. mainstream rather than avant-garde), have also been associated with "film as art" as in those cases the restorers have chosen to remain as true as possible to the *auteur*'s intentions. Also "film as *dispositif*" can be associated with the restoration of Harry Smith's film, as in the case of *Zeemansvrouwen* discussed next, although they are two completely different films, in terms of genre (avant-garde vs. fiction), period (1931 vs. 1970/80) and technology (four sound color 16mm to be shown in a multiple projection vs. silent 35mm). Among the case studies analyzed, *Mahagonny* is the only project carried out without any use of digital tools. With this respect it is a relevant exception that shows how the transition does not manifest itself necessarily through digitization.

4.4 *ZEEMANSVROUWEN / SAILOR'S WIVES* (NL, 1931 AND NL/DK, 2003): "FILM AS *DISPOSITIF*" AND REMEDIATION

Zeemansvrouwen, directed by Henk Kleinman and photographed by Andor von Barsy in 1931, originally meant to be the first Dutch sound film, became the last Dutch silent film.[251]

Zeemansvrouwen was restored as a silent film by Eye Filmmuseum via photochemical duplication in 1984 when a duplicate negative was made, based on the only surviving 35mm black-and-white nitrate film print, and, from there, a FINE GRAIN positive and new projection print. The surviving nitrate projection print was still in quite good shape and the superficial scratches removed in duplication through a printer equipped with WET GATE resulted in a fairly clean image. This duplication work was carried out at Haghefilm laboratory.

In 2002, Eye Filmmuseum produced and released a new version of *Zeemansvrouwen*, with a completely new soundtrack, including a music score, dialogues (with voices by contemporary Dutch actors including Jeroen Krabbé and Nelly Frijda) and sound effects. According to Frank Roumen, Producer at Eye Filmmuseum, this project originated from the enthusiasm of Dutch composer Henny Vrienten, who liked the film's documentary dimension and its realistic portrait of Amsterdam in 1930. This new version of *Zeemansvrouwen* was an experiment in many ways. While Vrienten composed an original score, Dutch writer Lodewijk de Boer wrote dialogues based on the homonymous theatrical play by Herman Bouber and, on the deciphering by a professional lip-reader of what the actors were actually saying in the silent film.

The decision to make a sound version of *Zeemansvrouwen* was also the reason for resorting to digital technology for this project. The silent version of the film runs at 22 frames per second, while a sound film needs to run at a

Image from the film *Zeemansvrouwen* (Henk Kleinman, NL, 1930 – courtesy of Eye Filmmuseum).

standard speed of 24 frames per second. The so-called stretching of the film, from 22 fps to 24 fps, discussed in detail further on, could be done at lower costs and with more precision via digital rather than photochemical duplication. The same applies to the reformatting, from silent full frame to sound Academy frame, which was needed to accommodate the new soundtrack along the perforations, on the left side of the frames, without losing any part of the image. The digital process was carried out at Digital Film Lab in Copenhagen under the supervision of Paul Read. Besides stretching, reformatting and GRADING, no additional digital work (e.g. digital clean up) was done, since the only existing nitrate print was in good condition. A photochemical duplicate negative from the nitrate, on the other hand, was made via the use of WET GATE photochemical printing to get rid of most scratches. The duplicate negative was then scanned at 2K RESOLUTION.

The stretching process was one of the most challenging aspects of this project as it was the first time that both Eye Filmmuseum and Digital Film Lab did something like this digitally. In addition, it should be considered that, while the work on the image was taking place, Vrienten was mixing the soundtrack at Metasound, a sound studio in Amsterdam, using as a reference a reconstruction on video at the speed the film would eventually run after digital intervention. This video simulation had to be matched perfectly

by the final film print, otherwise music and dialogue would not have been synchronized.

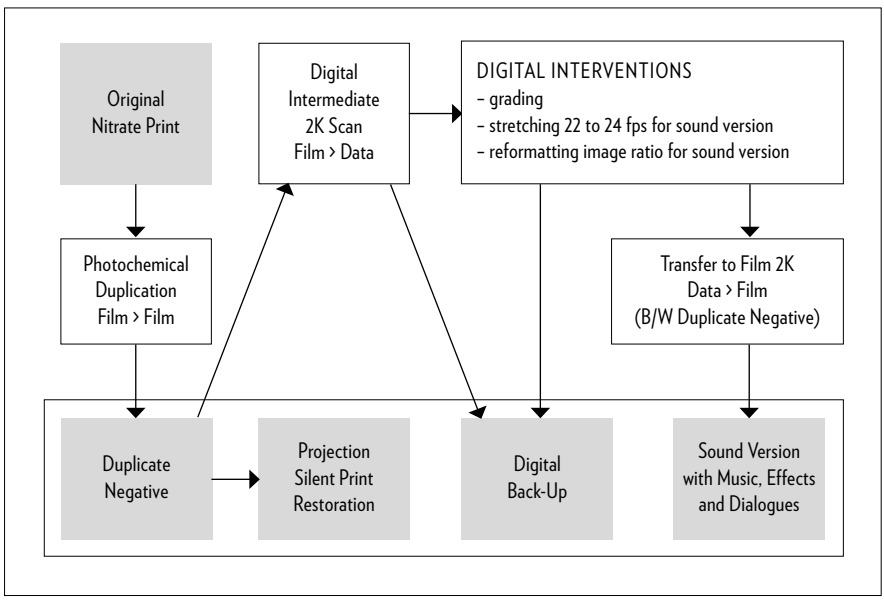
Read explains how the stretching process was approached:

> As we were working to a VHS that was already being used to create synchronous music and effects, we also imported this "offline" VHS image into the Inferno [i.e. the software used for image manipulation]. With all the material available [film and video images], the two sets of pictures were run in parallel so that any scenes and [title] cards that had been removed could be matched on the new data, and the extended running time could be precisely matched.[252]

Based on this comparison it was concluded that the speed changes were not uniform throughout the film. In order to create a perfect match the following procedure was used:

> The VHS image was cut into several approx. 5,000 frame sections, and each section of the new data was matched with the offline. From this, it was possible to calculate the additional time, and therefore the number of frames, required. The Inferno calculated the frame repetitions needed

Restoration workflow of *Zeemansvrouwen* (Henk Kleinman, NL, 1930).



> (for example one section needed a new frame every seven alternating with every eight), and carried out the addition. As a final check, the new data was played out to Digi Beta (PAL resolution) and the playout and offline were run in parallel through a vision mixer to create a split screen image and recorded this on another videotape. Each section matched at beginning and end perfectly but due to some omitted frames there was a maximum drift of three frames at one point.[253]

When the correct match was obtained, the film was printed back on film negative. In the meantime, the soundtrack had been mixed with the dialogue and the sound effects created by Vrienten. The final mix was printed on film creating a Dolby Digital optical negative soundtrack to be printed together with the image negative produced by Digital Film Lab. The result had to be a projection print with synchronic image and sound. This print was made by Haghefilm and delivered to the Filmmuseum just a few weeks before the premiere planned during the Filmmuseum Biennale in April 2003. The result was stunning, not only because sound and image matched perfectly (an easy goal to set but quite a challenging result to achieve) but also because the new sound and, especially the new dialogue, suited this seventy year-old silent film quite well.

Based on the enthusiastic response by the Amsterdam audience during the Biennale, the many following screenings at Eye Filmmuseum, and by the press, the experiment was considered a success. Also, a year later, the sound version of *Zeemansvrouwen* was shown in Los Angeles at the Academy of Motion Picture Arts and Sciences' Samuel Goldwyn Theater and, from there, at many venues in the USA and Canada in the frame of a tour of recently restored Dutch films organized by Eye Filmmuseum and UCLA. During this American tour, most reactions to the sound version of *Zeemansvrouwen* were quite enthusiastic.

While some fellow film archivists raised the question of whether a film archive should be the promoter of such an experiment, most reactions were not against the creation of an alternative version of *Zeemansvrouwen*. I must admit that, at the time, I was expecting many more critical, and even negative, reactions. But there should be no misunderstanding: this was a new version and not a restoration. Probably, since *Zeemansvrouwen* was an unknown title to most before the sound version was made, few people felt like objecting to the initiative of Eye Filmmuseum. In the end it was also a way to present the film to a larger audience. In the case of a well-known title, the reactions might have been different.

The sound version of *Zeemansvrouwen* is an eloquent example of Eye Filmmuseum's presentation policy, in line with the "film as *dispositif*" framework. It is from this perspective that the film was chosen as the centerpiece of the

first edition of the Filmmuseum Biennale in 2003. The film can have various lives: it can be shown with live music accompaniment in a cinema that has been preserved from the silent days, like the Parisien theater at Eye Filmmuseum, and it can be shown in a new theater equipped with a Dolby Digital soundtrack as a sound film.[254] Note that *Zeemansvrouwen* was also shown on television and that it will be made available digitally (both the silent and the sound versions) in the context of the project *Images of the Future*, discussed in the previous chapter.

The sound version of *Zeemansvrouwen* is also a good example of the remediation concept, as it has been refashioned via digital into a quite different medium. It can be argued that the final result was a traditional film as was its original nitrate artifact. On the other hand, the complete workflow was conceived based on the possibilities offered by digital, both for image and sound. Probably today, and definitely tomorrow, the sound version of *Zeemansvrouwen* is going to remain in the digital domain and is going to be shown as a digital projection. This will make the remediation process complete.

But *Zeemansvrouwen* could also be associated with the "film as state of the art" framework. Similarly to the restoration of *The Matinee Idol*, in this case also an unknown territory of film technology was explored, although with different goals. The sound version of the last Dutch silent film is a film that never existed before, other than, maybe, in the director's initial plans. From this perspective, not only the limits of the technology were challenged but also those of film restoration ethics. Indeed, in contrast with all the other cases discussed here, the sound version of *Zeemansvrouwen* has led not only to a new *dispositif* but to a completely new version of the film. From this perspective, *Zeemansvrouwen* is the only film discussed here that the film archivists would not consider a restoration. But again, as pointed out earlier, the restoration version of *Zeemansvrouwen* also exists, carried out according to the "film as original" framework.

4.5 *BEYOND THE ROCKS* (USA, 1922 AND NL, 2005): "FILM AS *DISPOSITIF*," CONVERGENCE/DIVERGENCE

The long lost *Beyond the Rocks*, directed by Sam Wood in 1922 and starring Gloria Swanson and Rudolph Valentino, was found by Eye Filmmuseum in 2004 and was restored in 2005. Both digital and photochemical techniques were used for this restoration project, which resulted in the production of seven different versions, namely two silent restoration film versions, two sound distribution film versions, one sound distribution digital version, and two DVD versions with two different soundtrack options.

The news of the retrieval and restoration of this title has traveled across the globe. The different versions of the film have been shown at several festivals and in hundreds of venues in Europe, North and South America, Australia and Asia. Such wide theatrical distribution, together with the DVD release and the television broadcasts (on Turner Classic Movies and on Dutch public television), made it possible to reach a much larger audience than the quite specialized one that is usually exposed to silent films. Obviously, such a wide exposure has opened the forum for an unprecedented broad discussion on film restoration. The discussion focused, on the one hand, on the new possibilities given by technology and, on the other hand, on the ethical issues related to its application. Some of these ethical issues will be discussed below while describing the restoration of *Beyond the Rocks* and the decisions taken along the way. It should be remembered, as mentioned in the introduction to this chapter, that the discussion of this case will be more detailed compared to the previous ones since I was supervisor of the restoration and one of the digital restorers of the film and, therefore, I have access to more information and technical details.[255]

Beyond the Rocks (Sam Wood, USA, 1922) was found among these cans. Image of the collection when it arrived at the archive. (Courtesy of Eye Filmmuseum).

Until 2004, *Beyond the Rocks* was one of the many silent films considered lost forever. Between 2000 and 2004, an almost complete nitrate print of the film resurfaced, literally reel by reel, at Eye Filmmuseum. The film was held in several unlabeled cans scattered throughout a large film collection donated to Eye Filmmuseum by the family of a Dutch film collector, after his death in 2000 (see figure page 236). It took more than three years for Eye Filmmuseum, under the supervision of researcher Elif Rongen-Kaynakçi, to register and identify this large collection and with it all the reels of *Beyond the Rocks*. The nitrate print, in the end, turned out to be almost complete, with only a few frames and shots missing. Remarkably, only two minutes of the recovered film were damaged beyond restoration and the overall state of the nitrate was relatively good.

The valuable collaboration with the University of Texas, Harry Ransom Research Center, where the Gloria Swanson Collection is held, and the Margaret Herrick Library, at the Academy of Motion Picture Arts and Sciences, which preserves the Paramount Scripts Collection, helped Eye Filmmuseum to reconstruct the film editing and its title cards.

ING Real Estate financially supported this restoration project, and it was carried out in collaboration with Haghefilm laboratories. From the very beginning, it was decided that not only would the film be restored to its original silent version, but that a version would also be produced with a newly composed soundtrack, written and performed by the Dutch composer Henny Vrienten. The collaboration between Eye Filmmuseum and Vrienten had led already in the past to the realization of a few soundtracks for video and DVD releases of Dutch silent films, along with the score for the sound version of *Zeemansvrouwen* discussed earlier.

The first digitally restored sound version of *Beyond the Rocks*, carrying the Dutch title cards that were found in the nitrate print, premiered in Amsterdam in April 2005 during the Eye Filmmuseum biennial festival, the Filmmuseum Biennale. A second sound version was shown in May 2005 at the Cannes film festival in the Cannes Classics selection; for this version more digital restoration had been applied to the image (i.e. more scratches were removed) and new English title cards, based on the continuity script, had replaced the Dutch ones. In July 2005, the restoration version was shown at the festival Il Cinema Ritrovato, held each year in Bologna. Both the sound and the silent restoration versions were shown at the Le Giornate del Cinema Muto in October 2005.

Beyond the Rocks has been by far the most ambitious restoration and distribution project carried out by Eye Filmmuseum, in terms of investment, exposure and techniques employed. The whole project cost around 200,000 euros, including the costs for the analog and digital restoration process, the new preservation film elements, the distribution film prints, the realization of the

new soundtrack and the digital masters for digital projection, DVD and broadcasting. The cost of the restoration alone was about half of the total amount. It should be noted that the average cost of a photochemical restoration for a feature-length silent film, with a running time of 90 minutes (that is a length of about 1,800 meters) would today be about 30,000 euros, less than a third of a digital restoration. Nevertheless, as discussed earlier, a solely photochemical process could have never given results comparable to those obtained by also applying the digital. Let us look at the restoration process step by step.

Once the nitrate print was recovered and inspected, the first step for its preservation was to reconstruct the correct editing of the film. As mentioned above, this was made possible thanks to the availability of the original continuity script, kindly provided by Margaret Herrick Library at the Academy of Motion Picture Arts and Sciences, with Paramount's permission. After minor re-editing, the nitrate print was sent to the laboratory, in this case Haghefilm laboratory in Amsterdam. There, the nitrate print went through careful inspection and physical repair. Every single joint, tear and sprocket hole was inspected and, where necessary, repaired by hand. Subsequently, the nitrate print was carefully cleaned. After repairing and cleaning, a one-to-one photochemical duplication of the nitrate print was made to produce a black-and-white duplicate negative. This negative serves as the preservation element of the nitrate print before any kind of digital interventions are carried out.

Before digitizing the nitrate print, a series of RESOLUTION tests were performed to establish the necessary RESOLUTION and BIT DEPTH for capturing all the details of the print in the scan. Based on the tests, it was decided to scan the nitrate print at so-called 2K RESOLUTION (i.e. 2048 x 1556 pixels per frame) and at a COLOR DEPTH of 10-bit logarithmic. The scan was carried out at Haghefilm laboratory, using an Oxberry scanner equipped with a WET GATE. Due to the fragility of the material, the scanning process had to be carefully supervised and often the film had to be fed manually into the scanner's gate.

For the digital restoration of a film, every single frame is typically stored as a separate file. In the case of *Beyond the Rocks*, 80,000 files were produced, accounting for a total of more than 1 terabyte. The files were subsequently imported in the restoration software Diamant. Note that, during digital restoration, a temporary storage of about five terabytes was needed, more than four times the size of the scanned film. The digital image restoration process included image stabilization, de-flickering and dust removal.[256]

Digital stabilization was needed because, mainly due to the shrinkage of the nitrate print, the image often shook on the screen during projection. It is now possible to correct this instability with digital tools, as described in Chapter One. Still, the restorer's goal should not be that of total stabilization. As opposed to contemporary films, film-born films, especially silent ones, have

never been "rock steady." Also, for *Beyond the Rocks*, a slight image instability was preserved, which replicates the original appearance of the film in projection.

Some of the scenes also suffered from quite heavy flickering, i.e. the instability of light within the same shot. After a set of reference frames was chosen, shot by shot, the Diamant software averaged all the frames accordingly. As in the case of stabilization, the choice was not for a complete un-flickering but rather for a lower level of flicker, typical of film projection and not disturbing for the eye.

Dust removal (also known as scratch removal), discussed in Chapter One, was also largely applied. Before digital tools for restoration were developed, it was possible to remove only superficial scratches that had not reached the image via WET GATE duplication. When a scratch has removed part of the original image from one or more frames, the only option is to recreate the missing part in the digital domain. This is possible by copying it from the previous or the following frames. Dust removal is a very powerful tool but also the most delicate to apply. A film consists of several thousands of frames, each one containing hundreds of scratches as a result of heavy use and decay. Only an automated filter can tackle such an enormous number of corrections. Since computer software can easily misread the image and, by mistake, remove part of it as a scratch, constant supervision is required and, when necessary, software mistakes must be corrected by the restorer.

The illustrations in the color insert (figs. 21, 22, and 23) show how moving objects, such as the dog in this sequence, can be easily misinterpreted by a dust removal filter. In the example, parts of the dog have been erroneously removed together with real scratches and similar damage. There are two ways to approach this problem: either to undo the automatic correction locally, or to protect in advance all the areas at risk by applying masks, so-called regions of interest or ROI. The latter is a more efficient solution as it saves unnecessary rendering time.

Once stabilization, de-flicker and dust removal were carried out, there was still much damage in the image that needed to be addressed manually. Diamant, as with most software for digital restoration, includes tools for correcting damage, such as tears or patches, individually. When *Beyond the Rocks* was restored, in 2005, the only available tool for this in Diamant was the interpolation tool. As shown in the illustrations (figs. 24 through 27 in the color insert), in these cases the missing image information was reconstructed by mixing the previous and the following frames, only in the place of spots, scratches or patches.

An extreme example of a digital intervention is shown in the illustrations (figs. 28 and 29 in the color insert) where a completely new image was created

Example of nitrate deterioration to a point beyond restoration (*Beyond the Rocks*, Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

which did not exist before and which we can only assume to be very similar to the one that was heavily damaged. From a restorer's perspective this is an ethically questionable intervention. Most restorers, though, will accept it as long as it is well documented and it supposedly does not distort the original appearance of the film.

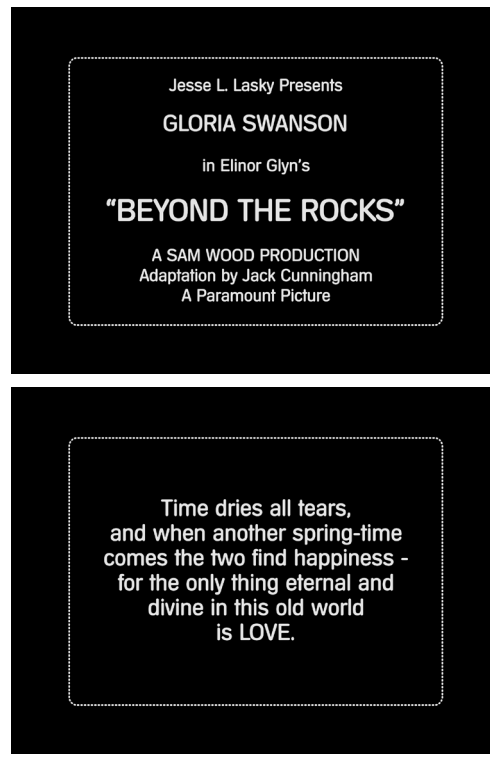
Only two sequences of the nitrate print were so severely damaged by chemical degradation that it was impossible to recover the image significantly (see examples below and in the color insert, figs. 30 and 31). It was decided to keep these two sequences in the restored version anyway, as the narrative in these damaged fragments was still clear enough to preserve continuity.

Once the digital restoration was completed, the whole DIGITAL INTERMEDIATE needed to be graded to establish the correct printing lights for the entire film. GRADING was carried out at Haghefilm and the final result was approved by Eye Filmmuseum before printing the graded data (i.e. the DIGITAL INTERMEDIATE) on black-and-white negative (in this case film stock 5234 Kodak was

used). Re-recording back to film was done on an Arrilaser machine at a RESOLUTION of 2K, the same used for the scan.

It was decided to simulate the original tinting effects present on the nitrate print photochemically. This was achieved by applying the Desmet method during the printing of all projection prints produced for this film.[257] Projection prints were printed on a particular color film stock, namely the Agfa CP30, as it gave the best results, based on a series of tests.

New English title cards that were missing in the Dutch version were created for the silent restoration version, following the continuity script. Missing a reference for the original style of the English title cards, and since the Dutch titles were too plain compared to those of studio productions from the time (often including artwork), it was decided that a modern style should be used (as shown below). In this way a contemporary audience would not be tricked into thinking that the title cards were original or based on an original reference. This is again a controversial choice since it influences the overall reception of the film, considering that title cards are an integral part of the whole. From a conservative perspective, only the restoration version with original



Examples of new title cards made for the restoration of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

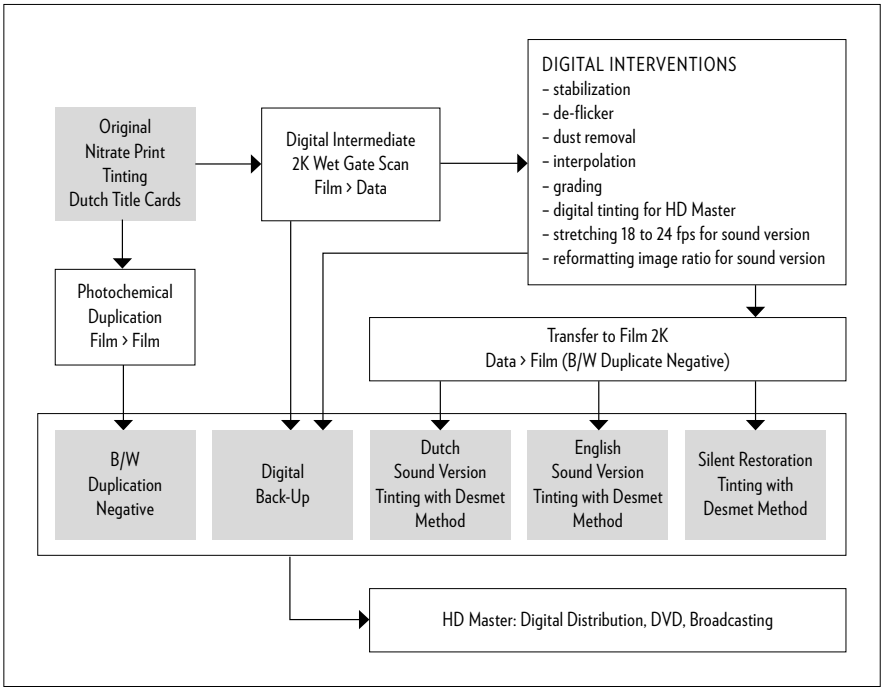
Dutch title cards would be considered the restoration of what the film had been when shown to a Dutch audience at the time of the original distribution. The English version with newly made title cards could be considered, from this perspective, no less "tampered with" than the version with added soundtrack discussed below.

As mentioned earlier, besides restoring the film to its original silent version, Eye Filmmuseum decided also to produce two distribution versions of *Beyond the Rocks* with a new soundtrack by Dutch composer Henny Vrienten, one with the original Dutch title cards and one with the newly made English title cards, based on the original continuity script.

Vrienten's soundtrack, although definitely less intrusive than the one he created for *Zeemansvrouwen* (where, as discussed earlier, even dialogue was added), was still the subject of much criticism from within the archival community. Indeed, although the score was widely appreciated, the sound effects (such as opening doors, barking dogs, and such) became the main point of criticism from colleague archivists and scholars. As mentioned earlier, it is quite interesting to notice that what was considered acceptable for an unknown title such as *Zeemansvrouwen*, became the topic of fiery discussions within the film archival field in the case of a much more popular title like *Beyond the Rocks*. Mainly for this reason, Eye Filmmuseum decided to add an alternative sound option to the DVD edition where sound effects are reduced and well integrated in the score. Nevertheless, both of these versions, as well as the other five, are still very much in line with the Filmmuseum's policy of creating presentation versions of silent films meant for a contemporary audience, and they all fit in what has been earlier defined as the "film as *dispositif*" framework.

Although the workflow described above was used for both the silent and the sound versions, some extra steps were needed for producing the sound versions and the digital master for the DVD and for broadcasting. For the production of the sound version an extra digital step was needed together with the production of a separate negative for the sound version. Besides the new film negatives (silent and sound), from which the silent restoration and the new sound version were made, a HIGH DEFINITION tape was also produced directly from the restored data, as a master for the digital projection, the production of a DVD, and for television broadcasting.[258]

The two most intrusive interventions were done to convert an originally silent film into a sound version. Two modifications were needed for the purpose: first, stretching the film from its original frame rate of 18 frames per second to the standard sound frame rate of 24 frames per second; secondly, the film's full frame had to be reformatted to a smaller size, the so-called Academy format, in order to make space on the left side of the image for the soundtrack. Both these, discussed earlier with regard to *Zeemansvrouwen*, are



Restoration workflow of *Beyond the Rocks* (Sam Wood, USA, 1922 – courtesy of Eye Filmmuseum).

at the moment the only ways to add a soundtrack to a silent film and to make it projectable (as film) in any commercial cinema. When digital projection is more wide spread, the need to stretch a silent film to show it in regular cinemas will not be necessary anymore. In fact, this is still a controversial point of discussion, as mentioned in Chapter One, as Hollywood studios' DIGITAL CINEMA INITIATIVES (DCI) and the SMPTE have set the standard projection speed for DIGITAL CINEMA at 24 frames per second.

Technically, the stretching could have been done in two ways, either by creating new frames as interpolations of the existing ones or by doubling existing frames. Based upon test results, in the case of *Beyond the Rocks*, the latter was chosen as interpolation led to the creation of weird looking frames that were not acceptable. On top of that, from an ethical perspective, creating new frames, even though by interpolation, means adding images to the film that have never been there and could easily be mistaken for original frames. If badly documented, these interventions could also become irreversible. Differently, the stretching process that was chosen in the end, namely to double every third

frame of the film, going from 18 to 24 frames per second (i.e. 123345667899...), is both detectable and reversible. The drawback of this choice though is that a stuttering effect can be noticed in projection. In reality, only an expert eye will notice the stutter, which becomes more visible in combination with lateral movement within the image and with panoramic shots.

Finally, a different path for simulating the original tints was followed in the creation of the HD master meant for the digital projection, the DVD release and the television broadcast. As the Desmet method, a photochemical process, was used for making the film prints, a digital process had to be applied for making the digital versions. Here color filters, simulating the original tints, were added digitally to the black-and-white digital image.

The project of *Beyond the Rocks* is a good example of the application in practice of the "film as *dispositif*" framework in line with Eye Filmmuseum's policy for presentation and distribution. The film has been shown within a reconstructed original setting (i.e. in the 1921 Tuschinski theater in Amsterdam) but with a newly composed musical score and not-original *apparatus* (i.e. a sound print instead of live music accompaniment); as a digital projection in several cinema's across the Netherlands; as a DVD with two different soundtrack options (i.e. with and without sound effects); as a television broadcast; and, finally, as a sound film with live accompaniment at two festivals, Il Cinema Ritrovato and Le Giornate del Cinema Muto.

The case of *Beyond the Rocks* also shows more than any other case discussed in this chapter how users, with the turn to digital, are gaining a growing level of inclusion in the film archival technological frame, to use SCOT's terms. A film like *Beyond the Rocks*, thanks to the great popularity of its leading actors, especially that of Valentino, belongs to the audience. Once the retrieval was announced, the expectation of being able to see the film instantly grew high everywhere. This clearly influenced the restorers, also with respect to the choice of using multiple *dispositifs*. And, in turn, it is thanks to its multiple *dispositifs* that the restoration of *Beyond the Rocks* has reached many more users than restored silent films usually do.

Beyond the Rocks, though, is also a project where the "film as original" framework has been put into practice. The original artifact has been duplicated one-to-one photochemically, to make sure that this unique print of the film could be preserved as it was found, even if the nitrate original would be damaged beyond recovery. Also, all the possible "originals" have been restored, that is both the Dutch release version, with Dutch title cards, as it was found by Eye Filmmuseum, and the American release version, with English title cards, based on the continuity script. If only these two versions had been restored, the "film as original" framework should have been considered the leading one in the project.

The project of *Beyond the Rocks* is also representative of convergence/divergence as everything that film technology could offer in 2005, on both photochemical and digital fronts, was tested and, in most cases, used for making one of the seven versions that exist today. In line with Haghefilm's practice, as discussed in Chapter Three, digital and photochemical tools were adapted in order to duplicate the fragile unique nitrate print. For instance, a state-of-the-art digital scanner was equipped with a traditional WET GATE and it was fed manually, frame by frame, in order to capture as many details as possible from the seventy year-old film. The restoration in the end has been a compromise between what could be done to make the film cleaner, more stable and more pleasant to the viewer's eye, what was affordable, and what would have made it look as close as possible to the original. In contrast to *The Matinee Idol*, for instance, the restoration of *Beyond the Rocks* still shows image damage, as approximately only half of the defects were digitally corrected. If the technology and the means had allowed it, though, at least one of the versions would have been completely cleaned from damage, placing this restoration also within the simulation concept.

4.6 *WE CAN'T GO HOME AGAIN* (USA, 1973 AND NL/USA, 2011): "FILM AS PERFORMANCE" AND REMEDIATION

Best known for classic Hollywood titles such as *Rebel Without a Cause* (USA, 1955) and *Johnny Guitar* (USA, 1954), Nicholas Ray made *We Can't Go Home Again* between 1971 and 1972 when he was hired to teach filmmaking at Binghamton University's Harpur College in upstate New York in the fall of 1971. A collaborative effort between Ray and his students, the making of the film began as a class project but was never completed. To learn hands-on the different aspects of film production and post-production, students rotated through different jobs, making the project as much about the process of making a film as it was about the students themselves. The making of *We Can't Go Home Again* eventually outgrew its original academic scope and Ray and his most engaged students moved off campus to continue working on it.

Characterized as highly experimental, the film contains multiple images throughout most of the film. In fact, the 90-minute version of the film contains approximately four hours of footage that runs concurrently on-screen, split into two to sometimes six images at a time. Shot in different formats (i.e. 8mm, 16mm, 35mm, and video), the film also includes visual effects created by Nam Jun Paik's video synthesizer. In Ray's own words, *We Can't Go Home Again* "[...] is a depar-

ture in filmmaking, a multiple-image show, making use of Nam June Paik's video synthesizer and resting on the concept that we don't think in straight lines, and that the celluloid strip recognizes neither time nor space, only the limit's [sic] of man's imagination" (Ray, 1995: 204).

All in all, approximately forty hours of footage was shot for the project. This material was preserved throughout the years by The Nicholas Ray Foundation, housed at various archives and commercial storage facilities around the world. It was only recently that this unique collection found a new home at the Harry Ransom Center in Austin, Texas.[cliii]

Although the film was never finished, it was never abandoned either. Ray edited and imagined many different versions together with some of his most loyal former students, who kept in contact with Ray's widow, Susan Ray, and continued discussing the project even after the director's death in 1979. They each had their own opinion about how the film should be edited, restored, and screened. One version was shown at the Cannes Film Festival in 1973, which, for practical purposes, will be referred to here as the "Cannes version"; whereas, a later shorter version, the so-called "1976 version" was released three years later. Both versions derived from the same 35mm negative and were shown as 35mm prints. These are the only two versions (with just a couple of surviving prints between them) which have been screened at *cinémathèques* and festivals in the four decades between the theatrical release in Cannes and its restoration in 2011. Additionally, there is at least one recount by film critic Jonathon Rosenbaum of a private screening of the film at the Cinémathèque Française on April 9, 1973, where the footage was projected simultaneously in the various original formats (8mm, 16mm, 35mm).[cliii]

Bernard Eisenschitz, who has written extensively about Ray, refers to *We Can't Go Home Again* as a "work in progress" and writes that "[a] first, hastily assembled version was shown at the end of the 1973 Cannes Film Festival. [...] Ray moved from Amsterdam to New York to San Francisco to Houston and back to New York, working away on *We Can't Go Home Again*, of which a shorter version, with his own narration, was prepared in 1976" (1995: xlvii-xlviii).

The restoration of *We Can't Go Home Again* was realized between 2010 and 2011 by a team composed of members of The Nicholas Ray Foundation, the Academy Film Archive at the Academy of Motion Picture Arts and Sciences, and Eye Filmmuseum.[cliv] The laboratory work on the image was carried out at Cineric in New York City and the reconstruction of the soundtrack at Audio Mechanics in Burbank, California.[clv]

The reasons why these three institutions teamed up to restore *We Can't Go Home Again* are manifold. Film restoration not being a core activity of The Nicholas Ray Foundation, its president, Susan Ray, had been looking for partners and funding for many years. Meanwhile, they had tirelessly gathered and preserved all the footage shot for the film as well as all related documentation, including writ-

ten and recorded comments by Ray about the film and possible ways to edit and present it. Susan Ray, who was Ray's partner for the last part of his life, including the years he actively worked on *We Can't Go Home Again*, has a profound and personal knowledge of this work. She had also kept in close contact with many of the students who had originally worked on the film with Ray; they too were very invested in the film and were eager to see it restored.

In 2010, after being prompted by Susan Ray, then director of the Venice Film Festival, Marco Müller, approached Eye Filmmuseum about this project as he and Susan were planning to show a restored version of the film in Venice in 2011 to commemorate the centenary of Ray's birth. In one of the film's rare screenings before its restoration, *We Can't Go Home Again* had been shown at the International Film Festival Rotterdam in 1991. Eye Filmmuseum felt that this film had a relevant connection with Dutch film culture; furthermore, as an experimental film it perfectly complemented one of Eye's core collections: the international avant-garde film collection. While Eye's restoration policy gives prominence to the version as intended by the author, it is also open to experimentation with new ways to present restored films in line with the "film as *dispositif*" framework, as discussed in Chapter Three.

Shortly after the first contact between The Nicholas Ray Foundation and Eye Filmmuseum, the Academy Film Archive was approached as crucial material for this title was held in their collection. Established in 1991, the Academy Film Archive is committed to the preservation and restoration of Academy Award-winning film titles (i.e. Academy Award-winning films in the Best Picture category, all the Oscar-winning documentaries, and many Oscar-nominated films in all categories), as well as related collections, including work by Oscar-winning directors as in the case of Nicholas Ray. As underlined by its Director Michael Pogorzelski, the Academy Film Archive takes "this mandate to be wonderfully broad, enabling the archive to preserve nearly every type of filmmaking: animation, feature films, short films, documentaries, avant-garde and experimental films, technical tests and even amateur and home movies."[clvi] Maintaining the original version of a film as the author intended serves as a guiding principle for the Academy Film Archive. Prior to this partnership, The Nicholas Ray Foundation had already deposited the negative of the Cannes version with the Archive.

Starting in the spring of 2010, the restoration project's first item on the agenda was the issue of what essentially should be restored. As the project had never been finished, Susan Ray and some of Ray's former students wondered if the restoration would benefit from the use of the raw source material they had carefully preserved all those years. This approach would guarantee a better photographic quality than either the Cannes or the 1976 version could provide; furthermore, parts that were omitted originally due to lack of time, money, and technical resources could now be included.

The restoration team realized early on that, while there were two existing prints

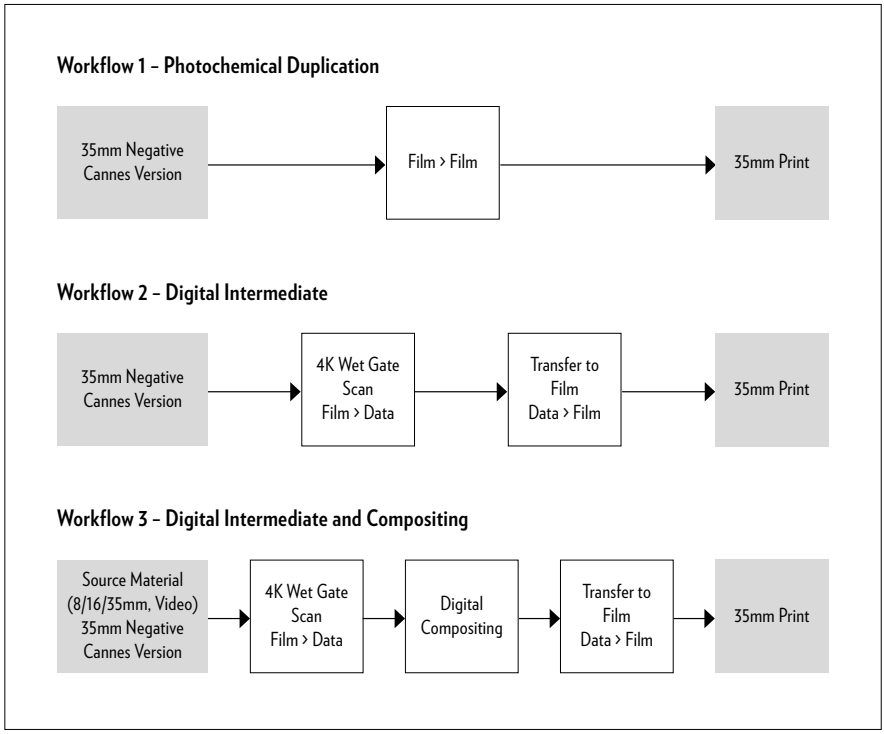
of the film that had been screened to the public – the Cannes and 1976 version – only the Cannes version was complete. Hence, it was decided that the Cannes version would serve as main reference in terms of image composition and editing. For this version, Ray and his students had created a new negative and print using a rear-projection technique. A camera was placed in front of the screen while the different elements composing the image were projected from the back. Keeping the elements in different formats (8mm, 16mm, and video), he projected them in various positions and combinations against a 35mm matte, integrating them into one image. (For an example of the image composition, see figure 32 in the color insert).

Before making any further decisions on the restoration workflow, it was decided to first carry out a number of technical tests to get a better understanding of the different options available for the restoration of the image in terms of workflow, photographic results, and costs. Based on previous experiences of the Academy Film Archive and Eye Filmmuseum, it was decided to commission Cineric in New York to work on this restoration.

In order to bring the film back to a form as close as possible to the original, three tests were carried out on two short sequences of the film. These samples would then be compared in projection to assess which workflow would be the most viable option. The first test concerned a fully photochemical duplication from the 35mm negative on deposit with the Academy. This fully analogical workflow, by far the most straightforward option, entailed making a new 35mm positive copy from the 1973 35mm negative of the Cannes version. While the duplication's WET GATE printing process was able to remove most superficial damage, it could not repair the damage to the emulsion or the duplicated damage of the 35mm Cannes negative. Having only to deal with analog corrections to the color GRADING and possibly a few digital inserts to replace either too damaged or incomplete frames, this workflow would be the least labor intensive, the least expensive, and would cause the least interference.

The second test also used the 35mm Cannes negative as source material; but, unlike the first test, the workflow was fully digital. The negative was digitized at 4K RESOLUTION using an Oxberry scanner equipped with WET GATE, allowing for the removal of the most superficial damage while reducing the work to be done digitally. Following the digital-image restoration process, the data was re-recorded onto a new negative from which a projection print was made to be compared to the other two test prints. By using the DIGITAL INTERMEDIATE process as described in Chapter One, this workflow's main advantage was that image and color could be digitally restored in a more extensive way than with photochemical tools. In addition, the resulting data could be used to create DCPs or other digital formats.

Finally, the third and most complex test included the use of digital COMPOSITING to recreate the multiple images from the different source material (8mm, 16mm, 35mm, and video). In those cases in which the original material was missing,



Comparison of three possible restoration workflows for *We Can't Go Home Again* (Nicholas Ray, USA, 1973).

the 35mm negative of the Cannes version was used to fill in the missing parts. In this case, by digitizing the source material at 4K, the most detailed and less damaged images were available. As in the previous test, the result was printed back on film and compared to the other two tests.

As could be expected, the results of the first two tests were similar. Although the first test was done photochemically and the second via a DI process, the source material – the negative of the Cannes version – was nonetheless the same.

However, the result of the third test was strikingly different. Whereas the source material for the first two tests was the Cannes negative which resulted from a rear-projection technique, as described earlier, the source material of the third test was the original footage from which the Cannes negative was assembled in the first place. By directly digitizing the original footage, the loss in image definition inherent to the rear-projection technique could be avoided, which led to a digitally composited image with significantly more details. Moreover, all the damage that had occurred during post-production (editing the footage before projecting it on

the screen for the rear-projection process) was not duplicated in this test. The following figures compare the results of the second and third test. As can be clearly seen, the test results of workflow three (figs. 34 and 36) show more details in the darker parts of the image, which affects the overall image composition.

Comparing the results of the second and third test, the issue of the ultimate aim of the restoration was raised once more. In the results of the third test so much more was visible in the image that it felt like watching a different film. All the details in the darker background that had disappeared in the Cannes negative were now front and center, drawing attention away from the main characters in the foreground. This is clearly illustrated by figures 33 through 36 (in the color insert). In the second test results, Ray and his students emerge as almost stylized characters in the Cannes version (figs. 33 and 35); whereas in the third test results, they are all of a sudden immersed in an everyday film-school situation. Another remarkable difference, which could only be appreciated while watching the comparison projected on the screen, was the clean aspect of the third test results when compared to the dirtier look of the first two test results. Indeed, the Cannes negative conveyed all the signs of its film production history: Ray and his inexperienced students assembling footage in precarious conditions. As a consequence, scratches, finger prints, bad splices, and other signs of defect were left on the footage used to make the negative of the Cannes version. These defects might have been unintentional at the time but have nonetheless become part of the film's history and aesthetics, forever inscribed in its handcrafted, collaborative, and experimental look. In this line, discussing the restoration of experimental films, Bill Brand points out that, "it is essential for the preservationist to understand the history, context, and materials of the original production to make critical decisions about [...] qualities considered defects in conventional films" (2012: 94).

After screening the tests, it was decided that the overly pristine look that resulted from the third test did not suit the team's intention of restoration. Rather than removing all those features that gave the film its "handcrafted" look, the team agreed to tackle defects caused by wear only (such as scratches, tears, and blotches), while leaving traces of the students' production process untouched. As most of those features had disappeared in the third test, it was decided to use the Cannes negative as main source and reference. And as the benefits of a digital workflow outweighed those of a photochemical one, the second workflow was chosen to restore the film.

The restoration of the image, carried out by Seth Berkowitz (Cineric) and supervised by Anne Gant and Giovanna Fossati (Eye Filmmuseum), became a balancing act between cleaning up defects and damage while maintaining the original "handcrafted" quality. By cleaning up the visual interference where it obscured the context of a scene and leaving the marks of the original filmmaking approach in many other instances, the team felt that the restored version would still be true to its original

screened version (specifically, the Cannes version) but would also bring this restoration closer to its makers' intention by erasing some of the most distracting damage.

Following agreed upon protocol, most of the tears, line scratches, and cue dots were removed, while grease pencil marks, finger prints, and tape splices in the original 16mm footage (recorded onto the Cannes negative) were left untouched. In addition, a large recurring white flash at the bottom of the screen, caused by a splice in the rear-projection loop during the recording of the Cannes negative, was removed. (For before and after examples, see figs. 37-40 in the color insert).

A similar approach was followed in the GRADING process, which was carried out by Daniel DeVincent (Cineric) and supervised by Anne Gant and Giovanna Fossati (Eye Filmmuseum). While the color fading of the Cannes negative was corrected, the characteristics of the original photography were left as is, including the imbalance in the color GRADING, exposures, and focus of the multiple images. (For before and after examples, see figs. 41-42 in the color insert).

Carried out by John Polito and supervised by Heather Linville (Academy Film Archive), the audio restoration took place at Audio Mechanics, Burbank, California. According to Linville, the primary source for the audio restoration was the 35mm three-channel magnetic track used for the Cannes version. As the track was in excellent physical condition, a limited amount of intervention was necessary; only minor distortions such as crackle, static, and hiss were removed. Additionally, given that a majority of the final audio mix was found in only one of the three channels of the magnetic track, minor cross talk or audio bleed through onto the two unused channels was also removed as this distortion was audible during playback. In addition to cleaning up the soundtrack, much of the original recordings, such as missing sound effects and an opening monologue delivered by Ray himself which had not made the Cannes cut, were recovered.[clvii]

With the assistance and expertise of Susan Ray and one of Ray's former students, Richard Bock, the missing material was restored in the reconstructed soundtrack. Linville points out that:

> The final mix of the 1973 track has many characteristics that set it in line with qualities of its image counterpart. The editing and mix is rough, there are drop outs, missing lines and FX [sound effects] in addition to loose sync.[clviii]

Using the preserved 1973 version of the audio as starting point, Bock, Polito, and Linville identified areas where missing material could be added using the original recordings of the 1/4-inch-wide audio tape. They focused on areas where there was missing dialogue or missing effects, correcting lines of essential dialogue that were distorted in the final mix. Many of the additions were short audio recordings, like a line of dialogue or added ambiance to a scene of only dialogue. The only instance where a lengthy recording was used to replace the existing dialogue of the

Cannes version was the opening monologue narrated by cast and crew member Tom Farrell speaking simultaneously with a French translator. This monologue was later replaced with a narration by Nicholas Ray himself for the 1976 version of the film. As Ray always intended to use his own voice, the restoration team decided to substitute Farrell's voice with Ray's.[clix]

On September 4, 2011, the restoration of *We Can't Go Home Again* premiered at the 68th Venice International Film Festival in honor of Nicholas Ray's 100th birthday. The film was accompanied by the screening of Susan Ray's documentary *Don't Expect Too Much* (USA, 2011) on the making of *We Can't Go Home Again*. Alongside the theatrical DCP screening in the Sala Grande of the Palazzo del Cinema, the film was also shown the next day at the "Rebel" event, an art exhibition by American actor James Franco celebrating Nicholas Ray's *Rebel Without a Cause*. It was a collateral event of the Venice Film Festival and the Venice Biennale with installations by Franco, Douglas Gordon, and Harmony Corine, among others, curated by Dominic Sidhu and displayed on La Certosa (an island in the Venetian Lagoon not far from the festival's main location at the Lido).[clx] The inclusion of the film in this special exhibition is interesting in and of itself as it attests to the film's suitability to appear alongside media art installations. As discussed in Chapter Two, media art installations are often interpreted as performances. It stands to reason that their restorations and presentations are also approached from that perspective. At the same time, the exhibition of *We Can't Go Home Again* on La Certosa adds to its performance history: it was shown in a new way (a media installation), in a different context, and to a different audience (a Venice Biennale audience).

After these two premieres in Venice, the film screened at many festivals and *cinémathèques* around the world, both as DCP and print, including the New York Film Festival and the London Film Festival in 2011.

Based on the film's performance history and the possible options presented to the restoration team in 2011, it can be concluded that the restoration of the 1973 Cannes version is but one of several possible restorations that could have been carried out. While this can be said about all restorations, in this case especially, there were a number of different philological and technical solutions available. Furthermore, these were all justifiable from an ethical perspective and in line with the theoretical frameworks discussed in this book. Each solution would have led to a customized workflow and to a different result.

In a similar vein, it could be generally argued that each exhibition of a film should be seen as a different performance. The restoration of *We Can't Go Home Again*, in particular, can be associated with the "film as performance" framework as described in Chapter Two, as this film has never officially had a final version even before its restoration. By choosing the theatrical Cannes version as main reference for this restoration, the team had opted for the most traditional version of the film. Of course, due to practical reasons the choice was rather limited; after all, only

the Cannes version had survived through a complete 35mm negative, held by the Academy Film Archive, and one 35mm print, held by film critic and distributor Jos Oliver who had kindly loaned it to Eye Filmmuseum during the project. Although the latter showed signs of color fading, it nonetheless provided a good reference for the restoration. These reasons went hand in hand with ethical considerations, as the film archives involved in the restoration – Eye Filmmuseum and Academy Film Archive – hold on to the guiding principle that a restoration should aim at recreating a historical artifact; that is, a version of the film that has actually been shown to an audience. In that respect, it could be argued that, aside from the screened Cannes version, all other potential versions would have been no more than creative interpretations of what might have been shown (as in the case of the multiple-image projection recounted by Rosenbaum) or what might have been made by Ray and his collaborators had they had the chance to work on a "final version."

Finally, particularly relevant in relation to this restoration was the concept of remediation. In this project, the hybrid DI process was chosen to ensure image repair that would not have been possible with a purely analog workflow. Remediating the analog material by means of a digital process meant that the final result of the restoration could be both analog (resulting in the 35mm negatives and projection prints held by Eye Filmmuseum and Academy Film Archive) and digital (resulting in the multiple DCPs held by the three project partners and the DVD that was released by Oscilloscope in 2012). Alternatively, should the team have had access to detailed documentation of a multiple projection performance of the film and, therefore, have chosen to restore such a version (using the original multi-format footage; see workflow three as illustrated above), simulation would instead have been the leading concept. Indeed, in that case there would have been an attempt to simulate a possible original version of a specific performance by means of digital tools, similar to the case of the restoration of *Mahagonny*, discussed earlier in this chapter.[clxi]

CONCLUSIONS

The five case studies discussed in this chapter are very different from one other. They vary with respect to period, genre, popularity (both at the time of release and at the time of restoration), and historical and aesthetic value assigned to them within the film canon. They differ also as artifacts, some being unique surviving film elements (such as *The Matinee Idol*, *Beyond the Rocks* and *Zeemansvrouwen*), one existing in limited exemplars as in the case of *Mahagonny*, and one, *Dr. Strangelove*, existing in many different forms, from second choice duplicating elements to thousands of projection prints and video reproduc-

tions around the world. But the five cases also differ dramatically in the way they have been restored, in particular when considering, as I have done in this work, the approach by the film archive that led the restoration, the influence of the laboratory that carried it out and the technology applied.

In the previous chapters I have presented the technology available for film restoration at the time this study is written, and I have proposed the relevant theoretical frameworks and concepts and associated them with the practice of film archives and laboratories. In this chapter all these elements have come together in the discussion of five film restoration cases. Restoration projects are the place where theoretical approach and practical execution come to terms and, therefore, they offer the ideal framing to present such interaction. In this conclusion, I will compare the five cases in light of the theoretical frameworks and concepts. By doing so, I will show how it is possible to recognize a coherent theoretical approach behind the choices made along the way. In addition, I will point out how, by making different choices during the restoration, different frameworks and concepts could have come into play.

The "film as state of the art" framework, as defined in Chapter Two, has been identified with an impetus, present both in filmmaking and in film archiving, for pushing the limits of existing technologies in order to translate ideas into moving images (for filmmakers) and to realize restorations that are ever closer to the ideal image of what a film had once been (for film restorers). In Chapter Three, I associated Sony Pictures Entertainment with this framework, arguing that Hollywood studios are the example *par excellence* of the "film as state of the art" framework because they have a high degree of inclusion in the filmmaking field at large as their connection with, and influence on, film manufacturers and service providers is greater than that of other film archives. Over the past twenty years Sony, in particular, has led a consistent preservation and restoration policy by always using state-of-the-art technology, by pushing its limits and by being transparent about its work with the rest of the field.

Not surprisingly, the two cases I have associated with the "film as state of the art" framework, *The Matinee Idol* and *Dr. Strangelove*, were indeed restored by Sony (in the case of *The Matinee idol*, together with the Academy of Motion Picture Arts and Sciences). In the case of Capra's silent film, opting for a digital restoration in 1997 was undeniably a choice for pushing the technology beyond its known limits. Also, this restoration was carried out in a time when the film archival field (the archival technological frame, in SCOT's terms) was not quite ready to fully appreciate the importance of such a project. Indeed, its importance as a benchmark for digital restorations to come has been appreciated only retrospectively. Based on Friend's and Crisp's words, it is quite evident that this restoration has been an exploratory journey where the path to be followed was unknown before it was covered. Ten years later, although

digital tools for film restoration have changed enormously, the restoration of *The Matinee Idol* is still a valid result. A similar motivation stands behind the restoration of Kubrick's film; yet, since it is a completely different film than Capra's, it is also a very different case of "film as state of the art" framework in practice. The choice of a full 4K RESOLUTION workflow, although never done before for a black-and-white film, was much less of an unknown territory than in the case of a digital workflow in *The Matinee Idol*. What makes the restoration of *Dr. Strangelove*, in my view, a fitting example of the "film as state of the art" framework is the restorers' goal of creating a DIGITAL CINEMA version of the film that would look on the screen like the best surviving elements of Kubrick's film. This goal not only challenges a technology, that of digital projection, designed in the first place for new color films, in order to truthfully reproduce black-and-white archival films, but it also challenges film archives' still dominant notion that a restored film-born film should be shown as film. In *Dr. Strangelove*, although the restored data have also been printed back on film, both for long-term preservation as well as for projection, a digital master has been produced for presentation.[259] In this case the combination of the "film as state of the art" framework with the remediation concept makes of this restoration a new benchmark for the archival field. The case of *Zeemansvrouwen*, which has been associated with "film as state of the art" as a secondary framework, is quite different. Although in this case the restorers also explored an unknown territory of film technology for the purposes of restoration, the goal was very different, namely that of creating a new sound version. Historical silent images were matched with a newly composed score, sound effects and new dialogue. This version has been presented as a new version alongside the previously realized restoration. Still, this project challenged not only the limits of the technology, but also those of film restoration ethics. Diametrically opposed to the restorers' goal in the cases discussed above, here the film as it was originally made and as the director intended it, was transfigured into a new film.

The "film as art" framework, as has been argued in Chapter Two, functions mainly in association with avant-garde films and with *auteur* approaches. It is also closely related to a medium specificity argument, especially when the filmmaker/*auteur* is partial to a particular medium. In Chapter Three, Anthology Film Archives was discussed in relation to the "film as art" framework because of its devotion to (avant-garde) film as an art form. The restoration of *Mahagonny*, carried out by the Harry Smith Archives together with Anthology, has been treated earlier in this chapter as the only case primarily associated with the "film as art" framework. As the people responsible for this project have clearly stated, the restoration's goal was that of reconstructing one of Smith's performances of *Mahagonny*. It has also been argued that the

nature of this film, as avant-garde performance for a selective public, places this film closer to visual-arts than to cinema and, therefore, within the "film as art" framework.

The other cases associated with this framework, although secondary, are those of *The Matinee Idol* and *Dr. Strangelove*. In both cases the intent of the projects was that of restoring the directors' version. Also, in both cases, the status of the directors, Capra and Kubrick, as *auteurs*, has played quite an evident role in choosing the restoration strategy. For these reasons both restorations have also been associated with the "film as art" framework. However, they represent quite different cases from that of *Mahagonny*. For *Mahagonny*, restoring Harry Smith's version did not necessarily mean restoring the film as Smith had made it, but it rather meant restoring one of only ten performances the film ever had. Indeed, because of its performative nature, *Mahagonny* required a different approach from those of *The Matinee Idol* and *Dr. Strangelove*, which are both examples of commercial films with a broad distribution at the time of release. The main difference between these projects lies in the choice of *dispositif*. Whereas *Mahagonny*'s restorers chose to change the film's *dispositif* in order to recreate (one of) Smith's performance(s), the restorers of *The Matinee Idol* and *Dr. Strangelove* maintained the films' original *dispositif* as part of the filmmakers' intention.

The "film as *dispositif*" framework promotes the practice of showing films by way of different *dispositifs* than the traditional film projection in a cinema. Also, it has been argued that, because of the growing influence of film audiences or users, thanks to digital media, the framework "film as *dispositif*" is becoming ever more present within film archives. Eye Filmmuseum has been discussed, in Chapter Three, as the case of a film archive that, for many years now, has privileged the "film as *dispositif*" framework in its policy and practice. In this chapter, the two cases that have been associated with this framework are *Zeemansvrouwen* and *Beyond the Rocks*, both restored by Eye Filmmuseum. The case of *Mahagonny* has as well been associated with the "film as *dispositif*," but as a secondary framework.

The case of *Zeemansvrouwen* is actually more an example of presentation than of restoration, since the new sound version produced by Eye Filmmuseum in 2003 should not be considered a restoration. This case has been associated with the "film as *dispositif*" framework because the original *dispositif* as a silent film intended to be shown with live music accompaniment has been transformed into a different, more flexible one. Because of its new score and the new added dialogue, the new *Zeemansvrouwen* can be shown in a modern theater with Dolby Sound System. Also, it has been shown, probably for the first time, to a North American audience, and it has been broadcast for the first time on Dutch television. This new version has literally given a second

life to the film. Something similar applies to one of the several restored versions of *Beyond the Rocks*, the other case associated with the "film as *dispositif*" framework. Indeed, the sound version has reached a large audience around the world, being shown in many theaters, broadcast on television and released on DVD. By contrast, the silent version of the film has been shown with live accompaniment only a few times at specialized festivals. The reason why the case of *Mahagonny* has also been associated with the "film as *dispositif*" framework is not different in the intent, but rather that of reaching a broader audience. On the other hand, while in the cases of *Zeemansvrouwen* and *Beyond the Rocks*, reaching a broad audience corresponded with the original goal of those who made the films, in the case of Harry Smith's avant-garde film, such a goal was never intended by the filmmaker, who showed the film only ten times in 1980 to a selective audience at Anthology. The association of the two frameworks "film as art" and "film as *dispositif*" seems in this case to give rise to a contradiction: on the one hand the goal was to restore the filmmaker's intent and on the other hand, by changing the film's *dispositif*, its very nature as performance has been transformed into a film that can be projected in any cinema. However, *Mahagonny*, also in its restored form, remains an avant-garde work that would not appeal to the same kind of broad audiences as a commercial film such as *Beyond the Rocks*.

I have earlier argued that according to the "film as original" framework, a film artifact re-acquires its status as original once it enters the film archive. The film artifact becomes then the original physical object to be restored. Because the importance of keeping original film artifacts as long as possible has lately become a widely agreed upon goal, most film archives nowadays at some level embrace the "film as original" framework, especially with regard to long-term preservation. Also, there are advocates of this approach who maintain that the original film artifacts have a special something, comparable to Benjamin's aura (Cherchi Usai, 1987 and 2002; Marks, 1997), which new copies, and thus restorations, cannot recapture. It has also been argued that the "film as original" framework can lead to opposite archival practices, one where the original artifact is considered so precious that it becomes untouchable, and another where access to the original artifact puts its preservation in jeopardy. However, most archives stand somewhere in between these two extremes. In Chapter Three, the Danish Film Institute was discussed as an example within the "film as original" framework because of its robust preservation policy for photochemical film artifacts. In this chapter, the cases of *Beyond the Rocks* and *The Matinee Idol* have been associated with "film as original" as a secondary framework. In the case of the long lost Swanson-Valentino title, because the film artifact found at Eye Filmmuseum is the last existing example of this film, not only was the artifact itself preserved in the best

possible conditions for the long-term, but also a one-to-one photochemical duplication was made to preserve the film as it was found. Also, from a different perspective within the same framework, in this case all the restorable "originals" were restored, namely the Dutch release version and the American release version. The case of *The Matinee Idol* is similar as also in this case a film considered lost has resurfaced in a unique film artifact at the Cinémathèque Française. And here too, not only was the film artifact preserved, but it was also duplicated photochemically, before the digital restoration was carried out. In addition, two "originals" were restored, the French version as it was found and the American version as it could be reconstructed based on the continuity script. However, the primary framework that these two cases have been associated with makes them quite different examples. Whereas in the case of *The Matinee Idol* the "film as art" framework appears to be the one driving the restorers' choices, in the case of *Beyond the Rocks* the restorers have privileged the "film as *dispositif*" framework.

Let us now look at the three concepts I have associated with the five cases, discussing how the same concept functions within different frameworks. In addition, since concepts have earlier been closely related to different interpretations of technology, let us look at some examples of how concepts in practice have led to different technical choices.

I have proposed the remediation concept, based on Bolter and Grusin (1999), as the practice of remediating old restoration technologies in the name of the film artifact to be restored, which is the "real" in Bolter and Grusin's theory.

The two cases discussed in relation to the remediation concept, *Zeemansvrouwen* and *Dr. Strangelove*, are quite different examples of this concept in practice. In the case of *Zeemansvrouwen*, the original silent nitrate film has been remediated via digital media into something new: a sound film provided with a new score, new sound effects and even new dialogue. Today such a project would probably even be projected digitally, rather than printed back on film as it was done in 2003, making the remediation process complete. In this case, remediation has led to a change of *dispositif*: the new sound version of *Zeemansvrouwen* is not a simulation of the original film (it is not even a restoration for that matter) but a new film that requires a different viewing environment, i.e. a modern theater equipped with Dolby Digital Sound System. Indeed this project has been associated with the "film as *dispositif*" framework. Also note that, in this case, the remediation has not been done in the name of the film to be restored, as in the definition of the concept proposed in Chapter Two, but it has served the refashioning of the original film through new media. The case of *Dr. Strangelove* is quite different. Also here digital technology has been used to remediate photochemical technology but, in contrast to *Zeemansvrouwen*, it

has been done in the name of the film to be restored. *Dr. Strangelove*'s original photographic quality, due to the destruction of its camera negative, could not have been approached via photochemical means. Indeed, only by remediating it via digital means, all the way to digital projection, is it possible to recreate the film at its highest possible photographic quality. The result is a remediation of the film as Kubrick intended it, in line with the "film as art" framework. Also the association with simulation as secondary concept makes of *Dr. Strangelove* quite a different case than that of *Zeemansvrouwen*.

With regard to technical choices, it should be pointed out that, in the case of *Zeemansvrouwen*, a photochemical approach would have made the project's tasks extremely complex and expensive (e.g. the matching of the image with the new dialogue). The project probably would not have been realized, at least not in this way, should digital means not have been available. The restoration of *Dr. Strangelove*, on the other hand, could also have been realized via photochemical means. The result would have shown most of the damage that only digital tools could have corrected, and the photographic quality would have been significantly lower. In such a case the project would have been related in the first place to the "film as art" framework rather than to the "film as state of the art" framework. Remediation would not have been related to it, whereas simulation would have been the leading concept.

The simulation concept has been defined as the ability to simulate photographic images, which is one of digital media's strongest potentials. Therefore, from the perspective discussed earlier – that restoration is simulation – digital should provide more suitable tools for restoration than analog.

The Matinee Idol and *Mahagonny* have been put in relation to the simulation concept. While the former is a restoration realized via digital tools, the latter has been carried out via a fully analog process. Nevertheless, they both originate from the intent to simulate what the film must have looked like, either when it was originally released, in the case of *The Matinee Idol*, or when it was originally "performed," in the case of *Mahagonny*. For restoring the former, digital tools have been applied to clean up the image from the ravages of time and use and, finally, to simulate the photographic image that was shown to the film's original audience. For the latter, photochemical tools have been employed to simulate the experience of the film as it was performed on one of the ten events that took place in 1980 at Anthology in New York. In this case the choice for COMPOSITING via optical printing can be associated also with convergence/divergence, as this highly specialized technology is becoming obsolete and replaced by digital COMPOSITING. Choosing in this case analog instead of digital is also in line with the project's simulation intent because optical printing, being less precise than digital COMPOSITING, adds a certain amount of instability among the four tiled images, making the result more

similar to multiple projections onto a single screen, as in the case of the original performances. If this project had been carried out digitally, a similar effect could have been simulated, but, in such a case, the project would have been associated in the first place with the remediation concept, whereas the convergence/divergence concepts would not have played a role.

Convergence/divergence refers to a process where convergence towards the digital is balanced by divergence towards specialized analog techniques. Analog and digital tools are used in combination to produce thoroughly hybrid results. This has indeed been the case for *Beyond the Rocks*, since both photochemical and digital techniques have been applied, often by modifying standard processes and by making equipment adequate for treating old fragile nitrate film. For instance, Haghefilm's state-of-the-art digital scanner was equipped with a WET GATE to get rid of superficial scratches before entering the digital domain, and the film had at times to be fed manually into the scanner in order to capture the most details without damaging the original film artifact. Another example is the simulation of the original tints of the film by using two different methods, the fully photochemical Desmet method for the film prints (divergence) and a digital approximation of such a method for the digital master (convergence). In this project, digital technology could have been used more extensively. Some of the various new versions could have resulted in a master for DIGITAL CINEMA, moving this project a step closer to the remediation concept and to the "film as state of the art" framework.

Mahagonny is quite a different example of convergence/divergence in practice. Since only photochemical means have been applied, it cannot be said that in this case digital convergence has played a role in the restoration. On the other hand, the choice for the highly specialized COMPOSITING technique for creating a tiled image via optical printing is definitely an example of divergence, especially so because this technique is quickly becoming obsolete and has already been replaced in most cases by digital COMPOSITING. Strictly speaking, the restoration of *Mahagonny* is more an example of divergence, although, within the framing of changing technologies, I would still argue that convergence/divergence are just two sides of the same coin. As mentioned earlier, this project could have been carried out digitally and the result would probably not have been very different, but it would have definitely been less divergent in terms of interpretation of technology.

In conclusion, in this chapter I have shown through different examples how the proposed frameworks and concepts can be recognized in recent film restoration projects. I have pointed out how they interact dynamically, as more frameworks can be combined and associated with the same project. As analytical tools, they allow deeper dynamics and logics to be revealed at play

in everyday practice, and they provide us with a better understanding of these practices within this transitional moment.

As I think that transition is at the basis of film and of film archival practice (the objects of this study), I similarly think that a suitable theorization for archival film practice should adopt transition as its point of view (framing). The tools I developed as a basis of my new theory of practice, frameworks and concepts, are applicable in a dynamic way, admitting the logic of variations and, at times, apparent contradictions.

Also, my theorization provides enough room for introducing new frameworks and concepts that have not been identified yet, and for the new ones that the transition will bring with it in the future.

A New Mindset for (Archival) Film in Transition: a Conclusion

Before moving to a concluding note, I will briefly sketch some of the steps that have brought us here.

My investigation of the changes occurring in film technology and practice and their influence on film archives has highlighted that archives are undergoing radical changes in their practices. This is due to the many technological, social and cultural transformations related to the transition to digital and, since such changes are ongoing and it is not clear yet where they will lead, archives have a unique chance to rethink their role and tasks *in medias res*.

The analysis of the interplay between film archival practice and film and (new) media theory has led me to identify a number of theoretical frameworks and concepts as relevant tools for both archivists and scholars to rethink their roles and to reshape the practice on a theoretical basis. Central to the theoretical discourse is the ontological question around film. For the purposes of defining those debates most relevant for the film archival practice, I have chosen to approach the existing lines of thought in film and new media theory by highlighting a tension between an indexical approach to photographic reproduction (the realistic approach) and an approach that places film's nature in movement or performance (the mind/film approach). Similarly, the discourse within the film archival field seems to move within the tension between the film as a material artifact and film as a conceptual artifact. In an oversimplification of these tensions, one could say that realism and material artifact are at one extreme and mind/film and conceptual artifact at the other, and that the latter does not recognize an ontological change from analog to digital while the former does. In fact, these extremes create an opposition that is only worthy of noticing because they actually frame a middle ground for reflection and dialogue. This middle ground is the conceptual basis and a starting point for the theorization of archival practice I propose. Within this discursive fram-

ing I have defined four relevant theoretical frameworks, i.e. "film as original," "film as art," "film as *dispositif*," and "film as state of the art," which function as the grid upon which a theorization of archival practice can be built. I have also identified three concepts, deriving from new media theory, which define different ways to look at the technological transition to digital when applied to the practice of film archiving. These concepts are convergence/divergence, remediation and simulation and they can all function within the four theoretical frameworks.

My theorization is pragmatic as the frameworks and concepts I propose are instrumental for analyzing the film archival field and the film archival film artifact. On the one hand, it intends to comprise the diverse conceptions of the nature of film already existing in the field, from the indexical to the one I have loosely defined "mind/film," as well as different assumptions of the nature of the archival film, from those focusing on the material film artifact to those placing emphasis on the conceptual film artifact. On the other hand, it proposes a new way to look at film's nature, from the perspective of transition. Such an approach is particularly productive in the current transition from analog to digital.

In my snapshot of the archival field I have investigated a number of relevant archives and laboratories to validate my theory in practice. I have shown how frameworks and concepts can be used to analyze archival practice as it reshapes itself throughout the current transition (with a reference period of 1997-2007), by focusing on some of the most important recent film restoration projects as case studies. Also, my frameworks and concepts allow us to identify deeper dynamics and logics at play in today's archival practice.

Adopting some of the tools offered by the Social Construction of Technology (SCOT) theory, I have discussed the cases stressing the social component to the ongoing transition. In this way, a landscape of variations and tensions has arisen where a plurality of approaches and perspectives coexist. The preference by a social group or actor for one or the other framework has a clear consequence for its path with regard to the transition to digital. However, all these frameworks belong to a common theory and are situated in that very middle ground discussed earlier.

In conclusion, in order for my proposal for a new theory of archival practice to be relevant and useful, two things should be recognized: the need for a theory of practice itself and the importance of a new mindset for scholars and archivists.

In my view, transition is the key for both.

As I have suggested from the beginning, transition is the object of this study as well as its framing. Studying a transition from within is especially challenging as everything (artifacts, fields, practices and theoretical tools) is

in movement, including the observer. However, it also offers great opportunities. First of all, it allows a perspective that is less burdened by the danger of a deterministic approach. As we do not know where the transition is heading, we do not need to concentrate on the outcomes. Actually, as transition is there to last, I have proposed not to think of the transition as a path leading to a precise place, but rather as a site worth exploring in itself, where diverse forces are moving in different directions. Secondly, by addressing the transition *in medias res*, we can possibly influence its direction. By understanding the changes as they happen and reporting in a timely fashion on the advantages and the shortcomings for archival practice, it is possible to shape the transition next to come. It will perhaps not be possible, and maybe not even desirable, to prevent Kodak from dismantling its film manufacturing business, but it is possible to lobby for digital standards that take into the account film archival needs, as, for instance, DIGITAL CINEMA formats that can properly translate heritage film formats, frame rates and ASPECT RATIOS. At the same time, by understanding changes, now it is possible to reshape archival practices so that they can benefit from the new technological tools (e.g. the digital archive) and from changing social dynamics (e.g. the new expectations of the changing users).

This brings us to the importance and the urgency of a theory of practice. The need for a theory of practice is a subject of debate within academic research: is it possible to theorize practice without limiting theory? In line with Henry Jenkins, this is not a choice but rather a necessity as we enter the twenty-first century:

> In many parts of the world, cultural scholars have engaged in active intervention in the public debates shaping cultural policy, often working closely with governmental bodies to pursue their interests even where they did not fully agree with the other participants or totally endorse the outcomes achieved. They did so because they knew it was more important to try to influence policy than to remain ideologically or intellectually pure. [...] discussions of creative industries need to take center stage as cultural studies enters the 21st century. We need to go into such collaborations and dialogues with our eyes wide open and, to do so, we need more nuanced models of the economic contexts within which culture gets produced and circulated. (Jenkins, 2004: 42)

I subscribe to Jenkins' call upon scholars for a further engagement with practice. Whereas he refers to media industries, I refer mainly to institutions and funding entities related to film archival practice. In this transitional moment scholars need to "get their hands dirty," as things change so quickly that, if

they do not, their objects of study will be so radically changed that they will not know them any longer. In turn, archivists, who at times doubt the usefulness of theory when facing everyday problems, need to have a common theory of reference in order to cope with a practice that is changing so quickly and so radically. Such a theory can provide archivists with new means to understand transition at a deeper level and to face questions about their changing role. For instance, while archivists have to make choices on a daily basis about how to handle archival film artifacts between analog and digital, a common digitally informed theory of archival practice offers both a theoretical tool to archivists for their choices and a reference to scholars for critically discussing such choices while they are being taken.

Finally, I would like to come back to the perspective that I have embraced in this work, namely that of privileging transition as a focus of analysis, and how this results in fact in a new mindset. I intend here to call upon a mentality change for film scholars and film archivists that would facilitate further exchange between academic research and archival practice, also in view of the current transition. Transition defines the upcoming change of the present state of things. Discourses, technology and practices are mutating but what lies at the horizon is still uncertain. And this uncertainty can be an inspiration and a guide. I call upon a mindset that acknowledges a theory of film archival practice based upon the idea of film as inherently transitional, rather than on the idea of film destined to transition to digital.

I would also like to point out once again that a theory of practice, as I intend it, does not necessarily lead to ethical guidelines as they are conceived today by the archival community. Although many ethical principles are and will remain largely shared within the archival field, it is important to recognize that they can be based on different theoretical frameworks, and that they may consequently differ. For instance, archives can understand the idea of film original quite differently, spanning from the original material artifact they hold to the concept of the film as it was shown to its original audience, to the concept of the film performance, irreproducible in its original form. Similarly, we are coming to a point where the choice between preserving film-born film as data rather than as film (when and if both practices would not be sustainable) will be legitimate and ethically defensible. It is important to recognize that ethics also need to be placed within the same transitional framing where all other elements of the equations are situated (from archivists to theorists, from conceptual film artifacts to material film artifacts). This is to say that the relevance and usefulness of ethics would be undermined if we did not reconsider it in view of the transitional character of film. Existing ethical principles guiding film restoration practice, like "being true to the original" or "guaranteeing reversibility," risk becoming meaningless unless we accept

that they can allow different interpretations. From this perspective, I argue that new ethical guidelines need to be more dynamic and open to the coexisting frameworks, in the spirit of a new mindset and of the new theory of archival practice I propose.

The new mindset I invoke calls for a more open approach to film artifacts, which can be material but also virtual. Precisely while film seems to become more virtual because of digitization, its materiality needs to be re-acknowledged. And, in turn, as the materiality of the film artifacts from the past seem to become more and more evident compared to the new virtual artifacts, their virtuality becomes just as important. Scholars and archivists find themselves discovering in film a multiplicity of objects, both material and virtual.

In the new mindset, new questions arise and old ones acquire different meanings. Also, new archival roles (e.g. the digital restorer and the archival information scientist) and new fields of interdisciplinary studies (where film theory meets archival studies, or film aesthetics meets information technology) become relevant.

Some of the new questions concern the changing role of archives as well as the changing character of film and media studies. An example in this regard is the question around the role of the film curator *vis-à-vis* the rise of publicly accessible digital archives (e.g. the Internet Archive). Has the traditional film archive curator become obsolete? In a participatory culture, should the curator become the voice of a collective entity, embodied by the archive's users as they participate in creating the archive where uploading equals acquisition and social tagging supercedes fixed metadata as a facilitator of selection? If that is the case, what kind of archive is this collective curator giving shape to? Can old and new curators coexist? These kinds of questions are obviously relevant for archives but they are becoming ever more relevant for film students as new academic programs are being developed with the aim of forming future curators and archivists.

And, retrospectively, the new mindset sheds new light on a century of film history that has created many "archives of absences," where choices, based on the very frameworks discussed in this work, have led to a partial selection of our film heritage.[260] Today, as digital technology is leading to more expensive restorations of a smaller amount of films and, at the same time, curatorial selection becomes a questioned practice within an ever more participatory culture, the question arises of how we are going to fill the gap between what is archived and what is (at risk of being) lost. A theory of archival practice is an essential precondition for charting this new territory in transition.

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Conclusions to the Third Revised Edition[clxii]

In this book I focused on film restoration and presentation practices of restored films. At the time of researching and writing (2007-2009), I felt that the restoration practice was still too little understood by those who were not directly involved and too little "explained" by those who were. The first step in stimulating a renewed dialogue on archival practice was to make visible some of the possibilities and choices made by film restorers based on their interpretation of film and their use of technology. At the time, my sole focus was on film, more specifically, recognizable film titles (rather than other film-related objects and other archival activities) as I felt this was the most effective way to start.

We are further along in the process now, and I believe the time has come to shift the focus to a broader and more integral view on film heritage. I feel that film restoration and presentation, the most visible activities within film archival practice, cannot be isolated from the rest of the work concerning film heritage. As we move ahead, we need to search for a broader territory and theorization that will allow us to analyze, discuss, and influence film heritage practice in a more comprehensive way. The horizon needs to be expanded to include, in addition to restoration and presentation, acquisition, selection, digitization, access, innovative projects for data mining, and online and on-site forms of presentation. Moreover, in terms of objects and practices, film heritage should be considered as a comprehensive corpus that includes film-related collections, such as posters, movie theaters, or historical devices, as well as what can be broadly defined as "intangible heritage," such as cinema-going practices and experiences or the knowledge of obsolete (post-) production practices, to name but a few examples.

A case in point is the renewed interest in the media apparatus, focusing on the artifacts as well as their related practices, and the inclusion of media archaeology as an integral part of media studies' programs. Scholars such as Erkki Huhtamo, Jussi Parikka, Wanda Strauven, Benoît Turquety, Andreas Fickers, Annie van den Oever,

Alexandra Schneider, and Thomas Elsaesser, among others, have led the way to new innovative research that bridges theory and archival practice and moves away from traditional film-centered approaches.[clxiii]

Furthermore, the general public today has mastered technological skills for filmmaking that were unfeasible a decade ago. In fact, most of us carry around a video camera and editing suite as built-in tools of our smartphones. This fact alone creates a new opportunity to reflect on our relationship with historical film devices.[clxiv] The position of apparatus collections, and film-related collections more generally, within film studies and film archiving is gradually changing. This new engagement with the film apparatus can also be related to the "material turn" discussed in the Introduction to this edition.

To move on to a more comprehensive approach to archival practices, while staying within the theoretical confines of the archival practice proposed in this book, new additional conceptual framings are needed. These need not be related to the film artifact *per se* but do need to be suitable for discussing activities around film heritage at large. With this in mind, I wish to introduce three new framings "Monument," "Document," and "Event," which I will briefly illustrate in relation to a number of new areas worth pursuing in research and practice in the coming years.

The conceptual framings of Monument and Document bear a strong relation to the teachings of the Nouvelle Histoire movement. I refer in particular to the work of historian Jacques Le Goff and his discussion of the mixed-concept Document/Monument, in which he stated that the main goal of a historian is "to critically assess a document [...] as if it were a monument" (1978: 38). In this line of reasoning, any document under assessment should be understood as having been materially altered by an editing process influenced by the society and era that produced it. Furthermore, it should also be considered as an artifact subject to interpretation, "a product of later eras during which the document lived – or was perhaps forgotten, during which it was retouched – albeit by silence. [...] Document is monument" (1978: 38).

The Nouvelle Histoire tradition and its rejection of earlier positivistic approaches to the study of history with its main focus on Monuments (such as big political events featuring "great men" as main actors) bears a clear connection to the New Film History, which similarly marks a shift in focus from the Monument, with its tales of pioneers and teleological recounts of "first times," to the Document.[clxv] The New Film History movement marked a turning point in film studies but it also formed part of the background against which film archivists and scholars started a dialogue in the late 1970s (the Brighton Congress having a pivotal role in this); a dialogue that is still influential today for research and archival practices.

What are some of these recognized Monuments of film heritage? A fitting example is Fritz Lang's 1927 film *Metropolis* as it stands out as one of the most celebrated and most frequently restored film titles in the history of cinema. And,

as such, it was one of the first film heritage objects to be included in the UNESCO Memory of the World Register in 2001. In film restoration practice, following the tradition of art restoration, films are typically approached as Monuments, and restored as close as possible to the original artifact, choosing the best suited and affordable analog, digital, and hybrid technology on offer, regardless of which framework is being embraced. Recognizing the monuments of film history, much in the same way other arts and disciplines do, has always been of strategic importance as these are the most visible and thoroughly studied objects in the field. They have had and still have an important role in drawing audiences to film museums and funding to research and restoration. Although this is still a feasible strategy, Monuments have been typically selected by the dominant perspective on art, culture, heritage, and so on. While the idea of the Monuments of film history (as well as the parallel ideas of *auteurs* and canon) has been heavily critiqued as early as the 1970s (with the Brighton Congress and the New Film History movement as symbolical starting points), there is still a lot to be done by archivists and scholars to open up a broader discussion on what the Monuments of film heritage are. Especially in this time of rising nationalism, I subscribe to Frick's view on heritage preservation:

> The preservation of so-called national or state heritage is not, and never has been, a neutral concept, although it is presented as such by politicians, the press, intellectuals, and archivists. (2011: 19)

Similarly, Monuments are not neutral entities. At times, they have been established in relation to national heritage; other times they have been inscribed in a transnational discourse (that of Film History), which partly originates in a Western-centered, author-centered, and (often) copyright-driven discourse.[clxvi] In terms of gender, traditional male perspective has also had an important role in determining which artifacts were selected as Monuments of our Film History. Indeed, only in the last three decades, through projects like the rightly acclaimed Women Film Pioneers Project, founded in 1993 by Jane Gaines, the collaborative work of a number of scholars and archivists worldwide has clearly demonstrated that a women film history has yet to be written.[clxvii]

These dynamics affect many facets of film archival practice, including the criteria applied for selecting and building collections, and prioritizing restorations and presentations. The Monuments that have been selected by the dominant discourses interfere with the expression of other perspectives and the enlisting of alternative discourses. Choosing to invest in (re-)restoring an established title (a recognized Monument of Film History) precludes other unknown titles from being discovered, restored, and presented. We can justify the Monument perspective for strategic reasons; after all, it facilitates the securing of funding which is needed to preserve, restore, and present the obscure titles. But, while it has been one of

the founding perspectives film heritage tradition is based on, it is perhaps time to reevaluate this perspective and work toward a more comprehensive approach that critically reviews the very idea of what a Monument is and explicitly acknowledges the complementary dimensions of Document and Event as equally informing the *archival life of film*.[clxviii]

Over the past 30 years, things have changed considerably partly due to the Nouvelle Histoire tradition. Today, we have a broader and less monolithic idea of what these Monuments are. For instance, multiple versions of the same film have been researched and restored. In the case of *Metropolis*, a number of different restorations have been carried out in the last two decades resulting in different versions of the film. Also, entire collections of films and film-related objects have been recently included in our idea of Monument. One example is that of the Jean Desmet Collection held at Eye Filmmuseum, which contains the archives left behind by the Dutch film distributor and cinema owner Jean Desmet (1875-1956) and consists of approximately 950 films produced between 1907 and 1916; a business archive of more than 100,000 documents; approximately 1050 posters; and around 700 photos. In the past decades the Desmet collection has become essential to research on early cinema, for its unique objects as well as for the richness of the associated business archive. As such, the Desmet collection is a fascinating example of the framing Monument/Document. Because of these features, it was inscribed in the UNESCO's Memory of the World Register in 2011. Since then, the Desmet collection has been completely restored and digitized and has been the object of several scholarly research and archival presentation projects.

With regard to the Document framing, a number of the projects fall under what we refer to as Digital Humanities (e.g. the application of digital tools to academic disciplines such as literature, history, and visual arts), a methodological approach that is quickly gaining momentum in academic research and education within film and media studies.[clxix] More specifically, a small number of scholars have been focusing on bridging the gap between digital methods, film studies, and film archives. Recent significant contributions to this digital turn in the humanities have been made by scholar and archivist Adelheid Heftberger who has done pioneering work on Digital Formalism (Heftberger et al., 2009) and has pointed out the challenges of applying digital tools to film archival research (2014), and scholar Christian Olesen who has put these connections in a broader perspective in his impressive study "Film History in the Making: Film Historiography, Digitised Archives and Digital Research *Dispositifs*" (2017).[clxx]

Another interesting case in this regard is the project "Data-Driven Film History: A Demonstrator of Eye's Jean Desmet Collection," which explores the potential and pitfalls of digital methods for research into early cinema history (Olesen et al., 2016). In this project, researchers developed a tool for studying the distribution, screening, and stylistic features of the films in this collection, focusing in particular

on visualizing the relations between the films' distribution and screening. Such a tool provides valuable insights into the quality of the available metadata (which was often produced with different objectives) and how metadata affect the film historical insights we are hoping to gain.[clxxi]

Projects such as these, in which film heritage is being analyzed through new digital tools, continue to grow in number. As we speak, new tools are being researched and developed which, for instance, are able to recreate entire vanished movie theaters through 3D modeling, such as the Cinema Parisien 3D project (Noordegraaf et al., 2016), or help search digitized audiovisual collections through sensory features such as color, texture, shape, and movement, as in the case of the Sensory Moving Image Archives project.[clxxii] New platforms allow media archivists and scholars to collaborate online through a number of experimental digital tools which can be applied to shared digitized collections; the Clariah Media Suite in the Netherlands and the Media Ecology Project in the United States are two such examples.[clxxiii]

Within the Document framing, this is indisputably one of the most important future areas of research where scholars and archivists would do well to work hand in hand. However, it should be pointed out that the adoption of digital tools within film studies is not being applauded by all film scholars. Indeed, there is a deep concern for applying metrics and big data to the study of the humanities. As scholar Eef Masson points out when discussing the collaboration between natural scientists and humanities scholars belonging to different epistemic traditions (one based on empirical analysis to reach conclusive results; the other concerned with critical interpretations):

> Over the past decades, this encounter between scholarly traditions has led to a number of frictions. While some humanists have adopted digital tools in the hopes of making their results more verifiable, others have questioned the underlying assumptions, arguing that they threaten to undermine the very project of the humanities. (2017: 26)

Addressing some of these concerns, a number of humanities scholars who work with digital tools have focused on the interpretive dimension of such tools and the resulting analyzed data. Through their research, they aim to reveal that tools and data are not neutral and objective but rather the results of previous interpretations.[clxxiv]

Other scholars point out the importance of complementing computational research on big data (e.g. digitized audiovisual collections or sound libraries, or document archives) with research on small data, which traditionally belongs to the humanities tradition. In this respect, media scholar Sean Cubitt argues that with "anecdotal methods" we can focus on the finer details and "unique qualities of art-

works and experiences. The anecdotal method does not abandon the project of making statements about larger, more abstract formations like 'society' or 'cinema' – it grounds them in the specific instance" (Cubitt, 2013: 5).

An example of anecdotal research that makes use of digital tools, and thus can be placed at the junction between the Document and Monument framings, is the project and publication *Fantasia of Color in Early Cinema* (Gunning et al., 2015). Here, single colored frames were scanned from nitrate prints at approximately 5K (5000 pixels per horizontal line) and presented to allow a broader audience to experience early color films. One of the goals of this project was to give the reader access to original heritage films in a manner that was once the sole prerogative of film archivists and a selective group of film historians. Whereas one could formerly only view such material in condensed form as compressed online videos or in computer explorations and visualizations such as those produced in the framework of projects like the Sensory Moving Image Archive mentioned earlier, one could now access and focus on a very limited selection of objects, namely high-RESOLUTION film frames from a film collection, which offered a new kind of experience. By the same token, a project like FilmColors (discussed in Chapter One) also belongs to the category of projects which make use of digital tools for combining close analyses of unique objects with the study of phenomena on larger corpora.

Finally, approaching film heritage as Event opens up new possibilities for research, restoration, and presentation practices. Taking into consideration the role of unstable circumstances, audiences, and users in the restoration process, the Event approach can also account for film's changing materiality as part of the way films are preserved, restored, and presented. Furthermore, by not restricting itself to a specific mode of historical preservation (typically associated with Western film archival tradition), it welcomes other approaches to film heritage preservation, such as intangible heritage. Concerning the latter, in her book *Saving Cinema* Caroline Frick refers to the case of the "preservation" of the Japanese Ise Temple, which is being rebuilt every 20 years following traditional methods, "thus ensuring that the living heritage (the knowledge of *how* to build such a structure, and so on) endures" (2011: 162). This is a promising new direction for theory and practice that I intend to focus on in the future.

In conclusion, the framings Document, Monument, and Event are new overlapping lenses that will add a new dimension to the theorization of archival practice as proposed in *From Grain to Pixel*. They will help us further discuss and analyze film heritage at large and propose new directions that will inform future discourse and practice.

I hope this brief new Conclusion to *From Grain to Pixel* illustrates that film heritage today, while young and dynamic, remains a discipline that builds on 120 years of tradition, experimentation, and knowledge. Right around the time, in the 1980s,

when film had been declared dying, a renewed interest started to grow around the study of film heritage, preservation, and restoration. Today, as a growing number of (inter)national film archivists and curators are being formed in our programs, the next generation, it seems, will be well equipped to bridge theory with practice and the analog past with the hybrid and digital present.

As heritage is now receiving renewed attention by policy makers, partly due to the new possibilities offered by digital access, it is imperative that a well-informed discussion continues to take place between scholars and archivists so that we can promote sustainable policies for our field at large.

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NOTES

1 Among the many studies dedicated to technological transitions in the history of audiovisual media, refer to Gomery (1976), Dibbets (1993), Zielinski (1999), Gitelman and Pingree, eds. (2003). Also, an important series of conferences on this topic has been regularly organized since 1999 at the Massachusetts Institute of Technology.

2 This has been the case in the past decennia as Gordon E. Moore predicted in 1965 (Moore, 1965). Indeed Moore's law foresees that the number of transistors contained on microchips (i.e. the processing power of microchips) is doubled roughly every eighteen months.

3 Refer, among others, to Barthes (1964) for a discussion of analog and digital from a semiological perspective.

4 http://www.merriam-webster.com/dictionary/analog and http://www.merriam-webster.com/dictionary/digital (accessed June 16, 2011).

5 Refer also to the dictionary definition of "isomorphic": "being of identical or similar form, shape, or structure" (http://www.merriam-webster.com/dictionary/isomorphic – accessed June 16, 2011).

6 Note that this is not true for the sound accompanying the image on a film strip even when it is stored as an optical track, as we need an additional transcoding process to be able to hear it.

7 As we will discuss in Chapter Two, Tom Gunning suggests something along this line when he writes that "Both photographic chemicals and the digital data must be subjected to elaborate procedures before a picture will result" (2004: 40).

8 In this study, the definition of framing, as proposed by Mieke Bal (2002: 133-173), following Jonathan Culler (1988), is preferred above that of context. As offered by Bal, framing refers to an activity (2002: 134-135), whereas context refers to stasis. As the object of this research, media in transition, is everything but static, the use of the concept of framing seems the only appropriate one.

9 It should be pointed out, however, that the idea of transition is in itself a construction of historiography and, more precisely, a tool to define a particular moment in film history.

10 SCOT is a constructivist approach to the study of the development of science and technology, primarily developed by Wiebe Bijker and Trevor Pinch. According to SCOT theory, the success or the failure of a technology should be defined by looking at different groups and stakeholders in the field, and, in particular, at those who define the technical criteria by which success is measured (Pinch and Bijker, 1984; Bijker, 1997; Bijker, 2001). Here, "constructivist" means that the truth of scientific facts and the working of technical artifacts are studied as accomplishments – as being constructed – rather than as intrinsic properties of those facts and machines. The term "social construction of technology" can be used to denote two different things. First, it is a research approach to study technical change in society, both in historical and in contemporaneous studies. Second, it is a theory about the development of technology.

11 "Technological development should be viewed as a social process, not an autonomous occurrence. In other words, relevant social groups will be the carriers of that process" (Bijker, 1997: 48; see in general 45-50).

12 "Technological determinism was taken to comprise two elements: (a) technology develops autonomously, and (b) technology determines societal development to an important degree. This view was seen as intellectually poor and politically debilitating. Technological determinism implies a poor research strategy, it was argued, because it entails a teleological, linear, and one-dimensional view of technological development. In addition, it was considered politically debilitating because technological determinism suggests that social and political interventions in the course of technology are impossible, thus making politicization of technology a futile endeavor" (Bijker, 2001: 15523).

13 Refer to Gracy (2007b: 17-43) for a discussion of the development of film archives in the United States.

14 It should also be noted that these names are often historically accreted terms, which reveal institutional history sometimes even more accurately than institutional goals.

15 This is the case of museums such as the Museo Nazionale del Cinema (Turin), the Deutsche Kinemathek and the Cinémathèque Française. Refer also to the issue of *Film History. An International Journal* (3, 2006) dedicated to this kind of film museum.

16 The following missions can be found on the CNC's website (www.cnc.fr): "regulatory; support for the film, broadcast, video, multimedia and technical industries; promotion of film and television for distribution to all audiences; and preservation and development of the film heritage."

17 A similar distinction is also made by Sabine Lenk in the *Manual for Access to Collections,* compiled on behalf of FIAF Commission for Programming and Access to Collections (Lenk, 1997). However, when the *Manual* was written, digital reproduction of films was not yet taken into consideration.

18 According to the FIAF website (www.fiafnet.org), the federation counted 141 affiliates on January 1, 2007.

19 For a discussion of copyright issues and so-called legal deposit policies, which both differ by state and exercise a great influence on the adopted collection policy, refer to Gorini, 2004.

20 Eye Filmmuseum's collection policy, which will be discussed in detail in Chapter Three, knows a distinction between an archival function and a museum function: the preservation of Dutch film heritage falls within the museum's archival function, whereas the collection and preservation of non-Dutch items, films and film-related objects, is considered a museum function.

21 In Chapter Two, FIAF Code of Ethics will be further discussed and questioned in relation to the changes due to digital means.

22 In the section on exploitation rights of the FIAF Code of Ethics, it stated that: "screenings will be non-profit making (which is not to say that screenings will necessarily be free, but that where entry fees are charged the income deriving from such fees will be demonstrably linked to the preservation and cultural mission of an archive, and not devoted to the commercial reward of any individual, group or organisation)" – see https://www.fiafnet.org/pages/Community/Code-Of-Ethics.html (accessed August 27, 2018).

23 Note that there are institutions using this designation that do not hold a film collection at all and, consequently, do neither collect nor preserve films. One example is the American Cinémathèque in Los Angeles, whose goals of promotion and exhibition of heritage film are exercised in two historical movie theaters where films from archives around the world are regularly shown. Similar are the cases of the Melbourne Cinémathèque and the Pacific Cinémathèque in Vancouver.

24 Some of the earliest articles entirely devoted to the subject of film restoration were written around this time (Pinel, 1985 and 1993; Cherchi Usai, 1985; Borde, 1986; Patalas, 1986; Meyer, 1986; Bowser, 1990; Canosa, 1992; Farinelli and Mazzanti, 1994). It should, however, be noted that the practice of film preservation has a much longer tradition, and FIAF has long before the 1980s published hand books for film archivists on duplication of archival films and other related technical issues.

25 Whereas I am not aware of published studies dedicated to digital film restoration in detail, a number of articles do tackle the issue in relation to specific case studies, such as Fossati (2006) and Wallmüller (2007).

26 Francis Ford Coppola, "Looking Back at One From the Heart." *One from the Heart*, DVD, American Zoetrope, San Francisco, 2004.

27 This is the case, for instance, for the *White Stripes*, who write on the inlay of their album *Elephant* (2003): "No computers were used during the writing, recording, mixing or mastering of this record."

28 Enticknap, 2005: 128 and 206-209.

29 "Foley editing" refers to the "process of adding sound effects such as footsteps and environmental sounds to films." This process is named after Jack Foley, indeed the first "Foley artist" in Hollywood (http://en.wikipedia.org/wiki/Jack_Foley_(sound_effects) – accessed June 16, 2011).

30 See https://www.dolby.com/us/en/about/history.html (accessed August 27, 2018).

31 Enticknap, 2005: 109-110.

32 The relation between economics and sound technology in film was first addressed with regard to the transition to sound in the early 1930s. In particular, Douglas Gomery has looked at the advent of sound in the American film industry "in terms of economic theory of technological innovation, which posits that a product or process is introduced to increase profits in three systematic phases: invention, innovation, and diffusion" (1976: 193). It is mainly with regard to diffusion that compatibility on a large scale becomes a crucial factor.

33 With regard to the definition of what is considered analog and what digital in this work, refer to the discussion in the Introduction.

34 The THX tradename is not an acronym but it refers to George Lucas' first film, *THX 1138* (USA, 1971). THX was developed by Lucasfilm in 1983 upon realizing cinemas' poor audio standards. *The Return of the Jedi* (USA, 1983) was the first film to be played in THX-certified cinemas.

35 One of the few contributions from the field to this issue is that of Lerouge, 1996.

36 Each single turning point discussed in this chapter should be positioned within the broader transitional phase in which it takes place. Refer to the Introduction for a discussion on transition of both the object and the point of view of this study.

37 It should be noted that, although the practice of negative cutting remains unchanged with DIGITAL EDITING, the "creative" part of the editing work was carried out on a so-called work print. By splicing together film shots in a work print, the editor used to make those editing decisions that, with DIGITAL EDITING, are made with a computer.

38 Negative cutting is one of those traditional film craftsmanships that are listed at the very end of a film's credits and that is essential to the realization of all films, with the exception of only a few made in a very limited number of takes, like Hitchcock's *Rope* (USA, 1948) or Miklós Jancsó's *Red Psalm* (*Még kér a nép*, HU, 1972).

39 For a discussion of film reconstruction, refer to Read and Meyer (2000, 69-79).

40 The term "synthespian," i.e. a synthetic actor, was introduced in the late 1980s by Jeff Kleiser and Diana Walczak, creators of computer-generated characters. The term is used, among others, by Cubitt (2002).

41 For more examples of digital effacing, refer to Prince (1996: 27-28) and to Chapter Four.

42 For a historical overview of the DI process, see Read, 2006: 120-122.

43 Note that a new film stock was put on the market thanks to this little photochemical experiment: "[...] Sigel shot the scene with Kodak's 5285, a reversal stock he actually had a hand in bringing to the market. 'I'd previously used bulk loads of various still-photography films in doing this kind of work, including Kodak's Ektachrome Professional Plus. But for *Three Kings*, I knew we were going to do a huge chunk of the film with it—the entire second act—so I asked Kodak to make us 1,000-foot loads of Ektachrome with edge-coding and Bell & Howell perfs. They were very hesitant to do it, but we ended up shooting 200,000 feet of it, so they were happy in the end'" (Williams, 2000: 3).

44 Rob Nelson, "What's Up Doc?" *Citypages*, April 20, 2005.

45 Anthony Kaufman, "INTERVIEW: Dazed and Enthused; Richard Linklater Proves He's No Slacker," *indieWIRE*, October 18, 2001: https://www.indiewire.com/2001/10/interview-dazed-and-enthused-richard-linklater-proves-hes-no-slacker-80713/ (accessed August 27, 2018).

46 Rob Nelson, "What's Up Doc?" *Citypages*, April 20, 2005.

47 For more on the cinematography of *Collateral*, refer to Jay Holben, "Hell on Wheels," *American Cinematographer*, April 2004: http://www.theasc.com/magazine/aug04/collateral/page1.html (accessed June 16, 2011).

48 See Enticknap, 2005: 224-225 and Sætervadet, 2005: 250-251.

49 See Sætervadet, 2005: 251-252.

50 The source of these figures is a thorough research carried out by MEDIA Salles, an initiative of the MEDIA Plus Programme of the European Union published in the *European Cinema Yearbook – Advance Edition*, sixteenth edition, 2007: http://www.mediasalles.it/ybk07fin/

51 Distributors cannot force exhibitors to invest in digital projectors if there is no clear financial benefit for them. On the other hand, distributors are not going to digitize the distribution chain if exhibitors are not equipped for showing their digital films.

52 Refer to Gomery (1976) for the USA and to Dibbets (1993) who focuses on the transition to sound in the Netherlands.

53 European Digital Cinema Forum (EDCF) was constituted in Stockholm, Sweden, on June 13, 2001, on the initiative of the Swedish Presidency, its main objective being to function as a network for European co-operation on DIGITAL CINEMA.

54 "The Pilot Project scheme constitutes the way in which the MEDIA 2007 programme ensures that the latest technologies and trends are incorporated into the

business practices of beneficiaries of the programme. The programme continues to support pilot projects to ensure that the latest developments on the information and communication technology markets are introduced and taken up by the players of the European audiovisual sector" (http://ec.europa.eu/information_society/media/newtech/pilot/index_en.htm – accessed September 10, 2008; page no longer accessible August 28, 2018).

55 See https://web.archive.org/web/20070612184151/http://www.cinemaneteurope.com/ (accessed August 28, 2018).

56 https://web.archive.org/web/20060618161700/http://www.ukfilmcouncil.org.uk/cinemagoing/distributionandexhibition/dsn/ (accessed August 27, 2018).

57 http://www.dcimovies.com/ (accessed June 16, 2011).

58 DCI Digital Cinema System Specification v.1.2: 17, see http://www.dcimovies.com/archives/spec_v1_2_No_Errata_Incorporated/DCIDigitalCinemaSystemSpecv1_2.pdf (accessed August 27, 2018).

59 Note that most technical definitions included in the DCI document are also discussed in Silva, 2006; see also Sætervadet, 2005: 239-248.

60 DCI Digital Cinema System Specification v.1.2: 18, see http://www.dcimovies.com/archives/spec_v1_2_No_Errata_Incorporated/DCIDigitalCinemaSystemSpecv1_2.pdf (accessed August 27, 2018).

61 See among others Brownlow, 1980.

62 The text of the open letter "Frames Rates for Digital Cinema Projection of Film Originated Material" was kindly provided to the author by Paul Read, member of the FIAF TC, on June 10, 2007. With regard to this discussion, refer also to Nowak and Fößel, 2008.

63 The term *dispositif* defines here, in broad terms, the viewing situation where a film meets its user. The origin and use of this concept will be discussed later in detail.

64 See http://www.tape-online.net/docs/Tape_survey_factsheet.pdf :5 and http://www.tape-online.net/docs/tracking_the_reel_world.pdf (accessed June 16, 2011).

65 European broadcast archives such as the British BBC, the Italian RAI, the French INA and the Netherlands Institute for Sound and Vision are collaborating in the project PrestoSpace (https://www.prestocentre.org/resources/projects/prestospace – accessed August 27, 2018), discussed in Chapter Three, for researching the viability of digitization on a large scale. Another important project in this respect is Video Active (https://videoactive.wordpress.com/workplan-2/ – accessed August 27, 2018), whose aim is to create access to European television content and build a bridge between broadcast archives (BBC and the Netherlands Institute for Sound and Vision, among many others) and universities (e.g. Utrecht University and Royal Holloway, University of London).

66 In this area some of the most precious research has been carried out by James M. Reilly and Jean-Louis Bigourdan at the Image Permanence Institute based

in Rochester, NY (see http://www.imagepermanenceinstitute.org/index.shtml – accessed June 16, 2011) and Michelle Edge at Manchester Metropolitan University, UK, and the Australian National Film and Sound Archive with their excellent Preservation Handbook (see https://www.nfsa.gov.au/preservation/guide/handbook - accessed August 27, 2018).

67 Probably, as has been the case of vinyl for the music industry, celluloid will maintain a niche market also when most film production and distribution is completely digital. A similar case in the film business has been that of the Super8 format that was announced dead since the introduction of video cameras for the customers' market; however, Super8 is still produced and used by a small but stable number of filmmakers.

68 Gordon E. Moore, a co-founder of Intel, now the world's biggest chipmaker, based his original formulation on the number of transistors that could be crammed onto a chip. Since the industry adopted it as a roadmap, Moore's law has become a self-fulfilling prophecy. See Gordon E. Moore, "Cramming more components onto integrated circuits," *Electronics* 38, no. 8, 1965 and "Less is Moore," *The Economist* January 17, 2009, p. 13.

69 See https://www.prestocentre.org/files/preservation_guide_main_preservation_guide_-_overview_of_preservation.pdf (accessed August 27, 2018) for the definition of "maintenance" as intended within the scope of the PrestoSpace project.

70 See https://web.archive.org/web/20080603012459/http://viia.ascentmedia.com:80/viiaservices/ (accessed August 27, 2018).

71 See http://montebubbles.net/blog1/2006/07/april_15th_archive.html (accessed August 27, 2018).

72 See http://www.variablemedia.net/e/welcome.html (accessed August 27, 2018).

73 For more information with regard to LOCKSS, see http://www.lockss.org (accessed June 16, 2011) and refer to Uricchio (2007: 22-23). With regard to DISTARNET see http://www.distarnet.ch/

74 For an overview of the definitions given for the terms preservation, conservation and restoration, refer to Karen F. Gracy (2007b: 259-263). It should also be noted that often the terms preservation, duplication, re-mastering are all used to refer to what I define here as restoration.

75 In this regard Meyer points out that: "When new technologies are discussed it is usually meant the digital. In film preservation, however, there is definitely still innovation as for the analog" (Meyer, 2004: 29 – my translation).

76 Note that for digital still and video cameras the total amount of pixels in the picture is usually mentioned (e.g. 2 Megapixels). For DIGITAL CINEMA it would be impossible to name a constant amount of total pixels as the ASPECT RATIO may change per film. When digitizing a silent film, for instance, **2K RESOLUTION** means a total of more than 3 Megapixels (2,048 horizontal pixels x 1,556 vertical pixels) whereas digitizing a modern widescreen sound film at **2K** would result in 2.2 Megapixels (1,920 x 1,080).

77 The relation between the number of tones and the corresponding (linear) bits is exponential: 1 bit (2^1) = 2 tones; 2 bits (2^2) = 4 tones; 8 bits (2^8) = 256 tones; 24 bits (2^{24}) = 16,777,216 tones; etc.

78 In film one refers to the depth of a single color. An 8 BIT DEPTH for a single fundamental color (red, green and blue) corresponds to 24 BIT DEPTH for the three fundamental colors together.

79 See Fisher, 1993.

80 With regard to these software packages, refer to http://www.mtifilm.com/ (accessed August 27, 2018); http://www.blackmagic-design.com/products/davincirevival/ (accessed June 16, 2011); and http://www.hs-art.com/index.php/solutions/diamant-film (accessed August 27, 2018). The Diamant software was used for the restoration of *Beyond the Rocks* (USA, 1922), whereas the DaVinci Revival software was used for the digital restoration of *Dr. Strangelove* (UK,1964), carried out by the laboratory Cineric in 2006 on behalf of Sony Picture Entertainment, both discussed in Chapter Four.

81 See https://web.archive.org/web/20110630040903/http://www.snellgroup.com/products/conversion-and-restoration (accessed August 27, 2018).

82 Duplication under liquid (WET GATE), which is typically used in photochemical duplication, can only deal with the superficial scratches that have not reached the emulsion layer where the image is formed.

83 For more information on the software, refer to https://web.archive.org/web/20100729154744/http://usa.autodesk.com/adsk/servlet/pc/index?id=5562767&siteID=123112 (accessed August 27, 2018) and https://www.blackmagicdesign.com/products/fusion (accessed August 27, 2018).

84 For a discussion of color in silent films, see Cherchi Usai, 1991a and Fossati, 1996 and 1998. The matter of digital restoration of color in silent films will be treated further in Chapter Four in relation to the restoration of *Beyond the Rocks* (USA, 1922).

85 This technique is named after its inventor, Noël Desmet, head of the film laboratory at the Cinéthèque Royale du Belgique. See also Read and Meyer, 2000: 287-290 and the excellent thesis focusing on this subject by Annike Kross (Kross, 2006).

86 For a discussion on different methods for restoring colored silent films, see Fossati, 1996.

87 For more information on early color systems, refer to Enticknap (2005: 74-97) and Read and Meyer (2000: 195-209), who efficiently summarize the subject writing the following: "Some 150 different colour film systems have been devised and a number have reappeared under different names on several occasions. Fewer than this have been commercially successful. After 1950 only one general system has been commercially successful. This is the use of integral tripack films, either with the dye coupler incorporated in the emulsions (Eastman Color, Fujicolor, Agfa-

color, Gevacolor, etc.), or with the dye couplers in the developer (Kodachrome, early Fujicolor, etc.). The Technicolor imbibition printing method, using integral tripack negative as camera film, lasted until 1978 in the USA and UK" (Read and Meyer, 2000: 195).

88 Magid, 1997b: 56.

89 Refer to Canosa (1992) and Canosa, Farinelli and Mazzanti (1997) for a discussion on film restoration from the perspective of classical restoration theory and on the importance of documenting the restoration process. Refer also to a recent article by Julia Wallmüller (2007), who proposes theoretical guidelines for digital restoration based on concepts derived from classical restoration theory.

90 See, for example, Koerber, 2000.

91 The latter example refers to the so-called "social tagging," which includes the possibility for Internet users to add comments to an online item, for instance, to a video, as in the case of YouTube. A number of museums are experimenting with this feature in their online catalogues in order to enrich the metadata related to their collection's items and to open up to the public. Social tagging goes beyond metadata as it is related to the emerging "social media" (e.g. web logs, wikis), which, as pointed out by Uricchio (2007: 16), "lack any homologies to traditional archival objects." This area, though, falls outside the scope of this work. For a discussion on this phenomenon, refer to Uricchio (2007) and De Jong (2005). Also, refer to De Jong (2003) for a discussion on metadata of audiovisual archives. It should also be noted that a discussion is ongoing within the archival field whether YouTube should be considered an archive. One of the main issues concerns its policy for long-term preservation, which is considered a core task of archives. This deserves to be discussed at length but goes beyond the scope of this work.

92 See http://www.beeldenvoordetoekomst.nl/en.html (accessed August 27, 2018).

93 Examples of this trend are those of large broadcast archives, like BBC, and large state archives, like Library of Congress. Refer also to the study *Digital Dilemma* carried out by the Academy of Motion Pictures and Science (AMPAS, 2008).

94 For a comprehensive overview of the history of film archives, see Houston, 1994 and Jeanson, 2001. For US archives refer to Gracy, 2007b: 17-43.

95 The age by which films pass on to the public domain is defined differently by each country of production. In the US, for example, all films produced before 1923 fall under public domain.

96 For an overview on legal issues regarding protection and access of cinematographic heritage in Europe, with a focus on "legal deposit" and related questions arising from the introduction of digital media, see Gorini, 2004.

97 Examples of these touring programs are: *Dutch Silent Cinema* distributed by Eye Filmmuseum, *Biograph* distributed jointly by British Film Institute and Eye Filmmuseum, *American Beauties* by Library of Congress and *Unseen Cinema* by Anthology Film Archives.

98 This definition and other thoughts expressed here on the subject of access and distribution of archival films were first introduced in Fossati and Verhoeff, 2007. Also, refer to the definition of "moving image stewardship" introduced by Karen Gracy (2007a).

99 Examples of archival DVDs are *Exotic Europe* (Fachhochschule für Technik und Wirtschaft, Eye Filmmuseum, Cinema Muzeum and Bundesarchiv – Filmarchiv, 2000), *Treasures from American Film Archives* (National Film Preservation Foundation, 2000), and *Unseen Cinema – Early American Avant Garde Film 1894-1941* (Anthology Film Archives, 2005).

100 http://www.wired.com/wired/archive/12.10/tail.html; see also: http://www.thelongtail.com (accessed June 16, 2011).

101 http://creativecommons.org (accessed June 16, 2011).

102 For more on this, see Houston, 1994. A friction between showing and preservation seems to be an unavoidable aspect of archival practice and the new possibilities offered by digital technology are adding new challenging perspectives to this complex matter. See also Nissen et al., 2002.

103 http://www.archive.org (accessed June 16, 2011).

104 Rob Nelson, "What's Up Doc?," April 20, 2005.

105 Regarding the effects of the Brighton Congress see, among others, Elsaesser, 1986 and 1990, Kessler, 1995, Uricchio 2003 and Musser, 2004.

106 Significant grants have been given, for instance, by the Rockfeller Foundation to the MoMA for building a film preservation center and, later, by John Paul Getty Jr. to build the National Film and Television Archive (NFTVA) in Berkhamsted, England (see Houston, 1994: 90). It is also only from the late 1980s, early 1990s that Eye Filmmuseum has received a substantial budget for film preservation from the Dutch Ministry of Culture, thanks to a renewed and extremely pro-active collection and preservation policy (Lameris, 2007: 63-67).

107 There are a few exceptions where the conceptual dangers posed by studying film restorations have been explicitly addressed, e.g. the past editions of the Amsterdam Workshop held at Eye Filmmuseum (1994, 1995, 1998 and 2004), which have been characterized by an open dialogue between the two fields based on the screening and analysis of restored film prints. The seminar "Film Archives in the Digital Era" was promoted by the EU program Archimedia and organized jointly by Eye Filmmuseum and the Danish Film Institute in 2003 (Walsh and Read, 2003). Also, the Orphans Film Symposium and archival festivals such as Le Giornate del Cinema Muto (Pordenone) and Il Cinema Ritrovato (Bologna) offer the possibility for scholars and archivists to informally discuss restored films.

108 Refer in the latter case to the "cultural artifact" as defined on Wikipedia: "[…] a human-made object which gives information about the culture of its creator and users. The artifact may change over time in what it represents, how it appears and how and why it is used as the culture changes over time.": http://en.wikipedia.org/

wiki/Cultural_artifact (accessed October 18, 2008) For a discussion on the film artifact, refer also to Cherchi Usai et al., 2008: 83-106.

109 Film cannot be easily categorized together with other artforms. For instance, film can hardly be placed in one of the categories proposed by Nelson Goodman (1976). Film is not really autographic like painting, although it can be argued that there are films that have been painted upon in an autographic manner (think of early hand-colored films or avant-garde animation films by Oskar Fischinger or Norman McLaren), but it is also not really allographic like music, although every new projection of the same film is undeniably a different performance in terms of versions, musical accompaniment for silent films, and settings.

110 Refer to the FIAF website for the integral text: https://www.fiafnet.org/pages/Community/Code-Of-Ethics.html (accessed August 27, 2018).

111 See Chapters Three and Four for a discussion of the field and of a number of case studies.

112 Collection and selection policies have been briefly treated in the Introduction and will be discussed later in relation to the archives examined in Chapter Three. On the important issue of selection, see also Uricchio's article "Archives and Absences" (1995). Various forms of film exhibition practices within film archives and their influence on audiences' ideas on film have been recently discussed in detail by Lameris (2007: 153-232).

113 For a discussion on the truthfulness of photographic as compared to digital reproduction, refer to Mitchell (1982), Manovich (2001) and Kessler (2009).

114 Note that Bazin's theory, from this perspective, is not one that should be ignored, but that should be understood in a context other than its relationship with Peirce's indexicality. In this vein, Gunning rightly points out that "the index might not supply a complete understanding of Bazin's theory of cinematic realism" and that "his theory of cinematic realism depends on a more complex (and less logical) process of spectator involvement" (2007a: 33). With respect to the discussion on photographic indexicality, refer also to Gunning, 2004.

115 See Carroll's essay, *Film/Mind Analogies: The Case of Hugo*, Münsterberg (1996: 293-304).

116 In Rodowick's view, the sort of movement created by a film projection is ontologically different than the movement created by a digital projection as the latter "corresponds less to the duration and movements of the world than to the control and variation of discrete numerical elements internal to the computer's memory and logical processes" (2007: 166).

117 Apart from examples of color differences in silent films (Cherchi Usai, 1991 and 2000; Fossati, 1996 and 1998), it is interesting that the recent example of the Coen brothers' black-and-white film, *The Man Who Wasn't There* (USA, 2001), was printed on black-and-white film stock for the US distribution and on color stock for the European distribution – see interviews with Roger Deakins, Director of

Photography of the film: https://web.archive.org/web/20101214084731/https://www.cameraguild.com/AboutUs/memberspotlightcustom/member-spotlight-roger-deakins.aspx (accessed August 28, 2018).

118 In this vein, Crary writes: "The formalization and diffusion of computer generated imagery heralds the ubiquitous implantation of fabricated visual "spaces" radically different from the mimetic capacities of film, photography, and television" (1992: 1). Manovich offers quite an extreme view in this direction: "Cinema is the art of the index; it is an attempt to make art out of a footprint. [...] As cinema enters the digital age, these techniques are again becoming commonplace in the filmmaking process. Consequently, cinema can no longer be clearly distinguished from animation. It is no longer an indexical media technology but, rather, a subgenre of painting" (2001: 295).

119 Note that the recognition of the importance of preserving original film elements as long as possible even after they have been duplicated onto new film stock, is unfortunately relatively recent. See in this regard, Meyer (2001), Nissen et al. (2002) and Enticknap (2005).

120 Interestingly, long before the *politique des auteurs*, a film archivist like Iris Barry, founder of the film library at the MoMA and its first film Curator, considered Hitchcock an expert on "the art of film" as she invited him to lecture on the subject when he moved to the USA in 1939 (Bordwell, 1997: 24-27 and http://www.moma.org/interactives/exhibitions/1999/hitchcock/curator_essay1.html – accessed June 16, 2011).

121 Frank Kessler explains why the French word *dispositif* is more appropriate than the English translation *apparatus*: "The usual English translation of *dispositif* by 'apparatus' poses a twofold problem: first of all it does not render the idea of a specific arrangement or tendency (*disposition*), which the French term implies, and secondly, it makes it difficult to distinguish between two concepts in Baudry's theory, namely the '*dispositif*' on the one hand, and the '*appareil de base*' on the other" (2006: 60).

122 http://www.merriam-webster.com/dictionary/state_of_the_art (accessed October 20, 2008).

123 Refer to http://en.wikipedia.org/wiki/Videotape_format_war (accessed June 16, 2011) for more information on the videotape format war in the 1980s.

124 Refer to Wikipedia for a brief discussion of the bleach bypass process (http://en.wikipedia.org/wiki/Bleach_bypass – accessed June 16, 2011). For more details on the shaky-cam and other of Raimi's innovations, refer to http://thehorrorsection.blogspot.com/2008/08/12-things-i-love-about-evil-dead.html. For Gasparcolor, see http://www.brianpritchard.com/gasparcolor.htm and for Kokaram's software, see https://www.tcd.ie/news_events/articles/trinity-college-lecturer-dr-anil-kokaram-wins-oscar-award-for-visual-effects-software-for-films/ (accessed August 28, 2018).

125 *The English Works of Thomas Hobbes of Malmesbury*. Volume 1. Adamant Media Corporation, 2005: 136-137.

126 It should be noted once again that Rodowick, when discussing the ontological issue leans towards an essential difference between the analog and the digital. In Gunning's words: "Rodowick admits that digital images can (and usually do) resemble traditional chemical photography, but he maintains that transforming images of the world into a matrix of numbers absolutely changes their relation to time, the world and the viewer" (2007b: 78).

127 "[...] photography can by no means be assumed to be the sole pre-condition for a moving image medium, and if we go so far as to drop it as a necessary and defining condition, we might begin to ask very different questions about the cultural space film entered. For example, what if the film medium had in fact entered a space prepared for television?" (Uricchio, 2002a: 114).

128 "The two separate historical trajectories finally meet. Media and computer – Daguerre's daguerreotype and Babbage's Analytical Engine, the Lumière's Cinématographe and Hollerith's tabulator – merge into one. All existing media are translated into numerical data accessible for the computer. The result: graphics, moving images, sounds, shapes, and texts become computable, that is, simply sets of computer data. In short, media become new media" (Manovich, 2001: 25).

129 For instance, in the case of the restoration of Carl Th. Dreyer's film *Der Var Engang / Once Upon a Time* (DK, 1922), carried out by the Danish Film Institute in 1992, stills and texts have been added where scenes were missing. Also, for a trained eye, digital enhancements in the restoration of a silent film, e.g. de-flickering and rock steady stabilization, can be experienced as hypermediacy.

130 Apart from the already mentioned Baudrillard (1983,1995 and 2006), see also Debray (1992, 1993) and Virilio (1994, 1998).

131 In contrast to Actor-Network-Theory, SCOT does not attribute agency to technology and artifacts but rather looks at them as social processes avoiding the risk of lending technology an autonomous life of its own (Bijker, 1995: 49). Furthermore, SCOT, by looking at social groups rather than individual actors (Bijker, 1995: 192), like other theories do, offers a more relevant model for the archival field where archives, funding entities and laboratories have, in my opinion, a stronger influence than individuals. However, SCOT acknowledges also the role of individual actors, as I will do in analyzing the film archival field.

132 In this regard, Bijker states that: "Actors with a high degree of inclusion are more to the inside than actors with a lower degree of inclusion" (1995: 282).

133 The seminar The Reel Thing and the AMIA panel discussion took place at Eye Filmmuseum in Amsterdam on 11 April, 2007, the opening day of the Filmmuseum Biennale. The morning program was led by the organizers of the symposium The Reel Thing at its XVIII edition, Grover Crisp and Michael Friend. The symposium regularly offers an overview of the most recent technologies in the

field of film restoration and preservation. The afternoon program, organised by the Association of Moving Image Archivists (AMIA), dealt with the developments in archiving moving images and formed an important international platform for individuals concerned with preserving and utilising archival films.

134 Although I am not going into each of the five requirements Bijker points out for technological frames, note that they are to: "(1) be able to account for change in technology, (2) be able to explain consistency and lack of change in history, (3) be symmetrical with respect to success and failure, (4) encompass actors' strategies as well as structural constraints, and (5) avoid their implicit a priori assumption of various distinctions made by the actors themselves" (Bijker, 1995: 191).

135 Refer to the discussion on DIGITAL CINEMA in Chapter One.

136 If not for other reasons, this would be true because of the much broader scope of different relevant social groups that interact around film compared to those interacting around the bicycle.

137 Refer to Fossati, 1995 and 1998 for more on this subject and a discussion of the reason why color in early film risked being erased from film history.

138 It should be pointed out that in Bijker's theory, the "working" of a machine "is not an intrinsic property of the artifact, explaining its success; rather, it should figure as a result of the machine's success. Thus the success or failure of an artifact are to be explained symmentrically, by the same conceptual framework. An asymmentrical explanation might, for example, explain the commercial success of an artifact that we now consider to be working by referring to that 'working', while the failure of that same artifact in another context might be explained by pointing at social factors" (Bijker, 1995: 14-15).

139 With regard to the definition of "critical museum," Horwath states that the "museum is a critical, ethical, and political tool, which stands in direct opposition to whatever social mood or climate or ideology is hegemonic at a given time" (2005: 7).

140 Just to name a few Selznick graduates currently active in the field: Simona Monizza and Catherine Cormon at Eye Filmmuseum, Annette Groschke at the Deutsche Kinemathek, Rita Belda at Sony Pictures Entertainment, John Klacsmann at Anthology Film Archives, Mark Toscano at Academy Film Archive, Heather Linville at Library of Congress, Daniela Currò at Cineteca Nazionale in Rome, Arianna Turci at Royal Film Archive in Brussels, and Ulrich Ruedel at the University of Applied Sciences in Berlin.

141 Cherchi Usai justifies his decision to destroy the negative by saying that: "I like to treat my film as a biological entity. The prints have been deposited, donated or bequested to archives and museums around the world, with the legally stipulated proviso that the film will not be reproduced in any form nor projected with a recorded soundtrack." In the same interview, Cherchi Usai also points out that the seven black-and-white prints of *Passio* were all separately tinted following

a technique similar to the one used in the silent era: "Each print has a specific dominant hue, and the brushstrokes were applied to different shots in each print, based on the correspondence between colours and images in the film. As a result, the seven prints are very different from each other. Only the last shot was hand-coloured in all the seven prints." – Grant McDonald, "*Passio.* An Interview with Paolo Cherchi Usai": http://www.rouge.com.au/10/passio.html (accessed June 16, 2011).

142 The Danish Film Institute's activities extend further than the film archive and the so-called Cinémathèque, where films are shown to the general public in Copenhagen. The Institute also participates in the development and production of feature films, shorts and documentary films, as well as their distribution and marketing.

143 Note that the Danish Film Institute regularly receives new film elements for every new film that is produced in Denmark. This is the consequence of the so-called legal deposit system in place in several countries, including Germany, France, Italy and the United States of America. For an in-depth discussion of such a system, refer to Gorini, 2004.

144 Dan Nissen, Director of the Danish Film Archive, announced that: "The Danish Film Institute's collection of Danish and international films – from Dreyer's immortal masterpieces to Griffith's seminal 'Intolerance' and rare documentary footage from times long past – are securely ensconced in a 1,160 m2 underground refrigerator. The sole sign above ground is something resembling a cemetery of sarcophagi or an enigmatic modern landscape installation." See https://www.dfi.dk/english/new-nitrate-archive-opens (accessed August 28, 2018).

145 Note that Eye Filmmuseum is also considering this option for its new storage facilities, but only for the historical acetate collection and, in particular, for the original negatives and the FINE GRAINS that can be used as sources for future duplications.

146 Thomas Christensen, e-mail message to author, May 14, 2008.

147 Thomas Christensen, e-mail message to author, May 14, 2008.

148 Thomas Christensen, e-mail message to author, May 14, 2008.

149 Interestingly, the current Dutch Minister of Culture, Ronald Plasterk, is actively promoting the creation of such an organ that would group many of the small Dutch film organizations together with the Nederlands Filmmuseum and the Dutch Fund for Films. Such integration was realized in 2009 and led to the creation of Eye Filmmuseum in 2010.

150 Thomas Christensen, e-mail message to author, May 14, 2008.

151 Thomas Christensen, e-mail message to author, May 14, 2008.

152 Recently, Eye Filmmuseum has carried out an important project with the goal of acquiring, preserving and restoring Dutch experimental films from the period 1960-2000. A number of filmmakers actively cooperated with film restorer Simo-

na Monizza, who led the restoration efforts. Refer also to two DVDs resulting from this project and containing reports on the filmmakers' involvement in the work: *Barbara Meter – PureFilm* (Nederlands Filmmuseum, 2008) and *Frans Zwartjes – The Great Cinema Magician* (Nederlands Filmmuseum, 2007). See also https://www.eyefilm.nl/en/collection/search-and-watch/dossiers/experimental-film-in-the-netherlands (accessed August 28, 2018).

153 See http://anthologyfilmarchives.org/about/history (accessed June 16, 2011).

154 Filmmaker Jerome Hill was instrumental to the creation of Anthology, not only as one of the inspirations but also as the person who made it financially possible. Among his many philanthropic contributions to artists and avant-garde filmmakers, Jerome Hill funded the realization of Anthology's original screening room designed by Peter Kubelka, known as the Invisible Cinema, and funded the acquisition of film prints of the Essential Cinema Repertory collection (Haller, 2005).

155 See the Anthology Film Archives' Manifesto at http://anthologyfilmarchives.org/about/manifesto (accessed June 16, 2011).

156 See http://anthologyfilmarchives.org/about/essential-cinema (accessed June 16, 2011).

157 The definition "Orphan film" has gained particular relevancy over the last few years thanks to, among others, The Orphan Film Symposium, founded and organized by Dan Streible, at its sixth edition in 2008. According to the Symposium's website, an Orphan film is "a motion picture abandoned by its owner or caretaker. More generally, the term refers to all manner of films outside of the commercial mainstream: public domain materials, home movies, outtakes, unreleased films, industrial and educational movies, independent documentaries, ethnographic films, newsreels, censored material, underground works, experimental pieces, silent-era productions, stock footage, found footage, medical films, kinescopes, small- and unusual-gauge films, amateur productions, surveillance footage, test reels, government films, advertisements, sponsored films, student works, and sundry other ephemeral pieces of celluloid (or paper or glass or tape or . . .)." See http://www.sc.edu/filmsymposium/orphanfilm.html (accessed May 16, 2008).

158 See http://www.anthologyfilmarchives.org/schedule/search/film/?id=8789 (accessed May 19, 2008; page no longer accessible August 28, 2018).

159 Refer to the Anthology Film Archives April-June, 2008 Program.

160 This and following quotes are based on conversations and correspondence with Andrew Lampert, in particular a meeting on March 5, 2008 at Anthology in New York and a telephone interview on May 21, 2008.

161 This restoration project was supervised for Anthology by independent film Curator, Bruce Posner, and carried out at Cineric.

162 Andrew Lampert, telephone interview by author, May 21, 2008.

163 Although Third World film heritage falls outside the scope of this work, it is worth mentioning that outside Western Europe, North America and Japan, most of the remaining audiovisual heritage can be considered Orphan. From this perspective, it is again through digital means that audiovisual content can gain a world-wide visibility: not only world-wide in the sense that Western films can be seen everywhere, but also that non-Western films can be seen for the first time.

164 Andrew Lampert, telephone interview by author, May 21, 2008.

165 See http://www.ubu.com and in particular, http://www.ubu.com/papers/film_culture.html (accessed June 16, 2011).

166 Andrew Lampert, telephone interview by author, May 21, 2008.

167 See http://www.ubu.com/film/index.html (accessed June 16, 2011).

168 Refer to Lampert, 2006.

169 For a detailed background history of Eye Filmmuseum, refer to those who have done detailed research, in particular Hendriks, 1996 and Lameris, 2007 and 2017.

170 Both collections have been studied and discussed in many articles and books. The Desmet collection contains most of the international films shown in the Netherlands between 1907 and 1916 by cinema owner and distributor Jean Desmet (see Blom, 2003 and Lameris, 2007: 29-34). The Uitkijk collection contains the distribution films shown and distributed in the Netherlands by the Dutch early film club Filmliga, which between 1927 and 1933 brought to the Dutch *cinéphiles* some of the most important titles of the European avant-garde (see De Klerk and Visschedijk, 1999 and Lameris, 2007: 34-38).

171 About *Bits & Pieces*, see Delpeut, 1990 and Verhoeff, 2002 and 2006: 25-43; about non-fictional films, see Hertogs and De Klerk, 1994 and 1997, and, in particular, Peterson, 1997; about color, see Hertogs and De Klerk, 1996.

172 The project involved transfer at Standard Definition to Digital Betacam tapes and encoding to MPEG1 files.

173 André Waardenburg, "Publiek wordt zelf programmeur," *NRC Handelsblad*, January 11, 2008 – my translation.

174 See http://www.filmmuseum.nl, my translation (accessed April 13, 2008; page no longer accessible August 28, 2018).

175 Refer with this regard to phenomena like "social tagging" mentioned earlier in Chapter One and discussed, among others, by De Jong (2005) and Uricchio (2007).

176 For more background information on *Images for the Future*, refer to the official website: http://www.beeldenvoordetoekomst.nl/en.html (accessed August 28, 2018).

177 Note that at the time of writing three providers have been granted the preservation and digitization tasks by the Filmmuseum for the next two years. The Dutch laboratory, Haghefilm, and the New York-based Cineric have won the tender for film-to-film preservation, while the American company Thought Equity Motion (https://web.archive.org/web/20080308233452/http://www.thoughtequity.com:80/

video/shell/txp/about-us-home.do?title=About+Us - accessed August 28, 2018), specializing in digitization and asset management, has won the tender for digitization. Thought Equity is now Wazee Digital, see https://wazeedigital.com (accessed August 28, 2018).

178 To quote Emjay Rechsteiner, Project Manager of *Images for the Future* for the Filmmuseum: "Today programmers decide which film you can see in our theaters and when, within a couple of years the consumer himself will decide what to see and when: the audience becomes the programmer" (André Waardenburg, "Publiek wordt zelf programmeur," *NRC Handelsblad*, January 11, 2008 – my translation).

179 Exceptions are those non-profit archives that benefit from a national legal deposit legislation, as in the case of the Danish Film Institute. Still, also in this case, the relation with the industry (i.e. film producers) is quite different from that of film studios' archives.

180 Grover Crisp, e-mail message to author, May 27, 2008.

181 Interesting in this regard is a plea by filmmaker Jon Jost to FIAF, cited by Cherchi Usai, to take over the production of a few basic stocks of photochemical film (Jost, 2001, also cited in Cherchi Usai, 2002: 36-37).

182 Much of the information on Sony's work reported here derives from conversations with Grover Crisp and his interventions at the AMIA seminar (Amsterdam, 2007) mentioned earlier. See https://web.archive.org/web/20080517065159/http://www.sonypicturesmuseum.com/film_preservation/preservation.html and https://www.sonypictures.com/studios/bio/grovercrisp.php (both accessed August 28, 2018).

183 See Cathie Christie, "Restoration. 'A Matter of Life and Death.'": http://www.powell-pressburger.org/Reviews/46_AMOLAD/AMOLAD30.html (accessed June 16, 2011).

184 Grover Crisp, e-mail message to author, May 27, 2008.

185 This project will be discussed in detail in the next chapter. Note that Crisp has presented this restoration at several events, including the Joint Technical Symposium in Toronto and "The Reel Thing" in Amsterdam, both held in 2007, offering the first opportunity to discuss the use of the digital at such high RESOLUTION and showing how a digital projection of the results compares to a traditional film projection.

186 Grover Crisp, e-mail message to author, May 27, 2008.

187 Refer also to Chapter One where ViiA was briefly discussed.

188 Grover Crisp, e-mail message to author, May 27, 2008. For details on LTO tapes, refer to http://en.wikipedia.org/wiki/Linear_Tape-Open (accessed June 16, 2011).

189 See Prasad's website, http://prasadcorp.com/ (accessed August 28, 2018). One very important project Prasad has recently carried out is the digital restoration commissioned by Warner Bros. of the Cinerama title, *How the West Was Won* (USA,

1962). Also laboratories such as Cineric regularly outsource dust removal work to Prasad because of the highly competitive costs of manual labor. At the time of writing, Eye Filmmuseum has outsourced some digital "dust busting" work to Prasad. In this case, Eye Filmmuseum restorer, Annike Kross, has set the standards for the work to be carried out at the Indian laboratory.

190 Refer to the definition of frameworks and concepts and their distinctions in Chapter Two.

191 The discussion on Haghefilm laboratory benefits from twelve years of close collaboration with this laboratory and its exceptional staff. As Curator at Eye Filmmuseum and supervisor of many restoration projects, most of which were carried out in collaboration with Haghefilm, I regularly spend several hours every week at Haghefilm's facilities discussing restoration-related issues. I would also like to point out an article that quite uniquely discusses the work carried out by Haghefilm: *The Finesse of the Film Lab. A Report from a Week at Haghefilm* by Gabriel M. Paletz (2006).

192 For a discussion on color in silent films and the restoration approach towards such colors throughout the years, refer to Hertogs and De Klerk, 1996; Fossati, 1996, 1998, 2013, and 2015; and Yumibe, 2012.

193 Especially since 1999, when Eye Filmmuseum created a Film Restoration Department, led by me until 2002, the focus on restoration quality has been particularly strong and it has been translated into an intensified dialogue with Haghefilm technicians, through weekly meetings and thematic workshops (refer to Paletz, 2006: 14). It should, however, be noted that quality was central even in the period before, but it also had to be paired with the need for a high production, namely, more meters of film to be restored per week.

194 Refer to *Collectie, Kennis en Publiek. Beleidsplan 2005-2008* (Collection, Knowledge and Public. Policy Plan 2005-2008), Filmmuseum, November 2003: 7.

195 The rostrum camera is "a specially adapted camera used in television and film to animate a still picture or object. It consists of a moving lower platform on which the article to be filmed is placed, while the camera is placed above on a column. The camera is connected to a mechanism that allows an operator to precisely control the movement of the platform as well as of the camera." Wikipedia, http://en.wikipedia.org/wiki/Rostrum_camera (accessed July 16, 2008).

196 Within the Dutch Experimental films project, some remarkable results have been obtained through digital restoration from original 16mm color reversal films, where analog duplication could not accurately reproduce the colors and contrast typical of such film material widely used in the 1970s and 1980s. One such case has been that of *Tarting Over* (NL, 1981), shot on Kodachrome Color Reversal stock by Dutch experimental filmmaker Paul de Nooijer.

197 Refer to Chapter One for a detailed discussion of the DIGITAL INTERMEDIATE process. See also Glossary.

198 See among many others Read, 2002, 2004 and 2006, and Read and Meyer, 2000.

199 Paul Read, e-mail message to author, May 26, 2008.

200 Paul Read, e-mail message to author, May 26, 2008.

201 Refer to Chapter One and to the Glossary for a technical description of such processes, including a discussion on RESOLUTION and COLOR DEPTH values.

202 Much information contained in this study derives from interviews that I carried out with a number of staff members at Cineric in March, 2008. In particular, conversations with Balázs Nyari, President, Tom Heitman, Director of Preservation and Restoration, Simon Lund, Technical Director, Daniel DeVincent, Director of Digital Restoration, and Seth Berkowitz, Digital Repair, have been very useful.

203 Refer to Chapter One for a discussion on the digitization of optical special effects and digital COMPOSITING.

204 Eric Rudolph, "Saving Past Classics at Cineric," *American Cinematographer* 9, 2000: 161-162.

205 Idem.

206 As mentioned earlier, it should be noted that this technique has already become obsolete as digital tools can today reach better results in the restoration of color-faded films.

207 Tom Heitman, e-mail message to author, January 8, 2009.

208 A very informative documentary on this restoration, *Restoring CinemaScope 55 The King and I* (USA, 2004), made by filmmaker and Cineric Technical Director, Simon Lund, can be viewed online on the useful Video Aids for Film Preservation website at http://www.folkstreams.net/vafp/clip.php?id=42 (accessed June 16, 2011). This restoration was supervised by Schawn Belston, Vice President of Library and Technical Services at Twentieth Century Fox.

209 Daniel DeVincent, interview by author, Cineric, New York, March 3-5, 2008.

210 http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/329&format=HTML&aged=0&language=EN&guiLanguage=en (accessed May 28, 2008).

211 http://ec.europa.eu/commission_barroso/reding/ataglance/index_en.htm (accessed May 28, 2008; no longer accessible August 28, 2018).

212 See http://www.hs-art.com/index.php/solutions/diamant-film (accessed August 28, 2018).

213 The source of this information is the website of the software developer and dealer, HsArt Digital Service, which was also a member of the EU project: http://www.hs-art.com/index.php/about-us-2/customers (accessed August 28, 2018).

214 See https://www.prestocentre.org/resources/projects/prestospace (accessed August 28, 2018).

215 See https://web.archive.org/web/20080329205735/http://www.prestospace.org/project/index.en.html (accessed August 28, 2018).

216 See https://web.archive.org/web/20080223081341/http://www.edcine.org/ and https://cordis.europa.eu/project/rcn/80207_en.html (both accessed August 28, 2018).

217 Refer to Chapter One for a discussion of such specifications and standards.

218 See https://web.archive.org/web/20080323150947/http://www.edcine.org:80/project-summary (accessed August 28, 2018).

219 The first animation film restored entirely using digital tools is Disney's *Snow White and the Seven Dwarfs* (USA, 1937). Although animation is considered outside the scope of this work, this restoration (carried out in 1993), has been briefly discussed in Chapter One.

220 Sony Pictures High Definition Center (SPHDC) "[…] was set-up circa 1990 at the studio lot in Culver City initially as an R&D [research and development] facility related to the digital HD format that Sony was working on at that time. This was the 1035i format using 1" digital HD tape. Although designed for R&D, it eventually became primarily a telecine facility for Sony Pictures as well as a few outside clients, to do film-to-HD transfers. Additionally, engineers in the SPHDC worked with us to develop processes to use for restoration, some manual and some automated. […] Other projects there involved the scanning and re-registration digitally of separation masters [BLACK-AND-WHITE SEPARATION MASTERS] to record to a new negative (*Easy Rider* – USA, 1969- in 1996-1997), as well as other projects of a similar nature. The facility closed its operation in February of 2002" (Grover Crisp, e-mail message to author, May 27, 2008).

221 Grover Crisp, e-mail message to author, May 27, 2008. Note also that the innovative work of many people made the digital restoration of *The Matinee Idol* possible. In most cases the software needed for the job was developed or modified on the spot. In addition, the collaboration with the Cinémathèque Française has been instrumental to the successful result of the project. To the question of why a new intermediate positive was digitized and not the surviving print found at Cinémathèque Française, Grover Crisp notes that "At the time, there was a lot of discussion about scanning from original negative or from protection elements. We opted for scanning the protection (the Interpositive made from the Duplicate Negative) primarily on the assumption we were providing additional 'protection' against possible further damage to the negative. The top scanners at the time were pin-registered and the work was new and we were not anxious to take chances with original negative. That ethic has completely changed now, some twelve years later. In planning a digital restoration we always look to scan the most original source if possible" (Grover Crisp, e-mail message to author, January 22, 2008).

222 It should be added that Grover Crisp, in a later e-mail message to the author (January 22, 2008) pointed out that very recently tests have clearly shown "that to scan any 35mm film element at less than 4K is to lose image information. Good, faster 4K scanners are more readily available. Also, in this short amount of time,

the cost of 4K scanning has come down to more affordable rates." One more indication of how rapidly the technological frame is changing and how profoundly transitional today's practice is.

223 Michael Friend, e-mail message to author, August 20, 2008.

224 Interestingly, this was at first the only intervention that was meant to be carried out, as Friend recounts: "When we began *Matinee Idol*, we really thought we would just replace the French titles with English titles" (Michael Friend, e-mail message to author, August 20, 2008).

225 Michael Friend, e-mail message to author, August 20, 2008.

226 Michael Friend, e-mail message to author, August 20, 2008.

227 Whereas the shift from a theatrical exhibition to a DVD is clear enough in terms of changing *dispositif*, one could argue that the shift from a silent film projection with live music accompaniment to a film projection of the same silent film with a soundtrack optically recorded on the film print does not offer sufficient grounds to claim a different *dispositif*. In Chapter Two I have argued that the configuration of a new *dispositif* depends more on the viewer rather than on the setting. Indeed, a viewer who is not aware of the different apparatus will not perceive the shift in *dispositif*, whereas a viewer who is aware will. The same line of reasoning applies for a film-born film when projected digitally.

228 The discussion of this project is based on information originating from various sources, such as interviews and correspondence with Grover Crisp, Senior Vice President of Asset Management and Film Restoration at Sony Pictures, Daniel DeVincent, Director of Digital Restoration at Cineric Laboratory as well as presentations given by them at The Reel Thing XVIII (Amsterdam, April 11, 2007 – Grover Crisp) and at the Joint Technical Symposium 2007 (Toronto, June 28-30 2007 – Daniel DeVincent).

229 Grover Crisp, e-mail message to author, May 27, 2008.

230 Refer to Daniel Restuccio, "Making Stanley Kubrick smile: Dr. Strangelove gets restored at NYC's Cineric," *Post*, August 2007: https://www.highbeam.com/doc/1G1-168286333.html (accessed August 28, 2018).

231 Presentation given by Grover Crisp at The Reel Thing XVIII (Amsterdam, April 11, 2007).

232 Grover Crisp, e-mail message to author, May 27, 2008.

233 Grover Crisp, e-mail message to author, May 27, 2008.

234 Presentation given by Grover Crisp at The Reel Thing XVIII (Amsterdam, April 11, 2007).

235 The recent publication of an article promoting archival concerns in this matter, might suggest that the issues of obsolete projection speeds and of the ASPECT RATIOS might still be considered by the SMPTE standard commission for DIGITAL CINEMA (Nowak and Fößel, 2008).

236 Presentation given by Grover Crisp at The Reel Thing XVIII (Amsterdam, April 11, 2007).

237 Refer to Franco Terilli, "Il restauro della scena e del sonoro" – https://web.archive.org/web/20090405203850/http://www.desica.com/restauro.html (accessed August 28, 2018).

238 Presentation given by Grover Crisp at The Reel Thing XVIII (Amsterdam, April 11, 2007).

239 Note that, as discussed in Chapter Two with regard to the "film as art" framework, the relationship between the restorer and the filmmaker/*auteur* can be a difficult one, as filmmakers are not necessarily the most reliable sources for a faithful restoration of the film as it originally was. For instance, filmmakers would sometimes like to "improve" their films during the restoration process because their view about the film has changed since it was completed.

240 This record of the restoration of *Mahagonny* is based on interviews and correspondence with some of the people involved, including Simon Lund (interviews March 3-5, 2008), Andrew Lampert (June 21, 2008), and e-mail correspondence with Rani Singh (August 12, 2008) and Michael Friend (August 20, 2008). In addition, the entertaining short film made by Simon Lund, *Restoring Harry Smith's Mahagonny* (USA, 2002), has been a very useful source of information. Lund's film can be viewed on http://www.folkstreams.net/vafp/clip.php?id=5 (accessed June 16, 2011).

241 Simon Lund, e-mail message to author, August 5, 2008.

242 Simon Lund, e-mail message to author, August 5, 2008.

243 Rani Singh, e-mail message to author, August 12, 2008.

244 Rani Singh, e-mail message to author, August 12, 2008.

245 Andrew Lampert, telephone interview by author, May 21, 2008.

246 Simon Lund, interview by author, Cineric, New York, March 3-5, 2008.

247 Michael Friend, e-mail message to author, August 20, 2008.

248 In this regard Friend quite eloquently states that: "I would say that the only performative aspect of this work that has meaning is the performance of Harry Smith" (Michael Friend, e-mail message to author, August 20, 2008).

249 Rani Singh, e-mail message to author, August 12, 2008.

250 Andrew Lampert, telephone interview by author, May 21, 2008.

251 According to Eye Filmmuseum's website "director Kleinman stated: 'The concept known as the soundie is, in this case, limited to some songs and people should not expect complete dialogues.' It is for this reason that he cast two professional singers in the leading parts. The sound was meant to be recorded and played on gramophone records were it not that Kleinman had underestimated the complications surrounding sound technology. Hence the film became the last silent Dutch film" (http://lisa.filmmuseum.nl/biennale03/html/index-234.html - accessed June16, 2011; page no longer accessible August 28, 2018).

252 Internal report by Paul Read to Eye Filmmuseum (April 2003). Note that a few title cards were removed from the sound version as they had become redundant by the addition of dialogues.

253 Internal report by Paul Read to Eye Filmmuseum (April 2003).

254 For an exhaustive background story of the Parisien theater and its use by Eye Filmmuseum throughout the years, refer to Lameris, 2007: 114-116.

255 From January to March 2005 I spent most of my waking hours in front of two computer monitors with the goal of digitally restoring about one half of the film. The other half was outsourced to Haghefilm where Paulo Fonseca, Digital Restoration Artist, did the work in close contact with me to make sure that we would end up with matching results.

256 Refer to the second part of Chapter One for a complete overview of the technical tools available today for digital restoration and their technical descriptions.

257 Refer to Chapter One for a description of this method.

258 It should be pointed out that *Beyond the Rocks* was shown as a digital projection in the framework of the CinemaNet Europe (https://web.archive.org/web/20070612184151/http://www.cinemaneteurope.com/ - accessed August 28, 2018), discussed in Chapter One, which at the time employed only so-called E-Cinema projectors with a RESOLUTION of 1.4K, thus lower than the 2K standard for DIGITAL CINEMA projection, as indicated by DCI and SMPTE.

259 It should be noted that this is not the only case, as Warner Bros. has also released restorations in DIGITAL CINEMA format. Examples are *Casablanca* (USA, 1942) and *Gone with the Wind* (USA, 1939).

260 This idea is central to Jacques Derrida's discussion of archives (1995) and it has been articulated with regard to film archives in the earlier mentioned article by William Uricchio, "Archives and Absences" (1995).

NOTES TO THE THIRD REVISED EDITION

i Parts of this Introduction were also included in the author's inaugural lecture held at the University of Amsterdam on October 28, 2016 (Fossati, 2017).

ii See http://www.oapen.org/search?identifier=369986 (accessed July 3, 2018).

iii See http://www.mpaa.org/wp-content/uploads/2014/03/MPAA-Theatrical-Market-Statistics-2013_032514-v2.pdf and https://technology.ihs.com/421048/technology-moves-to-the-forefront-in-cinema-as-digital-overtakes-film. For more on the digital rollout, see also the updates to Chapter One.

iv In January 2014, Paramount announced that it would become the first studio to cease all film distribution (http://articles.latimes.com/2014/jan/18/entertainment/la-et-ct-paramount-end-to-film-20140118). See also a comment made at the time by UCLA Film Archive Director Christopher Horak on the consequences of Paramount's new strategy (https://www.cinema.ucla.edu/blogs/archival-spaces/2014/01/31/paramount's-all-digital-distribution).

v Instant photography is an example of a similar niche market. Recently, an initiative by the Impossible Project has successfully revived the defunct Polaroid company in a downscaled form (see https://eu.polaroidoriginals.com – accessed July 4, 2018). A similar attempt is being made by Film Ferrania for a small selection of film stocks that the large Italian film manufacturer Ferrania used to produce (see http://www.filmferrania.it/about/ – accessed July 4, 2018). Film manufacturer Kodak is also revamping obsolete technologies with its new Super 8 camera launched in 2016 (http://www.kodak.com/ek/US/en/corp/press_center/Kodak_Launches_Super_8_Filmmaking_Revival_Initiative_at_CES_2016/default.htm – accessed July 4, 2018) and the resumed production of Ektachrome film stock in 2017 (http://www.kodak.com/us/en/corp/press_center/kodak_brings_back_a_classic_with_ektachrome_film/default.htm# – accessed July 4, 2018).

vi Refer to the updates to Chapter One for more on this phenomenon.

vii Significant exceptions are Kumar, 2013 and Devraj, 2015.

viii For an in-depth discussion of the European film avant-garde in the 1920s and 1930s and its relationship with the emergence of film clubs and archives, refer to Hagener, 2007.

ix Refer in particular to Meyer, 1996 and 2001; and Cherchi Usai, 2002.

x In a broader sense, this turn to materiality is reminiscent of the idea of mining audiovisual archives for matter and, literally metals, as recently discussed by film theorist Patricia Pisters in her paper "The Filmmaker as Metallurgist" (2016).

xi See http://www.sprocketschool.org/wiki/List_of_analog_film_exhibitors (accessed December 12, 2016).

xii See https://www.eastman.org/nitrate-picture-show (accessed July 5, 2018).

xiii For a general introduction to "digital materialism," refer to Reichert and Richterich, 2015.

xiv See also the following papers: Crofts, 2008; Everett, 2008; Lipman, 2009; Hediger, 2011; Brand, 2012; Flueckiger, 2012; Giuliani and Negri, 2012; Frappat, 2013; Blümlinger, 2014; Lundemo, 2014; Jamieson, 2015; Negri, 2016; Brunow, 2017. Also a number of entries in the blog curated by UCLA Film Archive's Director Jan-Christopher Horak *Archival Spaces: Memory, Images, History* are of relevance here (see https://www.cinema.ucla.edu/blogs/archival-spaces – accessed July 5, 2018). See also the recently published "The Digital Statement. Recommendations for Digitization, Restoration, Digital Preservation and Access" by the Technical Committee of the FIAF (http://www.fiafnet.org/pages/E-Resources/Digital-Statement.html – accessed June 1, 2018).

xv For a background on the US situation, see http://www.dcimovies.com (accessed December 20, 2017) and the section on DIGITAL CINEMA in this chapter; for the European situation, see https://ec.europa.eu/culture/policy/audiovisual-policies/digital-distribution_en (accessed December 20, 2017) and its related documents including the "GREEN PAPER on the Online Distribution of Audiovisual Works in the European Union: Opportunities and Challenges Towards a Digital Single Market" (European Commission, 2011).

xvi For more details on the most telling episode revealing the scope of the film manufacturing crisis, see the announcement of Kodak's filing for bankruptcy in 2012: https://www.theatlantic.com/business/archive/2012/01/kodak-files-bankruptcy/332934/ (accessed December 23, 2017).

xvii For more information regarding FATF, see http://www.filmadvocacy.org/about-us/who-we-are/ (accessed December 23, 2017); for more information on FOFA, see Fairall, 2016 and Wengström et al., 2016; and for more on the Charter of Cinematographic Projection in the 21st Century, see filmprojection21.org (accessed March 19, 2018).

xviii See https://www.theguardian.com/artanddesign/2011/feb/22/tacita-dean-16mm-film (accessed December 28, 2017).

xix See the contributions collected in Cullinan, ed., 2011 and the project Re-Engineering the Moving Image (RE MI), http://www.re-mi.eu/ (accessed December 26, 2017).

xx See the press coverage on this topic (https://www.hollywoodreporter.com/behind-screen/christopher-nolan-jj-abrams-win-722363 – accessed December 26, 2017). In 2011, Christopher Nolan addressed an audience of Hollywood filmmakers and producers to plead for keeping film production alive (see http://www.laweekly.com/content/printView/2174582 – accessed December 26, 2017 – and Binder, 2015: 260). Also, Martin Scorsese addressed Kodak on this issue in an open letter in 2014 (see http://insidemovies.ew.com/2014/08/04/martin-scorsese-kodak-film-letter/ – accessed December 26, 2017).

xxi As a counterpart to the abovementioned voices in support of analog film, see others who underline the advantages of digital means: https://www.engadget.com/2016/02/15/films-cinema-comeback-is-driven-by-nostalgia-not-logic/ (accessed December 26, 2017) and http://www.hollywoodreporter.com/news/sorrentino-cinematographer-calls-film-school-725220 (accessed December 26, 2017).

xxii See https://www.filmcomment.com/blog/artist-run-film-laboratories/ (accessed December 26, 2017) and the website http://www.filmlabs.org (accessed December 26, 2017) for a discussion of the DIY laboratories active worldwide in 2015.

xxiii For more detailed information on the 2012 digital rollout, see http://www.mediasalles.it/journal/ecj2_12ing.pdf (accessed March 19, 2018) and Kessler and Lenk, 2016: 304.

xxiv See https://www.theguardian.com/film/2017/may/11/cannes-film-festival-takes-on-netflix-with-new-rule (accessed January 2, 2018).

xxv Many thanks to Andréa Seligmann Silva, Audio Restorer at Eye Filmmuseum, and Ronald Bosdam, Audio Engineer at Haghefilm Digitaal for their insightful feedback on the most important trends in film sound post-production and projection in the last decade, and on the repercussions of such trends for film sound restoration. For a critical review of Dolby's history and the reframing of its innovations in view of a broader film historical tradition, see Dienstfrey, 2016.

xxvi For a detailed description of surround sound technology and references to relevant literature, see https://en.wikipedia.org/wiki/Surround_sound (accessed September 19, 2018). Here, a number of important analog predecessors to multi-channel surround sound systems are also mentioned, such as Fantasound developed by Disney for *Fantasia* (USA, 1940) and the seven-channel SURROUND SOUND of *This Is Cinerama* (USA, 1952).

xxvii Refer to the description of Dolby Atmos for more details about how these kinds of sound systems work: https://www.dolby.com/us/en/technologies/cinema/dolby-atmos.html (accessed April 20, 2018). According to the description, the sound editor has more control over the manipulation of sound, since "[…] sound can be freed from channels. It enables artists to treat specific sounds as individual entities, called audio objects. These can be precisely placed and moved by the soundtrack creator anywhere in the cinema's three-dimensional space – they are not confined to specific channels – though the artist can continue to use channel capabilities as desired. The Dolby Atmos cinema processor then determines which of a cinema's huge array of front, back, side, and overhead speakers it will use to recreate this lifelike movement."

xxviii See http://postperspective.com/evoking-beauty-power-dunkirk-65mm/ (accessed January 2, 2018).

xxix Refer to Wengström, 2013: 131-132 and to the Eye Collection Policy 2018-2021, available for download at the bottom of the webpage https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018).

xxx See https://www.theguardian.com/film/2013/mar/07/disney-hand-drawn-animation (accessed January 3, 2018).

xxxi See http://www.getty.edu/conservation/publications_resources/newsletters/30_2/gcinews01.html and http://www.materialsinmotion.nl/about/ (both accessed January 3, 2018).

xxxii For a critical review of all that is wrong with contemporary use of CGI see http://www.cracked.com/blog/6-reasons-expensive-films-end-up-with-crappy-special-effects/ (accessed December 20, 2017).

xxxiii In this regard, refer to Bonnard, 2016; Gunning et al., 2015; and Fossati, 2015.

xxxiv Many thanks to Daniel DeVincent (Senior Colorist and Director of Digital Services at Cineric) for sharing his knowledge and experience about recent developments in the field (interview by author, November 27, 2017).

xxxv http://www.oscars.org/science-technology/sci-tech-projects/aces (accessed January 11, 2018).

xxxvi Refer to the ACES official website (http://www.acescentral.com) for technical descriptions and more relevant resources.

xxxvii Refer to the presentation given by Andy Maltz, Managing Director of the Academy's Science and Technology Council and project director for the ACES initiative, at the Conference of the Association of Moving Image Archivists in 2015, http://www.amiaconference.net/wp-content/uploads/2016/01/Maltz-Andy.pdf (accessed January, 11, 2018).

xxxviii Refer, for instance, to Sony's restoration and remastering of Steven Spielberg's *Close Encounters of the Third Kind* (USA, 1977) in https://www.

hollywoodreporter.com/behind-screen/close-encounters-third-kind-2017-4k-restoration-explained-1033691 (accessed April 3, 2018). This project is also mentioned in Chapter Three when discussing Sony's recent projects.

xxxix For a reflection on the implications of this announcement, see Giuliani and Negri, 2011.

xl See https://www.kodak.com/consumer/products/super8/super8-camera/analog_renaissance/default.htm (accessed January 11, 2018).

xli Refer also to the earlier mentioned documentary *Side by Side* (USA, 2012) which includes various interviews with filmmakers on their choice for digital cinematography and experience with digital cameras such as the RED camera.

xlii The phenomenon of dead and defective pixels was recently illustrated by Kevin Manbeck, Chief Technical Officer of the digital restoration manufacturer MTI, at The Reel Thing Symposium held on November 29, 2018, in New Orleans (http://www.the-reel-thing.co). Refer to the second part of this chapter for a reflection on how to deal with these kinds of digital irregularities.

xliii For information provided by Media Salles, see http://www.mediasalles.it/ybk2016/Berlin/pr.htm (accessed January 12, 2018) and Kessler and Lenk (2016: 304). For an analysis of the current situation in Europe see Bosma, ed. (2017: 39-47). The Wikipedia page on DIGITAL CINEMA offers a compact overview of the worldwide digital rollout: https://en.wikipedia.org/wiki/Digital_cinema (accessed January 12, 2017).

xliv For a detailed discussion of the differences between analog and digital projection for theaters and audiences and the consequences of the digital rollout for the cinematic *dispositive*, see Kessler and Lenk, 2016.

xlv Refer to the Cinema Digitaal website (in Dutch) http://www.cinemadigitaal.nl (accessed January 12, 2018). For recent information on the number of screens in the Netherlands, refer to *Facts and Figures of the Netherlands May 2017 Issue,* Netherlands Film Fund, 2017: 36, https://issuu.com/netherlandsfilmfund/docs/film_facts_and_figures_2016_issuu (accessed January 12, 2018).

xlvi A detailed discussion on the DIGITAL CINEMA workflow is provided by Saetervadet (2012). This text addresses the specific questions related to DIGITAL CINEMA within an archival context.

xlvii For current specifications, see http://www.dcimovies.com/specification/index.html (accessed January 12, 2018); and for additional specifications on HFR, see http://www.dcimovies.com/Recommended_Practice/ (accessed January 12, 2018).

xlviii For more details about the technical and economic reasons why lower frame rates are not yet implemented by manufacturers of cinema servers and digital projectors, see Saetervadet (2012: 66-70). For a discussion on how a wider

choice of frame rates for DIGITAL CINEMA would positively affect film archival practice, allowing accurate projection of historical films at their original frame rate, and the creative use of frame rate by contemporary filmmakers, see the presentations given by Jonathan Erland, founder of the new Pickfair Institute for Cinematic Studies, at The Reel Thing Symposium held in Los Angeles in August 2014 and 2016 on "The Speed of Cinema" (http://www.the-reel-thing.co/program-abstracts-2/ and http://www.the-reel-thing.co/program-abstracts-4/ – accessed January 12, 2018); see also Erland, 2014.

xlix See https://en.wikipedia.org/wiki/Digital_cinema (accessed April 3, 2018) on different available projection technologies for DIGITAL CINEMA.

l For an overview of the currently available DCI compliant equipment, see http://www.dcimovies.com/compliant_equipment/ (accessed April 3, 2018).

li For more information about cinema servers (a.k.a. media blocks) refer to Saetervadet (2012: 64-70). See http://www.dcimovies.com/compliant_equipment/ (accessed April 3, 2018) for a list of DCI compliant servers.

lii For coverage of the introduction of laser projectors in 2014, see https://spectrum.ieee.org/consumer-electronics/audiovideo/lasers-coming-to-a-theater-near-you (accessed April 6, 2018). For information on the LED screen displays recently introduced by Samsung, see https://news.samsung.com/us/samsung-debuts-worlds-first-cinema-led-display-harman-audio/ (accessed April 3, 2018).

liii Regarding the penetration of 3D screens in Europe in 2017, refer to Bosma, ed. (2017: 45). Refer to https://www.hollywoodreporter.com/behind-screen/is-golden-age-3d-officially-1025843 (accessed January 12, 2018) for an overview of box office revenues for 3D films between 2010 and 2016.

liv See http://www.in70mm.com/news/2016/Eye/index.htm (accessed January 12, 2018).

lv The Swedish Film Institute is one such case where the decision was made to take over equipment and personnel from a closing laboratory (the Nordisk Film Laboratory, which closed down in 2011) and carry out laboratory work inhouse (Wengström et al., 2013: 17-19).

lvi "Programmed obsolescence" is a concept theorized in the 1930s as a strategy to overcome the economic crisis. For a general overview on the principle of "planned obsolescence," see https://en.wikipedia.org/wiki/Planned_obsolescence (accessed January 17, 2018).

lvii Refer to the discussion of the *Images for the Future* Project (2007-2014) in relation to Eye Filmmuseum in Chapter Three and to more recent examples such as the Unlocking Film Heritage Project at the BFI (http://www.bfi.org.uk/sites/bfi.org.uk/files/downloads/bfi-ufh-digitisation-fund-guidelines-significant-collections-2014-09-10.pdf – accessed January 18, 2018) and the film part of the Media Digitization and Preservation Initiative (2013-2020)

at Indiana University (https://mdpi.iu.edu/index.php – accessed January 18, 2018).

lviii Refer to Larry Blake's presentation, "What Dilemma? A Realistic Approach to Digital Archiving." (The Reel Thing Symposium, Los Angeles, 2013). See http://www.the-reel-thing.co/program-abstracts/ (accessed January 18, 2018).

lix For an example of digital preservation strategy as currently developed by film archives, refer to the Collection Policies posted online by the BFI (http://www.bfi.org.uk/sites/bfi.org.uk/files/downloads/bfi-collection-policy-2011-11-16.pdf – pp. 14-22 –, accessed January 17, 2018); Eye Filmmuseum (available for download at the bottom of the webpage https://www.eyefilm.nl/en/about-eye – accessed July 25, 2018); and the Australian National Film and Sound Archive (NFSA) (https://www.nfsa.gov.au/collection/curated/collection-policy – pp. 9-10 – accessed January 17, 2018).

lx For a discussion of alternative file formats that are currently studied in the field, see Kromer, 2017.

lxi For a description of the OAIS model and a discussion of its use for audio-visual preservation workflows, see Van Malssen, 2011. Note that digital repositories are often referred to as Digital or Media Asset Management (DAM or MAM) systems.

lxii See page 16 of the Study's Executive Summary (http://www.ace-film.eu/wp-content/uploads/2012/04/exec_summary_en.pdf – accessed January 18, 2018) and the final report (http://www.ace-film.eu/wp-content/uploads/2012/05/final_report_en.pdf – accessed January 18, 2018).

lxiii See https://filmcolors.org (accessed January 18, 2018).

lxiv For the project's 2015 White Paper, see https://www.filmic.tech (accessed January 18, 2018) and http://static1.squarespace.com/static/577fe17fe6f2e15dc1765b29/t/5786c380ebbd1a5ae28647af/1468449672800/FILMIC+white+paper+November+2015+v3.1.jm+copy.pdf (accessed January 18, 2018).

lxv This part of the research is mainly based on recent literature (Enticknap, 2013; Catanese, 2013; Dagna, 2014), reviews in specialized press, marketing information released by the manufacturers, and a visit to the International Broadcasting Convention (IBC) held in Amsterdam in September 2017.

lxvi Such interviews took place between October 2017 and February 2018. For sharing all their priceless insights, I would like to thank: Seth Berkowitz (Digital Film Restoration Supervisor at Cineric), Ronald Bosdam (Audio Engineer at Haghefilm Digitaal), Rob Byrne (President of the San Francisco Silent Film Festival and independent film restorer), Daniel DeVincent (Senior Colorist and Director of Digital Services at Cineric), Gerard de Haan (Research & Development Manager at Haghefilm Digitaal), Tulta Behm (Eye and Haghefilm Digitaal Film Restoration Trainee), Annike Kross (Film Restorer at Eye),

Bin Li (Haghefilm Digitaal), Simon Lund (Director of Technical Operations at Cineric), Balázs Nyari (President at Cineric), Peter Roelofs (Haghefilm Digitaal), Andréa Seligmann Silva (Audio Restorer at Eye Filmmuseum), and Juan Vrijs (Haghefilm Digitaal).

lxvii Many thanks to Anne Gant (Head of Conservation & Digital Access at Eye) and Jeroen de Mol (Digital Film Specialist at Eye) for providing these real-life figures.

lxviii Refer to the Eye Collection Policy 2018-2021 available for download at the bottom of the webpage https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018). Elzbieta Wysocka, Head of Restoration at National Film Archive in Warsaw, and Tiago Ganhão, Head of the restoration laboratory ANIM (Arquivo Nacional das Imagens em Movimento), part of the Cinemateca Portuguesa – Museu do Cinema in Lisbon, have both discussed their current policy with regard to privileging 4K workflows in their presentations during the lecture series This Is Film! Film Heritage in Practice held at Eye Filmmuseum in 2018 (see https://www.Eyefilm.nl/en/thisisfilm – accessed June 7, 2018).

lxix For a background history of the Scanity scanner, see https://en.wikipedia.org/wiki/Spirit_DataCine (accessed January 25, 2018); for more technical information on the Scanity technical specification and archival features, see http://www.dft-film.com/products/archive-challenges-and-solutions.html (accessed January 25, 2018).

lxx See http://www.arri.com/archive_technologies/arriscan/ (accessed January 25, 2018).

lxxi For a unique comparative study of film scanners' performance when employed for the digitization of archival films, see Flueckiger, Pfluger, Trumpy, Croci, Aydın, and Smolic, 2018. See also the recently published "The Digital Statement. Recommendations for Digitization, Restoration, Digital Preservation and Access" by the Technical Committee of the FIAF (http://www.fiafnet.org/pages/E-Resources/Digital-Statement.html – accessed June 1, 2018).

lxxii See https://www.filmic.tech/multispectral-imaging (accessed January 25, 2018). See also Flueckiger, Op den Kamp, and Pfluger (2018), for a plea to consider new technologies, such as computational photography, to "combine a multitude of lighting situations with varying camera angles, focus planes, and/or 3D scans to form a comprehensive representation of scenes or objects. Future film scanning technologies should make use of these tools to register the full colour range with a multispectral approach and to capture the three-dimensional layers of the film as a material object" (249).

lxxiii For a description of such an experiment, see https://www.bbc.co.uk/rd/blog/2017-12-morecambe-wise-video-xray-microtomography (accessed January 25, 2018).

lxxiv Most of the information contained in this update on the state of the art of film restoration tools was kindly shared with the author by a number of international experts in the field in interviews carried out at the end of 2017: Annike Kross (Film Restorer at Eye – interviewed on October 3, 2017), Rob Byrne (President of the San Francisco Silent Film Festival and independent film restorer – interviewed on November 9, 2017), Daniel DeVincent (Senior Colorist and Director of Digital Services at Cineric – interviewed on November 27, 2017), and Seth Berkowitz (Digital Film Restoration Supervisor at Cineric – interviewed on November 27, 2017).

lxxv Annike Kross, interview by author, October 3, 2017. It should be noted that Kross mainly works with the Diamant software.

lxxvi Rob Byrne, interview by author, November 9, 2017. Like Kross, Byrne also mainly works with the Diamant software.

lxxvii Seth Berkowitz, interview by author, November 27, 2017. Berkowitz works with a number of different digital restoration software including Revival and Diamant.

lxxviii See http://www.mtifilm.com/news/2015/4/2/nab-2015-mti-film-introduces-dead-pixel-detection-and-correction-with-cortex (accessed February 2, 2018).

lxxix Rob Byrne, interview by author, November 9, 2017.

lxxx Seth Berkowitz, interview by author, November 27, 2017. Berkowitz refers in particular to a grain management tool originally developed by ARRI and recently taken over by Cinnafilm. Such a tool is available as a third-party application in software packages such as Diamant.

lxxxi In the framework of the research project DIASTOR, different ways to apply this method have been studied, compared, and thoroughly documented. See Flueckiger et al., 2016 and https://diastor.ch (accessed February 3, 2018).

lxxxii Daniel DeVincent, interview by author, November 27, 2017.

lxxxiii See also Heiber, 2015; and Carli, Verscheure, and Carli, 1995.

lxxxiv Ronald Bosdam, interview by author, November 14, 2017. For more on obsolete media, see http://www.obsoletemedia.org/ (accessed April 20, 2018).

lxxxv Andréa Seligmann Silva, interview by author, October 3, 2017.

lxxxvi Annike Kross, interview by author, October 3, 2017.

lxxxvii Rob Byrne, interview by author, November 9, 2017.

lxxxviii Seth Berkowitz, interview by author, November 27, 2017.

lxxxix Among many examples, refer to Byrne, 2012; Dixon and Webb, 2012; Walsh and Haggith, 2014; and Flueckiger, 2015.

xc Refer to De Jong et al., 2013 and Van Malssen, 2011 for an in-depth analysis of the adoption of digital preservation standards in the field.

xci For more detailed information about the goals reached by all project partners, see the project's final report: http://www.beeldenvoordetoekomst.nl/publication/Images_of_the_Past-publication.pdf (accessed February 12, 2018).

xcii Refer to Eye Collection Policy 2018-2021, available for download at the bottom of the webpage https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018).

xciii See http://www.bfi.org.uk/archive-collections/introduction-bfi-collections (accessed February 13, 2018) and http://www.bfi.org.uk/supporting-uk-film/funding-organisations/unlocking-film-heritage-digitisation-fund/faq (accessed February 11, 2018).

xciv This is the case for the feature film collection at Sony Pictures Entertainment (Grover Crisp, interview by author, November 30, 2017).

xcv As highlighted in the project's final report: "Of the 138,982 hours of digital audiovisual material, 15% is currently available for education and just 2.3% on demand for the general public" (46). See http://www.beeldenvoordetoekomst.nl/publication/Images_of_the_Past-publication.pdf (accessed February 12, 2018).

xcvi Refer to the text of the directive published here: http://ec.europa.eu/internal_market/copyright/orphan_works/index_en.htm (accessed February 10, 2018). For a discussion on the directive and its guidelines for determining the status of orphan works and their permitted uses on a national and international level, see Guibault and Ostveen, 2013.

xcvii See http://project-forward.eu (accessed February 10, 2018). Refer also to Vandegeerde, 2016: 65-69.

xcviii For a detailed analysis of the European tradition of copyrights in relation to audiovisual works, see Vandegeerde, 2016.

xcix For a discussion of archival DVD distribution, refer to Olesen, 2017: 111-137. For a reflection on the role of film archives in relation to access, see De Klerk, 2017.

c For a theoretical background of such projects, see Kenderdine, 2007.

ci See the activities of the director of research at the Applied Laboratory for Interactive Visualization and Embodiment (Alive) at the City University of Hong Kong where Kenderdine is Research Director (http://alive.scm.cityu.edu.hk – accessed February 11, 2018) and Kenderdine's website (http://sarahkenderdine.com – accessed February 11, 2018).

cii For a discussion of these kinds of exhibitions using the Eye Panorama as an example, see Fossati, 2012b; Ingravalle, 2015; and Smith, 2016.

ciii See https://beta.janbot.nl/ (accessed February 13, 2018).

civ For a critically thorough and original discussion of (the history) of these kinds of projects see Olesen, 2016. With regard to the collaboration between film archivists and scholars within Digital Humanities projects, see Heftberger, 2014.

cv For a discussion of the consequences of the digital rollout for film archives and the unique experience of film projection they can offer, refer to Lenk, 2014.

cvi For a discussion of the renewed focus on analog projection in New York venues, refer to Meacham, 2017.

cvii For an example of such a policy, refer to Eye Collection Policy 2018-2021 available for download at the bottom of the webpage https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018).

cviii In this regard, it should be pointed out that fine art conservation departments are often independent, whereas film archiving programs are typically offered as a specialization or a master's degree within the departments of Media Studies or Library Science. Such as an example can be found at the University of Amsterdam where Conservation and Restoration is an independent discipline with various specializations and includes postdoctoral research (see http://www.uva.nl/en/disciplines/conservation-and-restoration – accessed June 7, 2018), whereas the Master program Preservation & Presentation of the Moving Image is a Master shared by the Heritage Study and the Media Studies Departments (see http://gsh.uva.nl/content/dual-masters/preservation-and-presentation-of-the-moving-image-heritage-studies/preservation-presentation-of-the-moving-image.html – accessed June 7, 2018).

cix Refer to the new Introduction and to De Valck, 2015.

cx This text is partly based on two earlier texts in which I have introduced the idea of a "film performance framework" as a productive additional tool to theorize and give form to film archival practice. In the first text, I discuss the specific relevancy of such a framework to early and avant-garde cinema (Fossati, 2012); in the second text, I highlighted its more broader usefulness in coping with the more ephemeral aspects of films in general (Fossati, 2017).

cxi Refer to page 160 of this book and to Gaudreault and Gunning, 1998.

cxii More recently, scholar Sonia Campanini has discussed the issue of performance in relation to the restoration and exhibition of historical film sound (2016 and 2019, forthcoming).

cxiii This restoration, carried out by The Nicholas Ray Foundation, Eye Filmmuseum, and Academy Film Archive premiered at the 68th Venice International Film Festival in September 2011. Refer to pages 307-315 below.

cxiv Another similar but more recent example is the *Cinéma Magique* tent developed by Eye Filmmuseum for the traveling fair De Parade, see https://www.eyefilm.nl/over-eye/nieuws/cinéma-magique-eye-deze-zomer-op-de-parade and https://deparade.nl/voorstellingen/eye-filmmuseum/ (accessed July 3, 2018).

cxv Thomas Christensen, e-mail message to author, July 10, 2018.

cxvi Thomas Christensen, e-mail message to author, July 10, 2018.

cxvii Thomas Christensen, e-mail message to author, July 10, 2018.

cxviii Thomas Christensen, e-mail message to author, July 10, 2018.

cxix See http://filmcentralen.dk/museum/danmark-paa-film (accessed July 24, 2018).

cxx Anthology's archivist John Klacsmann points out that: "The last Unessential Cinema show we presented was on Friday October 23, 2015, featuring Nobuhiko Obayashi's *Confession*. We also put together a 10th anniversary show on July 30, 2014" (e-mail message to author, August 7, 2018).

cxxi For a selection of his films, publications, and more, see Klacsmann's website: http://www.johnklax.org (accessed July 25, 2018).

cxxii John Klacsmann, interview by author, New Orleans, November 30, 2017.

cxxiii John Klacsmann, e-mail message to author, August 7, 2018.

cxxiv See https://expansion-anthologyfilmarchives.org (accessed July 25, 2018).

cxxv See quote on page 225.

cxxvi It should be noted that the author became Eye's first Chief Curator in 2009 and since then has been part of the museum's Management Team and has been deeply involved in the decision making process behind its metamorphosis and its recent policies. For discussions of some of the changes at Eye Filmmuseum since the merger in 2010 and the opening of its new museum in 2012, see Ingravalle (2015), Kumar (2016: 272-306), and Lameris (2017: 195-207).

cxxvii The museum has had a number of name changes over the years: EYE Netherlands Film Institute, EYE Filmmuseum, and finally, since May 2018, Eye Filmmuseum. For the press release announcing the merger, see https://international.eyefilm.nl/eye-dutch-film-sector-joins-forces.html (accessed July 25, 2018) and to learn more about Eye Filmmuseum, see https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018).

cxxviii See https://www.eyefilm.nl/en/collection/about-the-collection/collection-centre (accessed July 25, 2018).

cxxix The project preserved, restored, and digitized over 90,000 hours of video; 20,000 hours of film; approximately 100,000 hours of audio; and 2,500,000 photos. Its result in terms of online access was unfortunately much lower than originally anticipated. Mainly due to the complexity of copyright legislation with regard to audiovisual works, only 15% of the digitized material is currently available online for education and just 2.3% can be viewed on demand by the general public. Its original budget was 173 million euro, but was reduced to 123 million euro when the obligation to raise revenue was scrapped. See http://www.beeldenvoordetoekomst.nl/en.html and http://www.beeldenvoordetoekomst.nl/publication/Images_of_the_Past-publication.pdf (both accessed July 25, 2018).

cxxx Refer to the Eye Collection Policy 2018-2022 for a detailed description of the current workflows and ambitions in terms of preservation, restoration, and presentation (available for download at the bottom of this webpage): https://www.eyefilm.nl/en/about-eye (accessed July 25, 2018).

cxxxi See https://www.sonypictures.com/studios/bio/grovercrisp.php (accessed July 25, 2018).

cxxxii Grover Crisp, interview by author, New Orleans, November 30, 2017.

cxxxiii For a definition of UHD, see https://en.wikipedia.org/wiki/Ultra-high-definition_television (accessed August 5, 2018).

cxxxiv Grover Crisp, interview by author, New Orleans, November 30, 2017.

cxxxv Grover Crisp, interview by author, New Orleans, November 30, 2017.

cxxxvi Grover Crisp, interview by author, New Orleans, November 30, 2017.

cxxxvii The restoration of *Lawrence of Arabia* was initiated in 2009 by Sony Pictures Entertainment at FotoKem Lab and Sony Colorworks under Crisp's supervision. It was a long process that took three years (2009-2012) to complete, during which an 8K digital scan was made from the original, a heavily damaged 65mm negative. The rise in interest in 70mm presentation, discussed in Chapter One, created the ideal conditions for the eventual transfer of the restoration back to 70mm. Only five 70mm copies were made.

cxxxviii Grover Crisp, interview by author, New Orleans, November 30, 2017.

cxxxix See https://www.prestocentre.org/hot-topics/cineco-film-lab-files-bankruptcy and http://www.filmkrant.nl/nieuws_2012/8337 (both accessed July 26, 2018).

cxl Peter Roelofs, interview by author, Amsterdam, November 14, 2017.

cxli See https://www.eyefilm.nl/en/about-eye/news/new-traineeship-eye-haghefilm-digitaal-film-restoration (accessed July 26, 2018).

cxlii Knowledge exchange includes the Haghefilm Digitaal Fellowship aimed at training film preservation students in laboratory work, see https://www.eastman.org/l-jeffrey-selznick-school-fellowships (accessed July 26, 2018).

cxliii Peter Roelofs, interview by author, Amsterdam, November 14, 2017.

cxliv See https://www.eastman.org/george-eastman-museum-acquires-rare-collection-lumière-films and http://www.giornatedelcinemamuto.it/en/haghefilm-digitaal-selznick-school-2017/ (both accessed 27 July, 2018).

cxlv Peter Roelofs, interview by author, Amsterdam, November 14, 2017.

cxlvi These techniques were presented by De Haan at the Reel Thing Symposium held at Eye Filmmuseum, Amsterdam (May 27-30, 2017), see http://www.the-reel-thing.co/the-amsterdam-program/ (accessed July 27, 2018).

cxlvii See http://www.avm.dk/artikel/visartikel.php?artikelnummer=5401 (accessed July 27, 2018). Many thanks to Christian Olesen for translating the article from Danish.

cxlviii See http://www.avm.dk/artikel/visartikel.php?artikelnummer=6030 (accessed July 27, 2018). Many thanks to Christian Olesen for translating the article from Danish.

cxlix Balázs Nyari, interview by author, New York, November 27, 2017.

cl Simon Lund, interview by author, New York, November 27, 2017.

cli See https://www.nytimes.com/2018/05/11/movies/2001-a-space-odyssey-christopher-nolan-cannes.html (accessed June 21, 2018).

clii The archive acquired by the Harry Ransom Center includes original treatments, annotated scripts, photographs, journals, notes, audio reels, and video recordings. See also http://www.hrc.utexas.edu/press/releases/2011/ray.html (accessed June 17, 2018).

cliii See https://www.jonathanrosenbaum.net/2012/04/the-vanity-of-autodestruction-we-cant-go-home-again-tk/ (accessed July 2, 2018).

cliv Anne Gant and Giovanna Fossati (Eye Filmmuseum) supervised the restoration of the image with help from film restorer Annike Kross (Eye Filmmuseum); Michael Pogorzelsky and Heather Linville (Academy Film Archive) were responsible for the sound restoration; all decisions were made in close consultation with Susan Ray (The Nicholas Ray Foundation). In addition, the Venice International Film Festival, RAI, Gucci, The Film Foundation, the Cinémathèque Française, the Gulbenkian Foundation, and the Museo Internazionale del Cinema supported the project. Refer also to http://nicholasrayfoundation.org/sites/default/files/Press%20Kit%20WCGHA..pdf (accessed June 28, 2018).

clv Daniel DeVincent and Seth Berkowitz (Cineric) worked on the color GRADING and restoration of the image, respectively; while John Polito (Audio Mechanics) worked on the sound restoration.

clvi Michael Pogorzelski, e-mail message to author, July 30, 2018.

clvii Refer to the presentation "The Restoration of Nicholas Ray's We Can't Go Home Again" by Anne Gant and Giovanna Fossati (Eye Filmmuseum) and Heather Linville (Academy Film Archive) held at The Reel Thing XXVIII Symposium (Austin, November 16, 2011) – see http://www.the-reel-thing.co/wp-content/uploads/2013/02/2011-Conference.pdf (accessed June 22, 2018).

clviii Heather Linville, e-mail message to author, July 27, 2018.

clix Heather Linville, e-mail message to author, July 27, 2018.

clx See https://www.huffingtonpost.com/artinfo/james-franco-to-bring-his_b_863080.html?guccounter=1 (accessed July 2, 2018); http://latimesblogs.latimes.com/culturemonster/2011/05/james-franco-is-james-dean-in-his-next-art-world-project-debuting-during-opening-of-venice-biennale.html (accessed July 2, 2018); and https://www.rapportoconfidenziale.org/?p=14436 (accessed July 2, 2018).

clxi It is interesting to point out that the restoration of *Mahagonny* was done exclusively with analog technology by Simon Lund at Cineric in 2002. Interviewed by the author in 2017, Lund said that, if given the choice today, he would probably still do that restoration analogically. However, aside from budget issues (a fully analogical workflow in this case is much more labor intensive and thus more expensive than a digital one), the main problem

would be that the film stock used at the time is no longer produced by Kodak and the replacement stock has too high a contrast to come anywhere near the original look of the film (interview by author, November 27, 2017).

clxii Parts of this Conclusion were also included in the author's inaugural lecture held at the University of Amsterdam on October 28, 2016 (Fossati, 2017).

clxiii Refer to Huhtamo and Parikka, eds., 2011; Strauven, 2013; Turquety, 2014; Andreas Fickers and Annie van den Oever, 2014; Schneider, 2016; Elsaesser, 2016. See also Fossati and Van den Oever, eds., 2016.

clxiv See Odin, 2016.

clxv With regard to New Film History, refer to Elsaesser, 1986 and to page 148.

clxvi For a stimulating analysis of copyright dynamics in early cinema and how these seem to reoccur in (early) digital cinema, see Gaines, 2014.

clxvii See https://wfpp.cdrs.columbia.edu/about/ (accessed July 11, 2018) and Gaines, 2018.

clxviii I am indebted to Jane Gaines who spurred me into being more explicit in discussing the Monument perspective in conversations we had in 2017 and 2018 in New York and Amsterdam.

clxix Refer to Acland and Hoyt, eds., 2016.

clxx See also Olesen's blog https://filmhistoryinthemaking.com (accessed July 11, 2018).

clxxi It should be noted that one of the datasets that was used for this project derives from the seminal Digital Humanities project *Cinema Context* started by film scholar Karel Dibbets in 2003 and continued by digital heritage scholar Julia Noordegraaf and her team, see http://www.cinemacontext.nl/ (accessed July 12, 2018).

clxxii See http://sensorymovingimagearchive.humanities.uva.nl/index.php/about/ (accessed July 12, 2018).

clxxiii See http://mediasuite.clariah.nl (accessed July 11, 2018) and https://sites.dartmouth.edu/mediaecology/ (accessed July 11, 2018).

clxxiv For more on this, see Masson, 2017: 32.

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GLOSSARY OF TECHNICAL TERMS

2K – Two thousand pixels or 2K (where K stands for one thousand) is a high resolution format that defines the RESOLUTION of a film frame in terms of the number of pixels in the width (horizontal lines in the frame). The exact RESOLUTION of a 2K image is 2,048 pixels in width x 1,556 pixels in height.

4K – 4K is considered a high resolution format. A 4K image contains approximately 4,000 pixels in the width. The exact RESOLUTION of a 4K image is 4,096 pixels in width x 3,112 pixels in height. The RESOLUTION of the 4K standard is approximately four times that of the **2K** standard.

ASPECT RATIO – The size of a projected film image, defined by the ratio between its width and its height. Whereas in television two main aspect ratios are applied as standards (i.e. 4/3 and 16/9), many different standards are applied in film. Today's most common aspect ratios for film are 2.39:1 and 1.85:1, both wide screen formats. Two of the most common aspect ratios for archival films are 1.37:1 (also known as Academy ratio) and 1.33:1 (typical of silent films).

BIT DEPTH – Also referred to as COLOR DEPTH, bit depth defines the capacity of a pixel to describe tones. A bit (i.e. binary digit) is the smallest available data package (it consists of either 0 or 1). A pixel instructed to depict only black and white (2 tones) has a bit depth equal to 1. A pixel instructed to describe also grey tones (typically, 256 tones) has a bit depth of 8. A pixel instructed to describe tones for the independent colors (red, green and blue, typically 16,777,216 color tones) has a bit depth of 24. In film, though, 24 bit depth corresponds to 8 bit depth, since the convention in film refers to one single independent color. Bit depth can be quantified by means of both a linear and a logarithmic scale.

BLACK-AND-WHITE SEPARATION MASTERS – Black-and-white film records of the so-called additive color primaries (red, green and blue) composing a colored film image. Separation masters are produced by copying the film three times through cyan, magenta and yellow filters (the so-called subtractive color primaries). The reverse operation is carried out to print the three black-and-white separation masters back onto a single color film.

BLUESCREEN – Also known as CHROMA KEY, Bluescreen is a technique typical of analog television by which a color (usually green or blue), typically used to define a specific area of the image, e.g. part of the background, is modified in post-production by replacing it with a different image. A very typical example is the weatherman's map, where this process occurs in real time via digital imaging.

CARRIER – Media artifact whose function is that of supporting information (images and sound). Examples of carriers are film (of cellulose nitrate, acetate and polyester), photograph, video tapes, and digital tapes and disks.

CEL ANIMATION – Traditional film animation technique that makes use of transparent cels, each portraying different hand-drawn elements of the image. By overlapping different cels a composite image is created that is photographed onto a film frame. Different combinations of cels allow the creation of (moving) images.

CHROMA KEY – see BLUESCREEN.

CGA – see COMPUTER-GENERATED ANIMATION.

CGI – see COMPUTER-GENERATED IMAGERY.

CINEON – Uncompressed file format developed to best represent film-born scanned photographic frames. The name Cineon derives from a workstation (which included a scanner, a digital compositing software, and a film recorder) developed and introduced in 1993 by Kodak for processing film digitally. While the production of the workstation was discontinued in 1997, the Cineon format is still in use.

COLOR DEPTH – see BIT DEPTH.

COMPOSITING – The process of combining different images into a new one. In analog film compositing is obtained by superimposing different source images onto the same film using a so-called optical printer. In digital film the assembly is carried out in the digital environment with compositing software. In this case the source images can be both photographically filmed and digitally generated.

COMPUTER-GENERATED ANIMATION (CGA) – Animation created with 2D or 3D computer graphics. CGA is considered the digital successor of the analog STOP MOTION technique for creating film animation.

COMPUTER-GENERATED IMAGERY (CGI) – The process by which film scenes are partially or entirely generated in the digital domain with 3D computer graphics.

DCDM – see DIGITAL CINEMA DISTRIBUTION MASTER.

DCI – see DIGITAL CINEMA INITIATIVES.

DCP – see DIGITAL CINEMA PACKAGE.

DEBRIE TAI PRINTER – Optical step printer produced by the French company Debrie that can handle shrunken archival film and can be equipped with a full immersion WET GATE. Many archives and film laboratories use the TAI printer for duplicating shrunken and fragile nitrate films.

DI – see DIGITAL INTERMEDIATE.

DIGITAL ARTIFACT – Visible defect produced during digital processing of images. Typical examples of digital artifacts in images are the aberration of colors (e.g. purple fringing) or the distortion of motion (e.g. jerky motion resulting from digital compression). Also digital restoration software can cause undesired artifacts, especially when applied in automatic mode. Extrapolating image information from adjacent frames sometimes results in the disappearance or the displacement of (part of) the original image information.

DIGITAL CINEMA – Also known as D-Cinema, Digital Cinema indicates the distribution and the projection of digital films produced for cinemas.

DIGITAL CINEMA INITIATIVES (DCI) – Panel created in 2002 by Disney, Twentieth Century Fox, Paramount, Sony Pictures Entertainment, Universal and Warner Bros. Studios for defining specifications for DIGITAL CINEMA.

DIGITAL CINEMA DISTRIBUTION MASTER (DCDM) – The requirements for uncompressed and unencrypted digital image, audio and subtitles, as specified by the DIGITAL CINEMA INITIATIVES.

DIGITAL CINEMA PACKAGE (DCP) – The compressed and encrypted digital file package, defined in the DIGITAL CINEMA INITIATIVES specifications, that is sent to cinemas by way of media CARRIERS, virtual private networks or satellite communications.

DIGITAL EDITING – The process of editing a film by means of a computer. Some examples of the most popular digital editing software are Apple Final Cut, Avid Media Composer and Adobe Premiere.

DIGITAL INTERMEDIATE (DI) – The process of digitizing film rushes or a film to be restored, or ingesting born-digital rushes, before post-production is carried out (from editing to final GRADING). DI can also be used to refer to the final result of such a process, which is the digital master used to create distribution copies (on film or digital).

DIGITAL VIDEO (DV) – The general term for video made by means of a digital camera. It is also used to indicate home movies, typically shot with digital consumers' cameras.

DPX (DIGITAL PICTURE EXCHANGE) – Uncompressed file format typically used for digitized film frames and, in particular, in the DIGITAL INTERMEDIATE process. DPX files derive from the earlier CINEON format.

DV – see DIGITAL VIDEO.

DYNAMIC RANGE – The range of tonal difference between the brightest light and the darkest dark of a film image. The dynamic range depends on many factors including the BIT DEPTH chosen for digitizing a film and the overall performance of the scanner used for the digitization.

FINE GRAIN – Black-and-white duplication film used for making positive copies from camera negatives. The creation of a fine grain film is as an intermediate step towards the creation of a new duplicate negative, and from there, of projection prints. A fine grain positive has a very low contrast and a very high RESOLUTION, and reproduces very well fine details both in the dark and light tones (and corresponding areas) of the image. A fine grain film is not meant for projection.

GRADING (ALSO KNOWN AS COLOR TIMING) – The process of modifying the colors of a film or video according to the wishes of the filmmaker or the cinematographer. Digital grading allows a much greater flexibility in altering the colors than analog grading.

HD – see HIGH DEFINITION.

HIGH DEFINITION (HD) – HD indicates today a standard with a RESOLUTION of 1920 horizontal x 1080 vertical pixels and finds its origin in television. HD is also often used to indicate films shot with professional digital camera opposed to film or video shot in DV.

HIGH DYNAMIC RANGE (HDR) – Photographic technique that reproduces a wider range of luminance (the luminous intensity emitted by a light source), similar to the dynamic range of the human eye. HDR allows for the capture of even the slightest details in the lightest and darkest areas that were typically lost in traditional photographic reproduction.

HIGH FRAME RATE (HFR) – Since its introduction in the 1930s, sound film has been shot and projected at the typical rate of 24 frames per second. Today, digital film allows for the shooting and projection of film with a higher frame rate (e.g. 48 frames per second). The visual effects of HFR are smoother motion, less blur, and a richer image.

JPEG 2000 – File format for image compression introduced in the year 2000. JPEG 2000 has been adopted by DCI in their specifications for creating a DCP for digital distribution and projection of films.

LOOK UP TABLE (LUT) – Conversion table that serves as a reference to transfer information between two related systems. In film post-production a LUT converts the color values of a GRADING system (both analog and digital) into the corresponding values for the film stock used to print and project the film. In this way the final colors on the film will be the same as the ones defined on a video or digital monitor during GRADING.

LUT – see LOOK UP TABLE.

MIGRATION – Cyclical transfer of data, usually onto a new CARRIER, to cope with the problem of changing standards and of obsolescence of both carriers, hardware, and software. Migration is carried out typically once every two to five years.

MXF (MATERIAL EXCHANGE FORMAT) – Open file format to relate and interlink audiovisual metadata with corresponding metadata. MXF has been adopted by DCI in their specifications for creating a DCP for digital distribution and projection of films. With MXF different file formats (containing for instance images, audio and subtitles) can be wrapped up and synchronized.

RESOLUTION – The capacity of a means of reproduction to describe detail, which can be quantified by defining the smallest distinguishable elements in the image. These elements are grain in photography and film, and pixels in digital imagery. The higher the number of grains or pixels per frame, the better is the capacity to describe detail and, therefore, the resolution.

STOP MOTION – Animation technique in which objects (or drawings depicting objects) are slowly moved in front of a camera and photographed frame by frame. This process results in a moving image when the film frames are shown in sequence.

WET GATE – Technique applied during the duplication of a film via a customized printer to eliminate superficial scratches. Such scratches would otherwise deflect light during duplication and would cause black lines to appear on the new film copy. In the wet gate process the film is immersed in a solution that fills up the scratches while each frame is duplicated onto a new film.

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