Work|s in Progress

Digital Film Restoration Within Archives

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Welcoming Remarks

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With Filmarchiv Austria and the Austrian Film Museum, Austria maintains two highly professional, well established and excellent film archives. Our standards keep up with the international requirements and we actively participate in the ongoing transnational discussion both on a professional and on a political level.

In the context of the digital era, film archives are facing major challenges. What will be the future of analogue film archives? What are the possibilities for digital film restoration, where are the limits?

These crucial questions were thoroughly discussed within the symposium, ›Digital Film Restoration Within Archives‹, which took place in Krems in Lower Austria in autumn 2011. With the participation of renowned international experts, the symposium was designed as a platform for discussions and practical workshops. Participants gained an overview of the most recent and essential focal points that are relevant in the field of digital restoration.

It is the task of the Federal Ministry for Education, the Arts and Culture to constantly enhance and accompany our film archives in their daily archival work. Considering the digital shift, we have supported the acquisition of digital projectors in both of our main archives to ensure screenings that would keep up with the latest technological changes.

With this book we want to give an insight into the ongoing international discussions. But, beyond the technical and theoretical debates, we must not forget the core of archival work: the film itself.

The project of digital film restoration in Laxenburg and Krems in Lower Austria is a model cooperation between the Austrian Film Gallery, the Austrian Film Museum and Filmarchiv Austria, which has been made possible through equal funding from the Federal Province of Lower Austria and the Federal Ministry for Education, the Arts and Culture. Only by this joining of forces and know-how can we face the major challenge of preserving our filmic heritage. In September 2011, the international symposium, ›Digital Film Restoration Within Archives‹, took place at the Austrian Film Gallery in Krems and brought together renowned experts from film archives and film institutions from all over the world in order to discuss the many aspects of digital film restoration and preservation. The symposium illustrated the vast scope of film restoration and was an inspiring and sustainable exchange of experiences. I am highly pleased that this publication will allow us to present the stimulating presentations and lively debate on ethical principles, theoretical challenges, as well as numerous practical examples from the work being done in this field.

On that note, I hope that our initiative in the field of digital film restoration will inspire future projects and that this book will encourage further discussion on film preservation and restoration in the digital age.

Preface

»The need for a discourse only reveals itself once it has gone out of fashion.«   Beat Wyss

By 2011/2012, celluloid film had all but vanished from the current motion picture production and exhibition landscape. Except in a few, special cases, modern ›films‹ are shot on digital formats of continually improving quality in increasing resolutions (HD, 2K, 4K, etc.). Virtually all mainstream cinemas, meanwhile, have set aside or thrown out their old 35mm analogue projectors and installed modern digital projection equipment for the exclusive presentation of films in digital format.

The so-called ›digital turn‹ has also had significant consequences for the archives, whose task it is to preserve the film heritage of both the past and present, to say nothing of the future. As film has only a limited life span, it has proven necessary to produce new duplicates for preservation as well as access. It is on this basic principle that the film archives have carried out their core task for the last three-quarters of a century. Although some archives have established their own in-house facilities for duplicating films, most have been reliant on third-party film laboratories to fulfil their needs.

The needs of film archives and the film industry have until now always run parallel, as the same laboratories producing first-run prints for contemporary cinemas were also duplicating films for archives. Now, the rapid digitisation of the cinema industry has made the services of laboratory facilities specialising in analogue film duplication redundant. Running a laboratory is an expensive business and the boutique requirements of a small number of film archives could not pos-

sibly keep all of them afloat. In recent years, they have one by one been downsizing to adjust to the changes in the market or been bought up by other companies, or closed down altogether. The situation became more critical in January 2012, when it was announced that Eastman Kodak, one of the oldest and leading manufacturers of motion picture film stock, had filed for bankruptcy. Kodak's main rival, Fujifilm in Japan, followed in September with news that it would discontinue virtually all of its negative and print film stocks by March 2013. As the company explained on its website, »Fujifilm has mainly provided negative films for shooting and positive films for projection in its motion picture film business operations. However, in order to adapt to the recent rapid transition of digitisation in the shooting, producing, projecting and archiving processes of motion pictures Fujifilm has decided to shift its business operations to provide products and services designed for digital workflow of motion picture production and projection.« As a small consolation to archives, Fuji will continue to produce its ETERNA-RDS long-term archival film stock, though even this is optimised specifically for use in digital intermediate workflows. Even today, where almost 100% of new films employ digital technology at some stage in their production chain, film remains the most durable means of storing and preserving audiovisual content. With the existence of analogue film now under threat, the future of the film heritage seems uncertain.

But there has also been a clear upside to the digital turn for film archives. Beginning in the late 1990s, digital technology has seen a practical application in the field of film restoration. The same image manipulation processes that revolutionised the post-production and ›Special Effects‹ industries have also revolutionised film restoration, providing hitherto inconceivable means for covering up the traces of damage left on a film over time, or reversing the negative side effects sometimes caused by earlier, analogue duplication attempts.

The initial expense limited the use of digital restoration techniques at first to just a handful of prestige titles and enduring ›classics‹. In just a few short years, however, digital restoration technology has become increasingly affordable to the point where it is now within the reach of even the smallest, modestly-funded archives. A leading example of this development is the collaboration between the Austrian Film Gallery in Krems, the Austrian Film Museum and Filmarchiv Austria. Since spring 2008, the three partners have been subjecting endangered films from the two archives' holdings to the process of digital restoration.

While the advent of digital technology has provided seemingly limitless possibilities for archives to restore and distribute film heritage on a much wider scale than ever before, it has

also presented them with a host of new challenges. New tools require new skills and film archives have had to adapt – at times uneasily – to the new digital terrain. Limitless possibilities, meanwhile, demand a strong ethical framework to ensure the maintenance of the high standards demanded by any archival institution for the safeguarding of the global cultural memory. Central to the joint endeavour of the Austrian Film Gallery, Austrian Film Museum and Filmarchiv Austria right from the beginning was therefore to institute the character of an open research laboratory. The aim was not to establish a veritable assembly line, churning out an increasing number of restored films in quick succession, but rather to take an artisan-like approach to film restoration.

The partners' shared restoration philosophy is based on the principle of reflection. With a selection of independent projects, representing the diverging focal points of the two archives, the possibilities of digital film restoration could be probed. In exploring these possibilities, communication and information exchange have played vital roles. Interdisciplinary discussions held on both a national and international level culminated in the three-day symposium, ›Digital Film Restoration Within Archives‹, which took place on the premises of the Austrian Film Gallery between the 21st and 23rd September 2011. On this occasion, around 100 archivists, curators, lab technicians, motion picture and television engineers and academics from across Europe, the USA and Asia came together to address vital issues concerning the technical quality and ethical principles of digital restoration. The event also significantly provided a much-needed forum at a critical time to discuss perspectives for the film heritage in an increasingly digital world.

The present publication is the direct result of this ›coming together‹. On the one hand, it serves as a record *ex post facto*, containing several reproductions of presentations that were held during the symposium by some of the most renowned experts in their field. Making their contributions available in this way puts them in the hands of those who, for one reason or another, could not attend the symposium in person. At the same time, however, the publication should also provide a stimulus for further discussion. Indeed, in the time of preparation, the publication itself has grown to become more than a record of the symposium but also a ›continuation‹ of it, featuring a number of brand new contributions by many of those who were present that have organically grown out of the discussions held in Krems.

To add an element of continuity, the volume has been structured into three main chapters. The first, labelled ›IN THEORY‹, groups together those essays which address the fundamental principles of audiovisual archiving and restoration, with an emphasis on how they have evolved (and will continue to evolve) in the ongoing changeover from analogue to digital. The second section, ›IN PRACTICE‹, examines the practical application of digital technology in the field of film restoration. An emphasis is put on the requirements of digital restoration techniques to be malleable, how the same tools are successfully adapted to deal with different cinematic formats, forms and genres: from early films on highly volatile nitrate base (still a major concern of film archives) to the still relatively unexplored territory of amateur films and ›home movies‹ or experimental films. Additional input is given into the development of new tools to aid archival activities, including – but by no means limited to – restoration.

To conclude, the third chapter illustrates how the theoretical and practical frameworks, as outlined in the previous two chapters, apply to concrete restoration projects through the investigation of a number of specific ›CASE STUDIES‹. These case studies range from well-known classics to lesser known, but no less relevant, works; from early silent films to contemporary avant-garde masterpieces.

In preparing the present volume, we have attempted to represent all contributions to the symposium, as far as busy work schedules and other commitments would allow. In closing, we would once again like to extend our deepest thanks to all of those who played a part in the realisation of both the symposium and its ensuing publication, in particular to the presenters/authors and to our colleagues at the Austrian Film Gallery, the Austrian Film Museum and Filmarchiv Austria.

Vienna, August 2013

OPENING SPEECHES

Alexander Horwath
Opening Remarks (Including Extracts from the Austrian
Film Museum's Digital Film Restoration Policy)

Thomas Ballhausen
The Madman in the Attic.
On Autonomy and the Archive

Opening Remarks (Including Extracts from the Austrian Film Museum's Digital Film Restoration Policy)

As there may be some uncertainty about the nature and length of this so-called ›Opening Speech‹, I should start by saying that it did indeed grow from what I had intended to be a brief introductory note to a roughly 20-minute paper. I will begin with a rather abstract discussion of the term ›compromise‹ and proceed to the more concrete attempt at producing a policy statement which addresses the position of my own institution vis-à-vis the topic of this symposium.

First of all, however, I want to thank Kerstin Parth, Albrecht Grossberger and the staff of the Austrian Film Gallery for organising this symposium, as well as my Film Museum colleagues and those of Filmarchiv Austria for their contributions. And I want to express my hope that this will be a gathering where the aspects of tradeshow, promotion, and institutional pride that sometimes afflict the climate at archive meetings and restoration festivals will recede to the background, while the aspects of searching and research, of open questions and open-ended processes, and a basic self-critical stance take full centre. Life is full of compromises, one of which resides in the regrettable fact that I will be able to participate in this symposium only until the end of the first afternoon. A more ›relevant‹ compromise may become apparent in the use of a certain term during the proceedings: while David Walsh will soon alert us to the fact that ›there is no such thing as digital restoration‹, I fear that both my own and many other contributions will nevertheless feature this very term with some frequency.

The great thing about a compromise is, of course, that it shields us against the seductive power of the absolute. The ›danger‹ inherent in compromise, on the other hand, is that it can be the easiest and most unproductive way out of a practical or intellectual predicament. It can also give a warm and fuzzy spin to the widespread practice of having one's cake and eating it too. In any case, a compromise can bring us face to face with the contradictions and inconsistencies in the life and relations of a person or an institution. This is nothing to worry about: inconsistency and contradiction are essential factors in any human endeavour. What is more worrisome is the fact that they remain ›unacknowledged‹ so very often. A compromise can be two things then: it can be seen as the closure of an argument, as the attempt to put an end to contradiction; in such cases, the precise nature of the previously conflicting elements and movements is usually swept under the table. Which is why I think we should look at compromise in a different manner: not as a point to be reached, a destination to arrive at, but rather as an ongoing, open-ended practice which lays out its terms and internal conflicts as clearly as possible in order to let the debate glisten and sparkle under the brightest of lights and circumstances. A compromise is worth something only if it is transparent activity instead of opaque result. And it is this, I would argue, that should separate ›Digital Restoration Within Film Archives‹ from the various promotional, industrial, bureaucratic, or otherwise ideological and ahistorical contexts in which the terms ›digital‹ and ›restoration‹ usually inhabit the same sentence.

This is also the reason why the Austrian Film Museum has supported the idea and the aims of this symposium. It seems more necessary than ever to overcome the reductive identification of film with the commercial cinema industry and to acknowledge the wide-ranging ›non-industrial‹ uses and viewpoints of film throughout its history, while at the same time accepting that the basic materials for all of film's uses are nonetheless industrially produced.

In the last few months, in the run-up to this symposium, the archival staff at the Film Museum with Matteo Lepore as the principal author and myself have begun to formulate a Policy Statement in regard to Digital Film Restoration, large portions of which I will read to you in a moment. It is a second draft and, to a degree, still a work-in-progress. There is nothing groundbreaking about this modest document, and I'm sure that some important issues are still missing. Most of the issues that are included will seem self-evident to you. Many aspects will not differ from those included in pre-digital restoration policies. And some may even appear quaint – especially to those of you who work in larger archives with a much more sizable digital restoration programme. We have found, however, that it makes a lot of sense to put such seemingly self-evident things into written form, not only to define the ground for existing

and future staff members, and not only for reasons of accountability, but also to refresh and reflect upon one's own positions from time to time.

Chapter 1 briefly deals with the ›History of and Approaches to Film Restoration‹. I will only quote one paragraph: The concept of restoration appeared relatively late in the world of motion picture film. It is based on the recognition that during a film's ›lifetime‹ its visual and aural characteristics change to varying degrees – because of chemical instability, mechanical damage, and so on. Film restoration implies the idea of using various printing techniques to approximate a film's (assumed) original look and sound and return to it some of its ›lost‹ characteristics. The set of techniques used in this process was mostly borrowed from commercial film production.

Chapter 2: ›Film and Digital Restoration: Duties, Risks and Potentials‹. I will quote it in full: As archivists and museum curators, it is our aim and our duty to preserve motion picture film for future generations and to enable them to experience and understand the film medium as a functioning system in which aesthetics, technology and social experience were intertwined in a unique manner, creating one of the most important cultural phenomena of the 20th century. At the same time, it would be ahistorical to ignore the unfolding of film into several other moving image media during the latter part of this same century. The ›mutational era‹ we live in is as much part of film's history as the similarly mutational era around 1890 that brought film into existence. A film museum, therefore, has the mission to concretely represent and document the specific capacities of film as well as the historical shifts that the medium has undergone (including its current ›mutation‹ into what are uniquely different media and forms of expression). Part of this mission is also to contribute to a terminology of differentiation and to a materialist understanding of cultural products.

The ›digital revolution‹ began less than three decades ago and has changed the entire technical milieu of commercial cinema. It has reshaped the chains of production, post-production and distribution; it has set different standards, supplied filmmakers with new avenues of research, or allowed them to revisit technological innovations from the past (like 3D or chroma key). It has become a defining feature of contemporary moving image culture. Put in terms of ›market evolution‹: as Lumière won over the other patents, as 35mm became the standard gauge in the early 20th century, as the optical soundtrack pushed out the other audio systems, now digital solutions for cinema are rapidly replacing photochemical film in the commercial arena.

As film exits the main stage of the culture industry, its specific profile as a form of expression becomes more widely recognisable. It is no longer the common, ›everyday‹, ›self-explanatory‹ medium of choice for entertainment professionals and audiences. It can now be perceived as a ›historical‹ medium (which it always was – like any other human practice, including the most current or most ›advanced‹ digital ones). Against this background, museums and their stakeholders will attempt to preserve film both through its artefacts and as a technological-aesthetic system. As has been the case with many other ›obsolete‹ art forms, it will be necessary to prevent the techniques, tools and materials of the art form from being discontinued. They will be needed specifically for museum purposes (restoration, duplication, exhibition) – and for those artists who choose to keep working with film. The contexts of its use will be highly specialised. The mass production and mass exhibition of moving images will also continue – by fully entering the digital realm. And as they have done in the past, archivists, restorers and museum curators will continue to ›borrow‹ from an evolving cinema industry some of its most recently developed techniques. This can and should not be avoided, as it enables museums and archives to continue to function as ›bridges‹ or communicators between the commercial world (where much of film – or ›film‹ – originates) and the non-commercial domain (to which we owe the concept of film culture and the awareness of film as part of human memory).

Digital technology not only offers film restorers additional means to achieve their aims, it also demands new forms of knowledge from them. New instruments require new skills. What does not change, however, is the basic archival understanding that this new knowledge will serve a non-industrial and non-profit purpose. Its main uses will have to be cultural – archeological, experimental, educational, etc. The biggest risk for archives, when applying digital technology to photochemical film, is short-sightedness – focusing too narrowly on one level of the process: its present, short-term usefulness; for instance, to achieve funding or gain visibility. At the other end of the spectrum, the introduction of digital restoration in film archives may prompt a deeper discussion of what it is that we produce when we restore a film.

Although this word is widely used among archivists, there is no such thing as a single original in motion picture film, and there never was. Reasoning in terms of sources and versions, instead, gives us a perspective: When we restore a film, we are simply producing another version, an interpretation of the past based on our present knowledge, our research, and our

personal relation to the film in question. It is necessary to keep these implicit parameters in mind: What we produce is another point of view, a historical interpretation and, hopefully, a philologically sound edition of an art work or document. This means that a restoration should always be conceived as a critical instrument to enlarge the debate around cinema and the archive's role in preserving and promoting it. Thus, the most crucial approach to digital restoration is twofold: experimentation, in order to understand its limits and discover the potentials for common practices in the future, and documentation, which makes the work transparent and opens it to further discussion. In order to share the results of our research and our experiences in an adequate manner with our colleagues and the public, and in order to improve our own practice and better understand its consequences, our work needs to be ›traceable‹.

Chapter 3 is entitled ›Resources and Principles of Choice‹. I will only quote its core aspects: The archival holdings of the Austrian Film Museum allow for a relatively clear perspective: the collection is rich in the field of independent, experimental, and small-gauge films, and there is a consistent body of early nitrate films. These two areas are primary, as far as our restoration programme is concerned. The choice of films as candidates for digital restoration is governed by several factors.

a) The overall status of the film. Not every film needs to be restored with digital means. A film will be considered for digital restoration if the amount and type of damage necessitate a reconstruction of the images or of the colour. **b)** The urgency of preservation and restoration interventions. Some films in the collection are decaying more rapidly than others and will receive priority over other items. **c)** The uniqueness of the materials and the historical or technical relevance of the film in question. By which we mean the rarity of the respective print, the role of the respective filmmaker in the context of the Film Museum, and an estimation of the film's value as a document, as an art work or as an example of a specific technical process. **d)** The educational and research potential of the project for a potential internship programme.

Chapter 4 concerns the ›Restoration Workflow‹:

Whenever archival material is worked on, the process must be widely documented to guarantee the reversibility of each of its steps. A detailed plan of the restoration is necessary before all technical operations begin. As the restoration progresses, this plan remains the reference for all interventions. Each step is conceived with the aim of minimising invasive activity. Before digitisation, the film is repaired as little as possible. Digital retouch is applied in accordance with the historical nature of the artefact, keeping in mind that certain types of so-called ›defect‹ present on the film bear testimony to the production milieu that originated that precise artefact (as, for instance, the peculiar flickering of a film shot with a hand-cranked camera, the instability typical of some small formats, or the imprecision of some early colouring techniques, etc.). Our objective is to realise a new version of the film, which will always represent a compromise between the unattainable (and always already lost) ›original‹ appearance of the film and the layers which time has inscribed on the artefact – including the newest layer, accrued during the digital restoration process.

At the end of each project the compilation of an exhaustive final report is mandatory. As long-term preservation standards for digital data do not exist yet, the periodical migration of our data, stored on LTO tape and on hard drives, will be ensured. For long-term preservation and for the museum's exhibition activities, it is also a basic aim to create a new negative and a projection print of the work on polyester motion picture film stock. To keep up with professional standards, and as digital workflows are subject to constant changes, the staff's further training is assured periodically.

Chapter 5 is a brief ›Conclusion‹:

The preservation of photochemical film as such will continue to be the priority of the Austrian Film Museum. At the same time, the museum accepts the invitation and the challenge posed by the newly increased range of film restoration methods. Digital film restoration partly sacrifices the photochemical lineage of motion picture film, but it enables restorers to simulate some of its characteristics which would otherwise be impossible to recover. While we are aware of the compromises that digital methods introduce into the practice of preserving films, we recognise this development as one of the ways in which archival practice always reflects shifts in culture and technology at large. As long as film museums and archives intend to play an active part in media culture and its historiography, their interpretation of processes and artefacts from the past can only be expressed in the shape of a dialogue with the media technologies of the present – both of which, past and present, need to be viewed as historical.

On a personal note, and in closing, I might add that this dialogue will require the use of multiple languages, and while translation is overrated, we won't be able to do without it.

The Madman in the Attic.
On Autonomy and the Archive

Karma police, arrest this man
He talks in myths
He buzzes like a fridge
He's like a detuned radio   Radiohead: Karma Police

§ 1 Let's get physical.

§ 2 Let's get political.

§ 3 Thinking about autonomy inevitably leads me – at least me – to questions of culture and the archive. I'm grateful for having been summoned to think about autonomy, to rack or at least try to rack my proverbial brains over the political. In doing so, the archive is the result, the repetition, the repeat offence.

§ 4 Autonomy, that is a deeply political term. Originally Greek, it is used to describe inner and outer freedom, with direct reference to independence and self-determination. But, not least in the field of culture, it is a category that draws a distinction and evokes the tension between existing laws and recourse to one's own law. After serving as a watchword during the religious wars of the early modern age, the term finds itself anchored in jurisprudence in the 18th century. And this is when all those problems really start.

§ 5 In Kant's hands, the term undergoes systematic treatment for the first time. In a twofold reading, he wants it to be understood both as a general term for all philosophical efforts and for the realisation of a practical critique of reason. Two investigations are premised on this line of thought: on the one hand, a close inspection of the recourse to tradition and existent authority; on the other hand, the examination of individual proposals with respect to their suitability as universally valid – i.e. authoritative – concepts. Critical reflection here turns into philosophical practise. Contrary to Fichte, who is prepared to forsake the ›I‹ within the philosophical system for a science in guise of theology, Kant always emphasises the potential independence from authorities and the incessant revision of ideas and concepts. Following on from here, we find autonomy being used – by Hegel, for example – as an expression of self-determination and self-education. Autonomy thus understood results from a critical reflection and understanding of the universal laws under which we live and act.

§ 6 Certain issues remain problematic. It is not clear wherefrom to derive the justifications for the respective – autonomous – criteria. Nor does autonomy admit binding obligations that go beyond the scope of individual insight. Insight, not position – this to me seems central. The understanding, the want-to-understand, is essential. Especially bearing in mind, as I would like to and have to do here, that autonomy as a category for political and aesthetic distinctions has historically also come to stand apart from an instrumental functionalism, or a postulated use-value of culture. Here too, there is a direct link to the archive.

§ 7 The archive – which is in equal measure a system of order and an actual collection, connected via a hinge of administrative, sub-medial processes that work to create difference – can be understood as a place of intellectual value-creation, ›pre-conditioned‹ by its heterogeneous contents. The highly diverse types of holdings in an archive aren't just signifiers in themselves, but much rather also act positively as a framework for dealing with the material at hand – as well as establishing certain guidelines for discursive undertakings and approaches. This is a far call from the misguided interpretation of the archive as an end in itself. Rather, an ongoing re-assessment of the archive leads to a better and more comprehensive understanding of one's own discipline and of recent developments, and also serves to develop critical-analytical instruments capable of covering social processes in a wider sense. The archive is the European ›key concept‹, in which theory and practice interlock.

§ **8** A persistent interrogation of the archive's de facto holdings – whether something might still be used as an exhibit, or is already to be considered part of and hence relevant to the discussion of a discipline's history – therefore cannot (or rather: can no longer) take place in the narrow and misguided sense of a hermeneutic claiming to be all-encompassing, and capable of delivering definite and eternally valid results. Rather, a serious study of memory and archive requires – in a poststructuralist vein – a chain of interrelated interpretations that also advance and enrich the history of one's own field of work and study. There may at times be reason to be critical of this interpretational method's outlook; yet it is still the most suitable means of uncovering and highlighting the changes in the importance of the material at hand, both in relation to a (disciplinary) history organised in narrative forms, and with a view to contemporary questions.

§ **9** The attribution of meaning within a discipline also needs to be considered here, within the framework of a twofold movement: the first of these movements is the emergence of the artefact at hand, the constitution of its value from an entropic state of disorder, of chaos, perhaps even of junk. The second movement will usually follow the first: a circulation of semantic – and also mnemonically relevant – attributions, which occurs in the context of studying an archive's holdings and individual objects, as a discourse in the sense of an oscillation between two points of tension. These intellectual-logistic efforts also comprise shifts of meaning and (re-)valuations. Seen in this context (amongst others), the analogue vs. digital debate reads as a bizarre repeat of the Pagans vs. Neochristians conflict. This is clearly a wrangling over the body – and there is a lot of wrangling in all sorts of places within the archival context. These are conflicting desires seized at the bodily level alone, or on the contrary, attempts to rid oneself completely of any form of physicality. Yet, as with many, if not most questions, this should not be an either-or matter. In this case, advanced European models already recognise two approaches that meaningfully complement each other, two ways of archiving and distributing, that cannot just be seen from the perspective of generative wars of succession. Debating these issues is necessary, it lets us make the step from national treasures to a European cultural heritage, and fuse past and present in view of a possible future.

§ **10** Discourse of memory and the archival system: these are the two faces of a Janus-headed child of modernity, which confront us as – in the best and most diverse sense – repositories of different, yet interrelated functions and operational modes. The preoccupation with memory and remembering may already have a long tradition on the basis of antique sources, but significant changes only emerged – just like the archives, gradually divorced from their primal economic or legal surroundings – in the early 20th century. As a result of historical breaks and technological developments, these two areas are gaining renewed attention from a range of different scientific disciplines and areas within the humanities. This is not always a constructive process, often also characterised by difficult, though urgently required discussions of rather less appealing aspects within the history of science and the humanities: forgetting, suppression, distortion.

§ **11** The wish to enliven an inheritance, to enter a constructive relationship with the past in our (discursive) present and work towards an imagined future is well worth supporting. This way of working was particularly significant for Aby Warburg, who together with Maurice Halbwachs can be considered one of the most important representatives of our present-day discourse of memory. Whereas the sociologist Halbwachs placed the social conditions of collective memory at the centre of his thinking and writing on the discourse of memory, the art historian Warburg endorsed the view of a culture and hence collective memory based on symbols, subject to changes and updates according to times and place. Warburg's inductive approach, dictated by the material at hand, can be seen as a foreboding of postmodernity in the work of a thoroughly (and in every sense) modern thinker, who to this day serves as reference point for the newest theories of memory. What is particularly apparent in these cases is the interdisciplinary approach – it very clearly characterises both Halbwachs' and Warburg's methods and the relationship between the discourse of memory and the archival system.

§ **12** The archive represents an ordered collection which, quite apart from the increasingly economic focus of the past decades, is progressively envisaged and designed in constructive relation to areas covered by the museum and the library. Apart from the practical benefits of such alliances, this probably owes to the fact that these institutional forms have usually also ended up creating internal archives, in order to adequately administrate and work with the heterogeneous parts of their holdings. Apart from classic collection content, such as the book medium (in the case of the library) or the more or less singular object (in the case of the museum), inheritances, unpublished material and much else besides has made its way into

these institutions. The challenges of recording the data, of preservation and expert treatment required and still requires an archival approach within the aforementioned, specific structures of a collection. The conservation of holdings can likely be considered the most pressing task. This scientifically underpinned procedure of reclaiming what is past, forgotten, and also suppressed can only be envisaged and practised as a balance between conserving the holdings and making them accessible, wherever their condition permits it.

§ 13 As for the (metaphorical) blind spots that result from being tied into a system – that is to say, in the widest sense, a quantum mechanical interrelatedness of position, observation and the work to be done: recognising this position can lead to insight into and awareness of one's participation in historical or historicising processes, very much in the spirit of a constructive relationship between rationality and collection. In this sense, it is well worth bearing in mind that this kind of mnemonic archival work is very much a thing of the present, and thus a form of participating in current discourse and responding to the archives' most pressing desire: to escape a delirious state, to steer towards an order capable of critically questioning itself and offering meaningful modes of support and (self-)reflection for any discipline, in the sense of a metaphoric registry.

§ 14 The objects' tissue, the tissue of potentiality and actuality, weaves itself into the voice of whatever is speaking. The tissue becomes part of the speaking, or is on the way of becoming it, but is still itself. But what are the relations, what kind of politics can be learned here? This is the place where the war machine can enter the scene, a thought-apparatus capable of questioning, perhaps even annulling normed hierarchies. It is a turn towards a practical solidarity, a politics of friendship amongst equals. The European structure within which this thought-instrument is unleashed and takes effect creates productive lines of flight, potentially capable of developing concepts, raising doubts and asking questions. The European archives could and can deliver all of this.

§ 15 These lines of flight acknowledge utopia as the horizon into which a politics of friendship is inscribed. They encourage a micropolitics whose constituent minorities are understood not in quantitative, but qualitative terms; and which are – and must be – based on mutual understanding. Ground rules and mediation between the actors is urgently required, though the short-term call for strong leadership seems questionable and compromised not only in a historical sense. As a place of intellectual and material value creation, the archive is an institution, a gesture, and indeed an attitude of *fraternité*. The balance between preserving its holdings and making them accessible requires archives to not only perform an incredible feat of logistics, but also to clearly position themselves. What is needed is an autonomous, courageous position, capable of striking a balance between humbleness towards the material, its questions and challenges, and the necessity of being a gate keeper in the interest of both the material and the public. Preservation and access go hand in hand.

§ 16 I would here like to point to the necessity of placing this line of thought in relation to the political, and to the disputed notion of European-ness, manifest not least in terms of values. A cartography is needed; both of what is moveable and what moves.

§ 17 The politics of the archive and of autonomy are procedural. A politics akin to the politics of friendship, and following on from Schelling's philosophy of nature or Derrida's later work, is always in the process of becoming. Two insights suggest themselves: first and perhaps foremost, an uninterrupted process of analysis and critique is an absolute necessity from the perspective of culture. On the other hand, there needs to be a vital connection between the political and all areas of human life, therefore also including culture; and this connection deserves to be recognised and strengthened. There needs to be an outspoken, expanded commitment to politics, which factors in the interdependence of politics, ethics and aesthetics. Within the context of a European culture and in terms of operating in a seemingly schizophrenic day-to-day reality, the archives make a significant contribution towards achieving this.

§ 18 This is intended as a friendly assault, please get moving.

Bibliography

Aristoteles (1985). *Nikomachische Ethik* (=Philosophische Bibliothek 5). Hamburg: Felix Meiner Verlag.

Benjamin, Walter (2009). *Einbahnstrasse* (=Walter Benjamin Werke und Nachlaß. Kritische Gesamtausgabe 8). Frankfurt a.M.: Suhrkamp Verlag.

Benjamin, Walter (2010). *Über den Begriff der Geschichte* (=WB, Kritische Gesamtausgabe 19). Berlin: Suhrkamp Verlag.

Codrescu, Andrei (2009). *The Posthuman DaDa Guide. Tzara & Lenin Play Chess*. Princeton: Princeton University Press.

Deleuze, Gilles & Félix Guattari (1997). *Kapitalismus und Schizo-*

26 phrenie: Tausend Plateaus. Berlin: Merve Verlag.

Derrida, Jacques (2002). *Politik der Freundschaft*. Frankfurt a.M: Suhrkamp Verlag.

Derrida, Jacques (2004). *Marx' Gespenster. Der Staat der Schuld, die Trauerarbeit und die neue Internationale*. Frankfurt a.M.: Suhrkamp Verlag.

Dosse, François (2010). *Gilles Deleuze & Félix Guattari. Intersecting Lives*. New York: Columbia University Press.

Erll, Astrid & Ansgar Nünning (eds.) (2004). *Medien des kollektiven Gedächtnisses. Konstruktivität – Historizität – Kulturspezifität*. Berlin: Walter de Gruyter.

Erll, Astrid & Stephanie Wodianka (eds.) (2008). *Film und kulturelle Erinnerung. Plurimediale Konstellationen*. Berlin: Walter de Gruyter.

Ernst, Wolfgang (2002). *Das Rumoren der Archive. Ordnung aus Unordnung*. Berlin: Merve Verlag.

Etchells, Tim (2008). »On Performance Writing«. In: Etchells, Tim (2008). *Certain Fragments. Contemporary Performance and Forced Entertainment*. London: Routledge, 98-108.

Goetz, Rainald (2008). *Klage*. Frankfurt a.M.: Suhrkamp Verlag.

Guter, Eran (2010). *Aesthetics A-Z*. Edinburgh: Edinburgh University Press.

Halbwachs, Maurice (1985). *Das kollektive Gedächtnis*. Frankfurt a. M.: Fischer Taschenbuch Verlag.

Ibbotson, Piers (2008). *The Illusion of Leadership. Directing Creativity in Business and the Arts*. New York: Palgrave Macmillan.

Jäger, Christian (2005). »Kriegsmaschinen. Zur politischen Theorie von Gilles Deleuze und Félix Guattari«. In: Preusser, Hans-Peter (ed.) (2005). *Krieg in den Medien* (=Amsterdamer Beiträge zur neueren Germanistik 57). Amsterdam: Rodopi, 423-435.

Kieran, Matthew (ed.) (2006). *Contemporary Debates in Aesthetics and the Philosophy of Art*. Oxford: Blackwell Publishing.

Krause, Ralf & Marc Rölli (2010). *Mikropolitik. Eine Einführung in die politische Philosophie von Gilles Deleuze und Félix Guattari*. Wien: Verlag Turia + Kant.

Liu, Alan (2004). *The Laws of Cool. Knowledge Work and the Culture of Information*. Chicago: University of Chicago Press.

Maleuvre, Didier (2011). *The Horizon. A History of Our Infinite Longing*. Berkeley: University of California Press.

Schelling, Friedrich Wilhelm Joseph von (1985). *Schriften 1794-1800*. Herausgegeben von Manfred Frank (F. W. J. von Schelling Ausgewählte Schriften 1). Frankfurt a.M.: Suhrkamp Verlag.

Schmitz-Emans, Monika (2005). »Gespenstische Rede«. In: Baßler, Moritz; Bettina Gruber & Martina Wagner-Egelhaaf (eds.) (2005). *Gespenster. Erscheinungen – Medien – Theorien*. Würzburg: Königshausen & Neumann, 229-251.

Schwemmer, Oswald (2004). »Autonomie«. In: Mittelstraß, Jörg (ed.) (2004). *Enzyklopädie Philosophie und Wissenschaftstheorie. Band 1:* A-G. Stuttgart: Verlag J.B. Metzler, 232-234.

Shields, David (2010). *Reality Hunger. A Manifesto*. London: Penguin Books.

Sontag, Susan (2007). *At the Same Time. Essays & Speeches*. New York: Farrar Straus Giroux.

Spieker, Sven (2008). *The Big Archive. Art from Bureaucracy*. Cambridge, MA: The MIT Press.

Steiner, George (2011). *Im Raum der Stille: Lektüren*. Berlin: Suhrkamp Verlag.

Thompson, Michael (2003). *Mülltheorie. Über die Schaffung und Vernichtung von Werten*. Essen: Klartext-Verlag.

Warburg, Aby (2010). *Werke in einem Band*. Auf der Grundlage der Manuskripte und Handexemplare herausgegeben und kommentiert von Martin Treml, Sigrid Weigel & Perdita Ladwig. Frankfurt a.M.: Suhrkamp Verlag.

White, Hayden (1980). »The Value of Narrativity in the Representation of Reality«. *Critical Inquiry* 1 (7): 5-27.

White, Hayden (1984). »The Question of Narrative in Contemporary Historical Theory«. *History and Theory* 1 (23): 1-33.

Wolfzettel, Friedrich & Michael Einfalt (2000). »Autonomie«. In: Barck, Karlheinz et al. (eds.) (2000). *Ästhetische Grundbegriffe. Band 1. Absenz – Darstellung*. Stuttgart: Verlag J.B. Metzler.

IN THEORY

Paolo Cherchi Usai
**The Lindgren Manifesto:
The Film Curator of the Future**

David Walsh
There is No Such Thing as Digital Restoration

Martin Koerber
»Who are these new archivists?«

Thomas C. Christensen
Film Heritage and the Transition to Digital

The Lindgren Manifesto:
The Film Curator of the Future

1 Restoration is not possible and it is not desirable, regardless of its object or purpose. Obedience to this principle is the most responsible approach to film preservation.

2 To preserve everything is a curse to posterity. Posterity won't be grateful for sheer accumulation. Posterity wants us to make choices. It is therefore immoral to preserve everything; selecting is a virtue.

3 If film had been treated properly from the very beginning, there would be less of a need for film preservation today and citizens would have had access to a history of cinema of their choice.

4 The end of film is a good thing for cinema, both as an art and as an artifact. Stop whining.

5 If you work for a cultural institution, make knowledge with money. If you work for an industry, make money with knowledge. If you work for yourself, make both, in the order that's right for you. Decide what you want, and then say it. But don't lie.

6 A good curator will never claim to act as such. Curatorship is a pledge of unselfishness.

7 Turning silver grains into pixels is not right or wrong per se; the real problem with digital restoration is its false message that moving images have no history, its delusion of eternity.

8 Digital is an endangered medium, and migration its terminal disease. Digital needs to be preserved before its demise.

9 We are constantly making images; we are constantly losing images, like any human body generating and destroying cells in the course of its biological life. We are not conscious of this, which is as good as it is inevitable.

10 Knowing that a cause is lost is not a good enough reason not to fight for it.

11 A film curator must look for necessary choices, with the ultimate goal of becoming unnecessary.

12 Governments want to save, not give, money. Offer them economical solutions; therefore, explain to them why the money they give to massive digitisation is wasted. Give them better options. Treating with the utmost care what has survived. Better yet, doing nothing. Let moving images live and die on their own terms.

13 Honour your visual experience and reject the notion of ›content‹. Protect your freedom of sight. Exercise civil disobedience.

14 People can and should be able to live without moving images.

There is No Such Thing as Digital Restoration

Film archives have taken to churning out digital restorations with enthusiasm, but how many of these really qualify as restorations? It is possible to devise a numerical tool for measuring the degree of restoration for any film, but, in its simplest form, this might be seen as encouraging unlimited improvement to the picture and sound. A simple rule is therefore necessary to define the acceptable limit to digital manipulation.

1

It has become a common refrain that digital technology is forcing film archives to redefine their role, and even to question their very existence. Converging technology is certainly helping to encourage a trend in which film archives are being absorbed into all-encompassing heritage institutions which offer digital access to everything. Nonetheless, the issues facing film archives, whether in or out of such entities, are much the same as they always have been – acquisition, preservation and access – and while digital technology may broaden the scope of these activities, there is nothing very special about digital technology itself. Why then is there so much excitement over ›digital restorations‹ if digital technology is just another tool in the box?

In order to explore this, let us go as tourists on a visit to the world of film restoration: we step off the bus in the main square of Restoration Town, and the first thing we see is Abel Gance's NAPOLÉON (1927), a truly monumental, if slightly ramshackle, edifice. There is always a big crowd to admire it, and we feel sure that this is the real thing – a restoration. Over on the other side of the square is another vast structure, METROPOLIS (1925-27) – undoubtedly a true restoration too. These two structures, where the end result has been painstakingly assembled from elements recovered from around the world, generally epitomise what most people think of as film restorations.

Let us now move away from the town centre, and down this little avenue to the home of the Imperial War Museums (IWM) Film Archive. Here the picture is a little confusing: there has certainly been something happening, but are these things restorations, or are they something else? To answer this question, we shall for the moment step out of our metaphorical conceit, and travel back to the year 1978.

In this year, IWM sent off to the film laboratory the original nitrate masters of the film WESTERN APPROACHES (1944), a groundbreaking drama-documentary, largely filmed using a huge Technicolor three-strip camera, plus sound recording equipment, plus lighting, plus crew and cast, all crammed into two tiny wooden lifeboats in the Irish Sea. IWM had recently acquired these masters and, as part of our nitrate film preservation programme, we were making new acetate protection masters, a new colour negative and a new print. Given that they hadn't printed much nitrate in recent years, the laboratory, Technicolor in London, who had worked on the film when it was first produced, did a good job, and we were satisfied that our duty of preservation had been fulfilled: we now had preservation masters and a fine new print for exhibition.

In the accepted wisdom of the time, what we had carried out was something called ›preservation‹: we had taken the original nitrate negative of a film, and using the best technology available, made a safety master copy, and a new print – exactly what we did with every other nitrate film in the collection. It never occurred to anyone to call this a restoration – because it wasn't.

Or was it? In 1994 an exhibitor managed to damage our print. Because we had done our preservation work properly, it was a simple matter of sending the colour negative made fifteen years earlier back to Technicolor for a new print. In these intervening years, restoration had become quite the fashionable thing, and so not to be left out, we booked the new print into the London Film Festival, invited along Pat Jackson the director, gave the film a grand introduction, and proudly called it a ›restoration‹. Was it? No, of course not. Even generously turning a blind eye to the fifteen year hiatus between doing the real work and launching this release, it was still no more than, well, a new print.

32 How dishonest were we? Let us step back into Restoration Town, and have a closer look around. There certainly do seem to have been a number of these constructions erected around this time, very often Technicolor films, with a big sign on the door saying ›Restoration‹, but when you open the door, you find that there's nothing behind the facade. There really doesn't seem to have been any restoration work going on at all. In fact, all they did was take the original negatives, and, using the best technology available at the time, make a new master and print.

But wait – who's this rolling into town with a fanfare of trumpets and a blaze of colour and sound? It's a whole new outfit, and they call themselves ›Digital Restoration‹ ... and wow, these people are good! Just look at what they are throwing up all over town – it's big and bright and sharp and really, really clean! And when we look back at poor old NAPOLÉON, we see that actually it's a bit untidy – the pieces don't fit together all that well, and if you go up close, you can see this sort of ... texture. The digital restorations don't have that: they are as smooth as silk. And everything matches so perfectly you can't see the joins at all. But don't worry, right next door there's another construction going up behind a big fence – and the sign on the gate says ›NAPOLÉON, the Digital Restoration, coming soon!‹ Fantastic!

Meanwhile, down IWM Avenue they are at it as well. There are digital restorations popping up all over their place too, and what are they working on right now? WESTERN APPROACHES, of course! Only this time it really is a restoration. It's a restoration because we have taken the original negative, and, using the best technology available, made a master copy, and a new print. Exactly as we did in 1978, when it wasn't a restoration. So actually, it isn't a restoration this time either – because there is no such thing as a digital restoration. There is restoration and there is digital technology, and sometimes you might use the latter in the cause of the former, but the term ›Digital Restoration‹ is just used to convey the fact that digital technology offers a greater ability to extract the best out of an original. You're not restoring anything, because you haven't lost anything in the first place – it's all there in the original masters.

To take a specific example, consider these frames from WESTERN APPROACHES, before and after restoration – ›before and after‹ being the usual, and wholly spurious, method of demonstrating the tremendous things done to a restored film: On the left, the ›before‹ frame, where one of the original elements had been torn across the frame. On the right, the ›after‹ frame: miraculously the tear in the negative has been spirited away. Restoration? Not really – we have a perfectly acceptable original Technicolor nitrate print from 1944 which does not
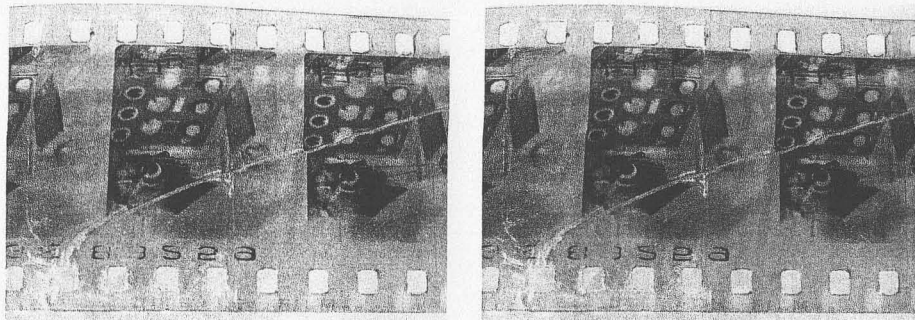

WESTERN APPROACHES Imperial War Museums (COI 393)

have this fault, so there is no sense in which we are recovering something which hasn't always been available. A more honest comparison would have been between the 1944 Technicolor print and the new digital version, and then there would be no miraculous repair work to see. The kind of work carried out to remove this type of damage is just the standard process of producing a new ›digital version‹ – a term I use as shorthand for any film which has passed through a scanning and digital manipulation process, whether or not it has been recorded back on to film or not.

In the parallel world of digitisation of photographs, this obsession with restoration is less marked. Photographic digitisation technicians know that the photographers and studios would never have issued a print made from the negative without there being a degree of intervention, both creative and technical, using various techniques in order to approach an ideal rendition of the scene captured in the negative. A digital scan of an original negative is considered to be just a digital version of that negative, and in order to produce a digital print, a similar process of enhancement is carried out, the difference being that digital technology offers the ability to approach even closer that ideal image, with considerably less effort. This process, entirely analogous to the work which technology is increasingly making routine in the film world, is usually called optimisation, not restoration.

In the fine art world, things are rather different. A torn canvas, the equivalent of the tear across the negative of WESTERN APPROACHES, might on the face of it appear to be comparable. The restorer goes to work with the aim of making the viewer as unaware of the damage

WESTERN APPROACHES Imperial War Museums (COI 393)

as possible, much as the digital technician did with our film, but the difference is substantial: the restoration of the artwork involves delicate work on the ›original‹ unique artefact. This work is irreversible: if the restorer makes a mistake, only further restoration work will do anything to attenuate the error. The result of the restoration, good or bad, is there for the audience to examine directly, as it is now an inextricable part of the original object. The digital repair of a film, on the other hand, is carried out by tinkering with the digits which represent the film content: the process is completely reversible, and the audience only experiences the result as an image created through some intervening mechanism. If we are to draw a parallel between film restoration and art restoration, the legitimate way of presenting the work on the damage to the WESTERN APPROACHES negative would be to show these two ›before and after‹ images: On the left, the tear in the original negative before digital restoration, and on the right, the same tear after digital restoration. The two pictures are identical of course, because we have done absolutely nothing to the original negative. We have not restored it.

2

Having now dismissed most current film restorations as nothing of the sort, perhaps we should adopt a more nuanced approach which takes into account ›all‹ the processes carried out during a restoration, and to this end I offer a quantitative analysis tool for restorations. To do this, let us take some of the essential ingredients of a restoration, such as how incomplete the archive's current master is, how widely the materials needed for the reconstruction

have been dispersed and how long the desired version has been lost, and by adding these elements together with some weighting factors, two simple formulae, one measuring the degree of reconstitution or reconstruction, and one the quality improvement, can be produced:

Reconstruction factor (R) $\qquad R = 2g + 2c + d + t$

Quality change (ΔQ) $\qquad \Delta Q = q_1 - q_0$

where: g ... Gain in completeness (Difference in completeness between the final version and the archive's master)

c ... Complexity of reconstruction

d ... Degree of dispersal of elements

t ... Time since aimed-for version last available

q_1 ... Quality of final version

q_0 ... Quality of previously available version

These two aspects can then be plotted on a simple graph, in which a move towards the top right corresponds to an increasing degree of restoration, and we can test this by plotting some actual restorations, with *Reconstruction* marked out of 4, and *Quality* out of 10 (the figures are of course largely subjective). So for the analogue work on NAPOLÉON, a film which had effectively been lost in any remotely complete version since its release, $g = 4$, $c = 4$, $d = 3$, $t = 3$. Marking the quality is more difficult since the quality varies widely in different parts of the film, but the versions that existed previously were fairly poor, so $q_0 = 2$, $q_1 = 6$. Putting these figures into the formulae:

$$R = 22$$
$$\Delta Q = 4$$

METROPOLIS, on the other hand, was widely available in shortened versions of often reasonable quality; nonetheless digital tools were employed to match scenes from disparate sources, and so $g = 3$, $c = 3$, $d = 3$, $t = 3$, $q_0 = 5$, $q_1 = 8$, to give:

$$R = 18$$
$$\Delta Q = 3$$

Others may disagree with the precise numbers, but the important thing is that both films score well in terms of reconstitution, and this puts them both well towards the top right of the graph.

How does the analogue work on WESTERN APPROACHES score? In the 1994 version there was, in fact, a small degree of reconstruction work carried out, namely restoring some optical effects missing from the original elements, so this just scrapes a score of 1 for gain in completeness, and perhaps another 1 for the complexity of doing this, but we get 0 for dispersal – all the material came out of our own vaults – and also 0 for the time since the full version was available – we have always had a complete original print of the film. So R is only 4, and because we had a perfectly acceptable release print of the film already, ΔQ is at best 1.

For the current digital work on the same film, the R factor is exactly the same as the 1994 release – as before we had to recreate the optical effects, digitally this time – but the quality score is higher because of the power of digital technology. Although the film now looks very fine indeed, the original print was remarkably good itself, so the improvement is from ›quite good‹ to ›very good‹, and is awarded a ΔQ of 4, which moves it a little further along the graph towards the right.

Now we can start putting all the digital versions of IWM films on the chart:

	R	ΔQ
MEMORY OF THE CAMPS (1946) Huge reconstruction from original negatives	22	5
BRITISH ATOMIC TRIALS AT MARALINGA (1956) Very little reconstruction, but huge quality improvement	1	6
THE WOMAN'S PORTION (1918) Reconstructed, small quality enhancement	10	3
EVERYBODY'S BUSINESS (1917) No reconstruction, small quality enhancement	0	3
NOW IT CAN BE TOLD (1946) No reconstruction, small quality enhancement	1	2
DESERT VICTORY (1943) No reconstruction, significant quality improvement	0	4

The curved line, which happens to be defined by the formula $R^2 + 3\Delta Q - 25 = 0$, I call the *Walsh Restoration Threshold* (WRT): anything above the WRT is a restoration, and anything enclosed in the area below is not (I have called it the Walsh Restoration Threshold because it represents where I personally consider a digital version can legitimately start to be called a
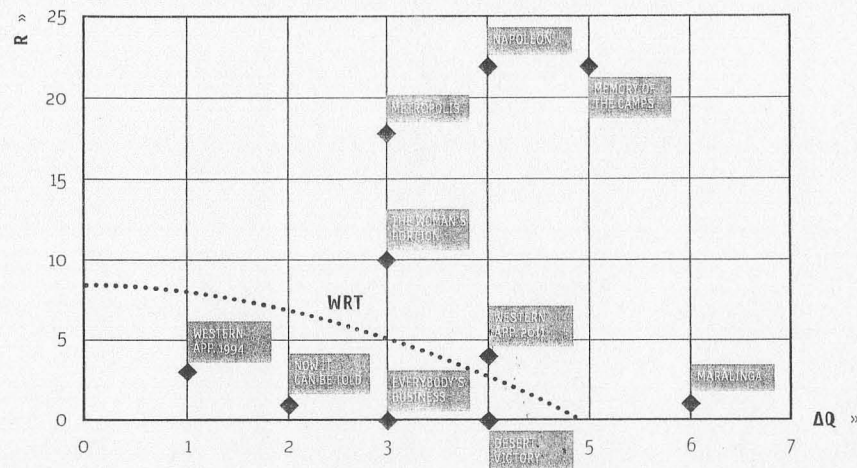
restoration). The line is curved to reflect the notion that quality can only be considered part of the restoration process where a really significant improvement has been achieved. With this we see that NAPOLÉON, METROPOLIS and MEMORY OF THE CAMPS are all comfortably in the restoration zone, but the 1994 version of WESTERN APPROACHES does not make it. The 2011 digital version is just above the borderline. However MARALINGA, despite having had very little reconstruction, gets in by dint of the large quality improvement.

I invite the reader to plot their own efforts on the graph and see if they qualify as genuine restorations or not! I am not actually proposing an International Restoration Standards Committee to police the work of film archivists, but rather drawing attention to all those so-called restorations which are nothing more than digital scans with a little image manipulation to make them more acceptable to the clean look of High Definition Television (HD TV).

3

In the end, though, it really doesn't matter whether you call your digital versions ›restorations‹ or not – anything which helps to persuade audiences to come and watch archive films is, arguably, justifiable – but more important is the question of the acceptability of what has been done to a film as part of the digital process.

The Walsh Restoration Chart implies that technical quality can be improved indefinitely as we move to the right, all the way to the point where the scene presented is indistinguishable

from the original reality in front of the camera, in other words, where the medium is no longer detectable. This may be a valid approach for actuality footage: imagine taking footage of the Battle of the Somme and increasing the sharpness and resolution so that no image structure remains visible, interpolating frames and increasing the frame rate so that the wagon wheels go forward rather than backwards, adding colour, transforming it into 3D, until the viewer is, in effect, standing in the trenches with the cameraman. Used responsibly, this would surely be an amazing experience.

For cinematographic works, that is ›films‹ rather than ›film‹, it is a little more problematic. Are we looking forward to a future where you can actually stand on the yellow brick road with Dorothy, where you really are in the courtroom sharing Joan of Arc's passion, where you can actually feel the heat from the incinerator as Rosebud goes up in flames?

This all may seem a ghastly fantasy, but as technology develops, there will be little difficulty in achieving this kind of virtual reality. I suspect most film archivists would feel that we have a responsibility here, but I suggest that our responsibility is not to spoil people's fun, but rather to be the guardians of the authentic cinematic experience by ensuring that ›we‹ strive towards an accurate simulation of the original cinematic work, whatever medium is available to us. So as digital technology moves us ever further away from our poor old grainy, flickery analogue films and towards a perfect simulation of reality, the real question is: how far may we go?

Many film theorists of a purist inclination will assert that the rule is very simple: the aim of any restoration is to produce as close an approximation as possible to an original print at the time of release, so in the case of WESTERN APPROACHES, the image displayed on screen should look exactly like the Technicolor print would have done when projected in 1944. Some would go further and insist that the result should look specifically like a nitrate print shown using a carbon-arc projector in a cigarette smoke-filled auditorium.

This is, of course, madness. It is madness because it necessitates the following scenario: the restorer scans the original three separation negatives, registers the resulting digital files, carries out a small amount of clean-up work on blemishes and dust marks, and produces a graded copy. The archivists view it, amazed at its superb quality and in awe of the skill of the Technicolor engineers of 75 years before. And then the restorer says: »OK, no one else is allowed to see this, because when we produce a release version of this film we are deliberately going to make it ›worse‹.«

Nobody will ever do this. Apart from the fact that restorers are unlikely to be persuaded of the need to degrade their work, to do so requires the application of highly inauthentic digital manipulations such as re-graining. It's not dissimilar to current video editing applications which have an effect called ›old film look‹ that can be applied to any footage. Are we seriously advocating applying the ›old film look‹ to our pristine restorations?

I propose instead a very simple set of guiding principles, which can most easily be illustrated in the form of a graph. This time, rather than plotting the ›change‹ in quality of a restoration, we will plot *Inherent Quality*, that is, the quality, rather than the condition, of any particular copy of a film. On the other axis we will plot a variable which we will call *Damage*.

Along the *Inherent Quality* axis we can mark the positions for the master negative and the first release print for our film. The first print position marks the quality of an ideal analogue film print, that is, a print in perfect condition with no scratches, dust marks, blemishes or fading of any kind, and made on a printer with perfect illumination and steadiness; the master negative marks the effective position of a perfect, and perfectly graded, positive rendition of the negative (and original soundtrack), and is consequently less grainy and with better resolution than the (analogue) first release print. This ideal version of the negative is not achievable by analogue film printing, but can be closely approached by digital technology.

To these two key points we can then add positions to represent any other copy which may be available: second generation masters (duplicating positives/interpositives) will be close to the print in terms of inherent quality, while third generation masters (i.e. duplicate negatives) will typically be a little further to the left. For the type of master all too frequently encountered in an archive, namely a duplicate negative made in the 1960s from a nitrate print in poor condition (and since destroyed), the inherent quality is even worse, and for a 6th generation 16mm print made on a poorly maintained optical printer, the inherent quality is heading towards zero. Far off the scale, to the right, is reality.
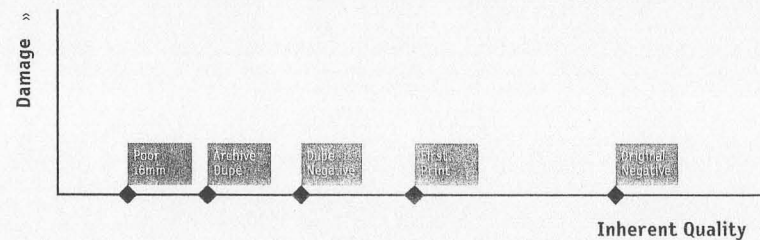
In the real world of analogue film, the perfect, damage-free copy cannot exist, of course. A copy in very good condition will still have some blemishes, while an archive's copy of a release print will very often be in quite poor condition. We mark the degree of damage in the vertical direction on the chart (in this example a good original, a reasonable new print, a decent dupe negative, a damaged nitrate print and the 16mm print in terrible condition – since we are only interested in relative positions, we don't need to assign actual values):
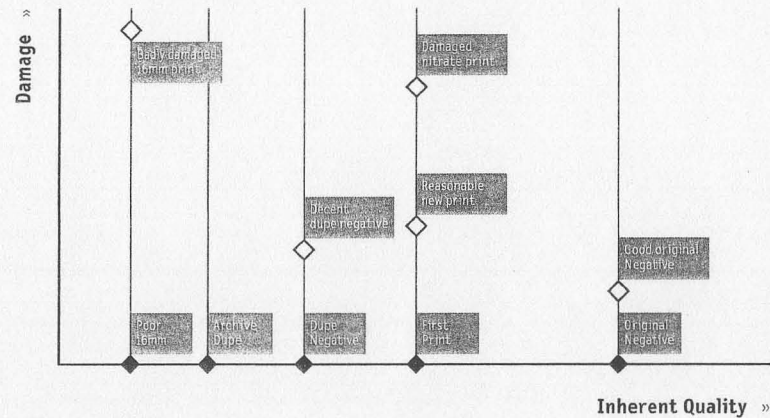
The rule for making an archivally acceptable digital version is then straightforward: starting with your source material you can move vertically down the graph, but not sideways. With one exception, it's as simple as that. In other words, you can use all of the digital tools available to remove scratches, tears, blemishes, and clicks and pops on the soundtrack, to stabilise printed-in frame movement and flicker, to balance and enhance faded colours, all of which are aimed at redressing the ›damage‹ factor, i.e. printer-generated defects, handling damage, and age-related deterioration. But you cannot do anything to ›improve‹ the inherent quality, such as removing movement generated in the camera gate, sharpening, colourising, reducing grain or converting the mono sound into 5.1 surround.

The exception to this rule is where the starting point is to the left of the first release print, in which case it is permissible to apply any additional manipulations which move the quality towards, but no further, than the first print – ›provided‹ that these introduce no digital side-effects. In practice the amount of inherent quality enhancement which can successfully be carried out with current technology is fairly limited: reducing flicker, using secondary colour correction, and enhancing shadow and highlight detail are unlikely to create any obvious digital artifacts, but grain reduction, for instance, can quickly lead to an unnatural ›digital‹ look.
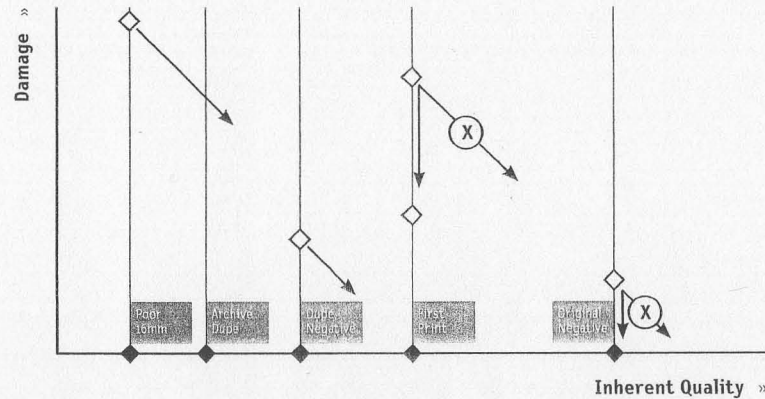
This rule allows the archive to take advantage of the better inherent quality of the original negative, if this is available, but forbids attempts to improve the inherent quality of a first release print by, for instance, reducing grain in order to move towards that of the negative. If we like, we can incorporate the notion of unacceptable image improvements into our earlier formula by adding (or rather, subtracting) a penalty, P:

$$\Delta Q = q_1 - q_0 - P$$

The work accrues penalty points for any forbidden movement away from the vertical, and so, for example, where the original negative has been scanned, cleaned up, and then turned into an emulation of HD TV by stabilising, sharpening and removing all the grain, we can award a penalty of, say, 3 for this unacceptable horizontal movement. If the original negative was in good condition anyway, the quality improvement, $q_1 - q_0$, is no more than 1. Subtracting the penalty of 3 then gives a ΔQ of minus 2. The reconstruction factor is at best 1, so this ›digital restoration‹ goes here on the graph:

$R \approx$

25

20

15

10

5

0

-3   -2   -1   0   1   2   3   4   5   6   7

›Digital Restoration‹

ΔQ »
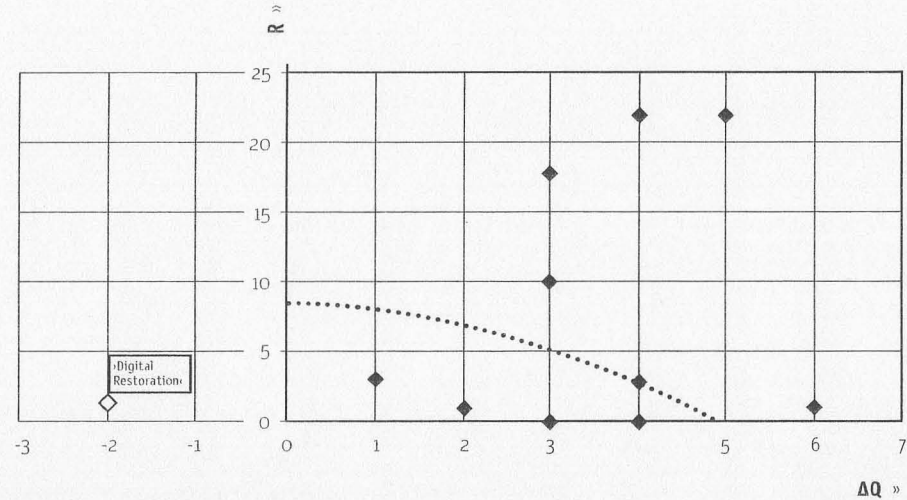
To sum up, we need to stop considering digital technology as something special in itself: it provides an alternative way of copying and presenting film, and it offers improvements in extracting the inherent information in analogue originals. Rather than being a challenge, it is a solution which offers film archives the ability to keep their films alive in a world where viewing habits are rapidly changing. It can be misused, deliberately or otherwise, but there is a simple rule when making digital versions of films: remove as much damage as you like, but do not carry out digital manipulations to improve the inherent quality of the film beyond that of an original print. Finally, if you come across a ›restored‹ film which is rock-steady, razor-sharp and completely grain-free, plot its position on the Walsh Restoration Chart, and send this off to those responsible, pointing out that they have achieved a negative score. If we all do this, perhaps we will have contributed in part to retaining some of the magic of cinema.

›› Martin Koerber

»Who are these new archivists?«

This text sees me assuming the role of a futurist. So, as I stare into my rather hazy crystal ball (something that is perhaps done best late at night, with a good brandy in reach), let me tell you what I think the future will bring – and let's see if, in a few years, I turned out to be right or not.

Audiovisual archiving, I believe, will become increasingly important in the future, for the simple reason that our world will not cease to produce audiovisual records. On the contrary, it will produce ever more audiovisual records in place of other documents and thus there will be a greater need to collect and preserve these records.

I also believe that the future of audiovisual archiving will see a fusion of the various sections of archival institutions dealing with audiovisual records, whether film, television or recorded sound. This is for the simple fact that the challenges of audiovisual archiving are going in one direction, and one direction only: digital.

The digital domain will ultimately be the domain where all audiovisual archiving will take place. When all access to and handling of audiovisual heritage material is digital, audiovisual archivists will use the same tools and procedures, regardless of whether they started out as sound engineers, moving image archivists, photo restoration specialists, or information technology experts.

This point does not just concern the future, however, as this future is here already. The final report of a study called *Challenges of the Digital Era for Film Heritage Institutions*, published in December 2011, bluntly states: »Cinema is Digital‹. This is not a possibility or a future

development anymore, it is a reality. [...] Over the past two decades cinema moved progressively to the complete digitisation of its production, post-production and distribution chain. Other than for theatrical exhibition, all distribution formats (broadcasting, home-video, etc.) have been digital for a long time. Most analysts place the ›tipping point‹ (when D-Cinema will become predominant) for most key markets in 2011 or 2012. Some countries are already almost completely digital. Already now, virtually all films are distributed also digitally. Some are distributed only digitally.«[1]

If the people working in the film archives, or ›film heritage institutions‹ as they now seem to have been renamed, intend to survive the change, they must adapt to this new world without forgetting what they have learned before the digital challenge entered their professional domain. Even when all access to and handling of audiovisual heritage material is digital, there will still be a need for specialists who know how to properly treat the analogue originals. There will be a need for the care and handling of ›old‹ carriers (as one could start calling them already), a need for knowledge about the intricacies of obsolete sound and image formats, as well as about the chemical misbehaviour of these carriers. There will be a need for people who can, for example, tell the difference between a Technicolor print and an Agfacolor print just by looking at them, or who can easily distinguish an Eastmancolor print from a Kodachrome reversal original. Indeed, it takes precisely this kind of knowledge and expertise to ensure that the digital representations of these very different renderings of the world resemble their analogue originals as closely as possible.

It will be self-evident in future as much as it is self-evident today that the colour space in which a piece of information is rendered or the spectral characteristics of an audio recording are not only form; they are part and parcel of the information itself. If we therefore want audiovisual recordings to retain their integrity and authenticity, we cannot divorce their technical characteristics from their content.

Audiovisual content can very easily be falsified if it is not transferred or displayed appropriately. Even those who know little to nothing about media technology would become suspicious if, say, a television documentary commemorating the 100th anniversary of the outbreak of the First World War presented them with an image of the assassination of Archduke Franz Ferdinand bearing all the technical characteristics of a present-day television image.

I don't honestly think anybody would believe they are seeing an authentic 100-year-old recording if the image has been brought ›up to current specs‹ by the engineer handling the transfer. One can only hope that this deplorable practice of making ›old‹ images look new is just a passing fancy, just as the equally absurd practice of making old (and new) images look even older by adding scratches and dirt through ›artificial aging‹ on modern editing consoles will hopefully subside and we will eventually be able to establish standards of good and sober transfers in respect of the original technical achievement.

So, the audiovisual archivist of the future will ideally be a mix of retired laboratory technician and television engineer who has lived through the entire evolution of tapes and encodings; a person who knows all about old formats and their ›looks‹ as well as their mechanical, chemical and electronic properties. One might want to dub such a person a ›signal extraction specialist‹. There will be a need for audiovisual archivists who possess even greater knowledge of the old carriers than most of them do today. This is because the existing infrastructure for the production and upkeep of traditional media will quickly disappear, as soon as the mass market currently supporting this infrastructure is no longer there. With the disappearance of manufacturers of film, tape and photosensitive paper, the laboratories that have handled the post-production of these media will disappear as well, and with them the products, techniques and equipment they used. We can already see this happening in the field of analogue sound recording on magnetic tape, and certainly in the field of photography, where the mass market has gone entirely digital. Once powerful companies like Agfa and Kodak are going bankrupt or are diverting their interests into new fields, leaving the archivists suddenly without the materials they need, materials that manufacturers had been producing in huge quantities for over a hundred years.

As stated in the *Challenges of the Digital Era for Film Heritage Institutions* report, »In the short term the closure of analogue film laboratories potentially offers the FHIs [= Film Heritage Institutions] the opportunity to take advantage of an increased supply of personnel highly qualified in analogue techniques (albeit not necessarily in preservation techniques). But this advantage will soon disappear as most of the senior staff currently employed by analogue laboratories are at the end of their working lives. In fact, in the medium to long term FHIs will face a serious problem in finding staff with any knowledge and experience in the analogue world of cinema. This trend is already noticeable today when for example students coming from universities or film schools have hardly been exposed to any form of analogue technologies in their lives: no films, but also no discs, no analogue audio tapes, no video cassettes, etc.«[2]

Thus, the audiovisual archivist of the future, if not of today, will not have a large community of chemists, mechanics, electronic engineers or their specialised industry to serve as a backbone to his or her own activities. Like specialists for medieval paintings, Baroque furniture or Roman glass, audiovisual archivists will have to learn, with difficulty, both the properties of the old carriers as well as the characteristics of the images rendered on them. For the old carriers will be with us for decades, if not for centuries to come, despite all the problems of decay and damage they certainly brought with them when they entered the archive.

The ongoing evolution of transfer technology and transfer quality means that the most valuable masters, the true originals, will become increasingly valuable and their careful storage will therefore be a good investment. New editions of valuable audiovisual assets will keep the public interest alive every time there is a major change in reproduction and display technology looking to be legitimised or – shall we say – ›glamourised‹ by widely accepted content of high cultural value.

Just consider the pattern of earlier technological changes in content rendering: When Gutenberg started printing, he first printed a bible. When photography tried to become a legitimate art, it married itself to the visual arts as a tool for painters, while early photographers made images that resembled paintings, in order to be accepted as true artists. Another example would be the boost in distribution that classical music saw when the Compact Disc was introduced a few decades ago.

While audiovisual archivists will be much in demand, as I believe they will, they will also have to continue to fight for their status. Compared to other heritage archivists, audiovisual archivists, and audiovisual restoration experts in particular, are still in a minority position. Often their demands to be accepted as heritage specialists go unappreciated by their institutions and by the heritage field as a whole. Audiovisual archivists have yet to define their field, and due to the continuing technological change, to constantly redefine who they are and what they do will be a key challenge for the foreseeable future.

In such a situation, it is useful to have a document that can serve as a reference point for anything one might want to do or might want to ask from other people; a document that clearly outlines the archivist's rights and provides a ›declaration of principles‹ firmly grounded in the widely accepted concepts of safeguarding (audiovisual) heritage.

Such a document exists. It has been published by UNESCO in several editions, most recently in 2004. Written by the Australian audiovisual archivist Ray Edmondson, it sums up the life experience of someone who was at the forefront of the (audiovisual) archival movement for almost forty years. Entitled *Audiovisual Archiving: Philosophy and Principles*, it touches on all the important underlying questions one may have when one begins to consider the ethics of what one is doing. It embeds the practice of audiovisual archiving in the theoretical framework developed mainly in other fields of art and art conservation over the last 150 years or so about what heritage is. Thanks to UNESCO, this document can be freely downloaded and it is an absolutely vital reference, despite (or perhaps because of) the technological changes facing us right now.[3]

Let's return to the fundamental question of this article: Who are these new archivists? Well, I happen to know some of them, as I have taught them on my audiovisual conservation programme at the University of Applied Sciences in Berlin, and occasionally elsewhere in the array of seminars on audiovisual preservation that take place here and there. They have also taught me a lesson or two. I am stunned, for example, by their determination to penetrate a field with relatively few job opportunities.

A thread on the listserv of the Association of Moving Image Archivists (AMIA), a popular discussion forum and exchange platform for audiovisual archivists the world over, addressed this problem. The thread started when the Anthology Film Archives in New York, a well-renowned home for experimental and independent film with a huge archive and a comparatively small budget, announced a job opening. The announcement read: »Archivist, Full time, permanent (minimum 2 Years)«. Good news, I thought, Anthology is in the position to hire. Bravo!

Now for the job description: »The Archivist oversees the principal visual and audio collections of Anthology Film Archives (AFA) including, though not limited to: motion picture film, video, and audio materials in multiple formats. Primary responsibilities include the day-to-day management of the archive office and facilities: supervision and management of interns, maintaining equipment, ordering supplies, receiving and fulfilling loan requests, and the initiation and management of film preservation projects – including print inspection and grant writing. The Archivist is expected to have a strong understanding of film handling and projection, and to be up-to-date with current best practices for the archiving of audio-visual materials.

A major project within the first two years will be the implementation and management of a large-scale cataloging project. Experience with cataloging, databases, and the management of such projects is a key requirement for this position. The Archivist will also work in conjunction with the Curator of Collections and the Digital Archivist to set up workflows, create and manage digital assets, and curate digital content online.

The Archivist will be expected to initiate and manage larger organizational projects, working in conjunction with Anthology's various departments: programming, development, and administrative. The Archivist is expected to attend weekly staff meetings, and to develop and maintain working relationships with other archives, laboratories, libraries, academic departments, etc.«[4]

Wow – that is a full agenda. It almost reads like ›my‹ job description as head of the film department at the Deutsche Kinemathek. Now to the qualifications and requirements for this position: »Advanced degree in archival film studies, library science, or equivalent. Five years of managerial experience, including oversight of staff and interns, preferred. Experience with basic film handling, editing equipment, and film and video viewing equipment required. Experience with cataloging, file-naming conventions, creating finding aids, and general information systems preferred. It is expected that the Archivist will have a basic understanding of standard computer word processing (Word, Excel, etc.), database software and functions, as well as a high level of comfort with learning new software and work flows.«[5]

While all that sounds reasonable the issue that kick-started a fierce debate resulting in possibly the most posts on a single topic I have ever encountered on the listserv was this: the salary. 30,000 to 35,000 US Dollars were being offered as annual income. This translates at best to around 25,000 Euros. Imagine trying to make a living on that in one of the most expensive cities in the world, New York City. The job description clearly indicates, meanwhile, that this is not a minor position but rather a leading one. However, most film heritage institutions, unless they are based in rich countries like the Netherlands, Sweden or Germany, are not in a position to offer better salaries. This is not unproblematic, and in the long run will result in the film heritage institutions losing precisely the people they need the most: dedicated specialists with a passion for their work, but also a lust for life outside the vault, including plans to e.g. start a family.

After the initial outcry against the low pay, an interesting debate began. As some people rightly pointed out, it was certainly more helpful of Anthology to give a realistic figure than to revert to a euphemism like ›salaries commensurate with experience‹. Then the debate quickly moved away from the salary issue and into a more interesting direction, namely: what is the future of all the people who come out of the various programmes that teach audiovisual heritage specialists today, be it the Preservation and Presentation of the Moving Image Professional Masters programme at the University of Amsterdam, the Moving Image Archive Program (MIAP) at NYU, the Moving Image Archive Studies (MIAS) programme at UCLA, the Selznick School in Rochester or my own audiovisual conservation programme at the University of Applied Sciences in Berlin?

One post by Stephanie Sapienza struck me as especially true: »Basically insofar as my experiences out in the world after earning my MA in archiving (from UCLA), it takes one or more of the following skill sets in ADDITION to what is typically learned in a graduate archiving programme to have any real job security:

a) IT/IA knowledge, with some level of prowess in database management,

b) experience with fundraising, project management and knowledge of non-profits,

c) extreme tenacity and entrepreneurial vision.

The more you have of these three things on top of your MA, the more likely you are to be able to thrive in this industry without having to scrouge [sic] for the few great-but-woefully-underpaid jobs that arise on this list.«[6]

Entrepreneurial vision is not something that is necessarily taught in the MA programmes, but I would agree that it is the single most important thing young audiovisual archivists can teach themselves. When I look back on my own career, one thing stands out: in any position I had, as small as they were in the beginning, I immediately started doing things that went above and beyond my call of duty; things that the institutions that had hired me would never have dawned upon. Filling a need that no one else could fill or fixing a problem that no else had noticed soon paid off as it was this approach that earned me better job offers later on.

Elena Rossi-Snook posted a sensible remark along the same vein: »I think the moral of this story is that if you are looking and applying to job postings advertising specifically for a Film Archivist, your options and salary may be limited. But it is possible to work successfully as an archivist at an institution with moving image holdings if someone can be convinced that archiving – and you – is necessary. For example, there is a certain MIAP grad who convinced the archive in Mexico to start an orphaned film division (with her in a managerial position!). I'm sure there are more than a few historical societies that would be interested in someone who wants to pool together the home movies of the immediate region (as long as they are also willing to work on the reception desk). The Adirondack Museum in upstate New York has amateur film holdings from the mid-century summer camps in the area but I don't think they have an archivist on staff. You may be starting in the proverbial Mail Room, but I can't believe that every position in institutions with moving images is filled.«[7]

This, I think, is a significant remark. Many positions for moving archivists are emerging from institutions that are in possession of moving image collections, yet do not see themselves as archives. Thus, they have no idea what they are supposed to do with these collections and how they can best take care of them. If the new generation of audiovisual archivists can therefore penetrate these institutions and put themselves in positions where they can actually make a difference for the archival holdings, then this will almost certainly result in better things later on.

It may not necessarily help to answer the question ›Who are these new archivists?‹ in full but I think we have to think beyond the usual jobs and job descriptions. That also goes for the existing film heritage institutions, most of which are underfunded and thus cannot hire extra staff, even though they have more than enough work needing done. So, maybe this approach of bringing in new people by other means – ›through the backdoor‹ as it were – will also be part of the future of audiovisual archiving.

[1] Mazzanti, Nicola (ed.) (2011). *Challenges of the Digital Era for Film Heritage Institutions: Final Report prepared for the European Commission, DG Information Society and Media, December 2011.* Luxembourg: Publications Office of the European Union, 20-22. Available online at: http://ec.europa.eu/avpolicy/docs/library/studies/heritage/final_report_en.pdf

[2] Ibid., 26.

[3] Available at: unesdoc.unesco.org/images/0013/001364/136477e.pdf

[4] Post by Anthology Film Archives curator Andrew Lampert on 15th September 2011. As of publishing, the archived post can be publicly accessed from the following URL: http://lsv.uky.edu/scripts/wa.exe?A2=ind1109&L=amia-I&F=&S=&P=18077

[5] Ibid.

[6] Post by Stephanie Sapienza, Project Manager, American Archive Corporation for Public Broadcasting, on Friday, 16th September 2011. As of publishing, the archived post can be publicly accessed from the following URL: http://lsv.uky.edu/scripts/wa.exe?A2=ind1109&L=amia-I&F=&S=&P=23503

[7] Post by Elena Rossi-Snook on Friday, 16th September 2011. As of publishing, the archived post can be publicly accessed from the following URL: http://lsv.uky.edu/scripts/wa.exe?A2=ind1109&L=amia-I&F=&S=&P=22520

›› Martin Koerber

›› Thomas C. Christensen

Film Heritage and the Transition to Digital

If you have to restore, you've failed!

Analogue media have allowed for a certain amount of benign neglect. However, it is worth noting that only 10-20% of the film heritage from 1895-1930 is thought to survive. Digital and electronic media are prone to several types of obsolescence. Besides the carrier and carrier format decay known from analogue media, there are also hardware, software, file format and runtime environment obsolescence to take into account. Typical refreshing of digital media is either ongoing or at least once every five years. Migration to new formats can also be expected at a more frequent rate than for analogue media. Current cost for trusted long-term digital repository storage is estimated to be equal to or higher than that for equivalent analogue preservation. Even if physical storage costs are expected to decrease, the intellectual and administrative costs are expected to remain stable or increase over time.

It is important to stress that preservation of the film heritage is the prerequisite for any other activity. If preservation is not performed properly, there will be no heritage to show and provide access to in the future.

In order to preserve film and cinema as an expression of history, culture and art, it is important to proactively collect, maintain and restore films as a long-term commitment. Preservation is here understood as the long-term conservation of an original film element, or as authentic a duplicate as possible thereof, whereas restoration is here used to describe the re-creation of a screening element adhering as closely to the original screening experience as

possible. Both preservation and restoration aim to give access to film heritage for present and future audiences. Today analogue film laboratories are closing every month and analogue film screenings will soon only happen in archival theatres. This has two immediate consequences: if access to the film heritage is to be maintained, archive film theatres must be equipped to screen digital film elements to be able to show new films, while archival films must be digitised to provide access to non-archival users.

Even though digital offers many benefits, there are several dilemmas that need addressing in the analogue to digital transition. Analogue films can be stored cold and dry for centuries without need for migration/duplication, while digital preservation is a parallel activity to the passive storage of analogue film and will require additional funding. Digital and electronic media are prone to hardware, software, file format and runtime obsolescence. Migration and refreshing are therefore ongoing activities. Digital preservation is a complex activity and not cost-efficient compared to analogue preservation.

For restoration, digital offers many magnificent tools, which allow powerful manipulation. However, film archives must strive for authenticity. Film archives have a moral obligation to retain the link to the film as a heritage element and to not over-restore or re-master for short-term purposes. Film archives must engage in digital restoration and production of digital film elements in order to develop a professional discourse on ethical standards in digital restoration. Even though it is impossible to be completely objective in film restoration, since the tools used for restoration are the same creative tools used in film production, it is important to seek to retain the authenticity of the original from which data is transferred. A restorer should be creative in regards to restoration and access technology, but be careful not to lose quality and authenticity. Creative re-use and re-purposing of heritage objects can be powerful components in new cultural products; however, the historical value of a heritage object is based on retaining an unbroken link to the past.

Film archives have a long tradition for heritage screenings of analogue films. This tradition is challenged by the digitisation of cinema, and new models for quality screenings of historically important films will need to be developed for the digital era. The financial challenges facing film archives, regarding both preservation and screening of film heritage in connection with the change to digital, are substantial. Maintaining an authentic ›cinematographic‹ screening experience is already proving a challenge, as digital transfers of heritage films often have a re-mastered look, which is better suited to electronic media than cinema screens. Also, it is important to distinguish between the professional D-Cinema projection and the lesser quality E-Cinema projection, such as projection from DVD.

Potentially, digital access can create new users and uses, generating new cultural value. Digital Cinema Package (DCP) distribution will open up wider distribution of heritage films, also to non-FIAF venues. However, this requires film archives to actively create authentic digital cinema quality elements, especially of public domain and orphan films.

As film exhibition becomes fully digital, this change will affect the collection building of the film archives and cinémathèques significantly. Even if more titles will become available, the diversity of historical titles will have to be addressed to avoid rigid canonisation. Cinémathèques and film archives should work to ensure that as many films as possible are available in the best formats. Cinémathèques will have to pursue the use of DCPs in the same way that the diversity of heritage film screening formats are maintained for proper display of original film works. The advent of digital cinema might force the film archives to create new ›business models‹ to secure the availability of films held and preserved in their care. There are questions to be dealt with in regards to transparent handling fees, rights management and the possible creation of a centralised catalogue with available DCPs, rights, serial numbers for servers and projectors, etc.

Film archives have been active in collection building beyond their national or preservation remit. Many archives also have ongoing screenings for educational and cultural purposes. The local availability of prints is an important part of cinémathèque programming. Despite the general thinking that everything will remain available, there is really no knowing which, and under what conditions, films will remain available.

In order to remain relevant and keep cinema heritage alive, film archives must work to create forums in which member archives can acquire the skills and intellectual and practical requirements of current and future access, archive technology and strategic planning. New training opportunities for staff and management should be created to upgrade film archives to become leaders in digital film technology and preservation. Film archives must work to ensure diversity in access to film heritage, including availability of DCPs of world cinema. The creation of a central DCP catalogue of culturally important titles could be an option to provide access to non-commercial film heritage in theatrical quality. Film archives must work to maintain and improve the political understanding that non-profit film archives are important stakeholders in the preservation and access to past, current and future film production.

IN PRACTICE

Pragmatic Solutions
for Problematic Sources

A New Possibility of Preservation – In-House Digital Facility

Filmarchiv Austria had already been involved in the development of an archival *Arriscan*, by providing Arri with nitrate material displaying various kinds of decomposition. Thanks to a joint project of the Austrian Film Gallery, the Austrian Film Museum and Filmarchiv Austria, an *Arriscan* was installed at Filmarchiv Austria in Laxenburg, and we acquired the whole workflow of digital restoration in-house, except the photochemical process.

The other equipment, two digital workstations featuring the general restoration software *Diamant*, the colour grading system *Scratch* and the digital film recorder *Arrilaser*, was (until the start of 2013) located in Krems, a beautiful small town by the Danube, where the Austrian Film Gallery is based. It is, of course, not very convenient to divide the entire digital facility between two locations which are more than 100km apart. However, in order to enable us to deal directly with nitrate sources under coordinated, thorough care, the *Arriscan* had to be brought to Laxenburg, where not only does Filmarchiv Austria have its nitrate vault, but also where one of the project partners, the Austrian Film Museum, deposits its nitrate holdings. After scanning, we transport data from Laxenburg to Krems via external hard drives. To avoid any risk of losing data, we save the raw scans in Laxenburg onto LTO tapes, for optimal long-term storage. In Krems, two further generations of data are also preserved on LTO, the one after *Diamant* restoration as well as the final data after colour grading with *Scratch*.

As our digital restoration team consists of only four members, and none of us had previous experience operating this hardware and software, the work was quite an effort until the team hit its stride and things started to run smoothly. Digital film restoration requires knowledge and experience in several fields that are quite removed from each other. Since I have established myself purely as a ›genuine‹ film archivist, the skills I was able to contribute to this project included handling historical material, evaluating photographic picture quality, and so on, but with digital matters I am little more than a layperson.

When I organised some of the first digital restoration projects in Japan in 2003-2006, I was in the comfortable position to be able simply to ask the lab technicians with expertise, in order to make the result come closer to my own taste, by saying, for example, »Could you please soften the contrast of this sequence?« or »Can we do anything to make these distracting grains look better?« And now I myself am in the position to find a solution. It is a difference, indeed.

We are still grappling with a lot of unsolved problems, but thanks to the thorough knowledge about source material of Nikolaus Wostry, our project leader, and the professional skill of Silvester Stöger and Claudia Kopp in operating various kinds of visual software, our team's work has finally reached a level we can be proud of. Since our shared digital facility came into actual use, Filmarchiv Austria has restored more than 40 titles digitally, including short films, at a resolution of 2K or above.

When Should We Go Digital?

To our great regret, even after every archivist became fully aware of the superiority of nitrate over acetate in terms of stability, some film archives still destroy nitrate sources after preservation. This is regrettable not just ethically, but pragmatically. When a new reconstruction project arises, and if the original nitrate source no longer exists, one has to start from a preservation element at least one generation inferior to the original. Defects caused by the preservation process cannot be corrected even by digital means, or at least if so it would become needlessly expensive. Scratches printed in the preservation element could have been easily eliminated by wet-gate; coarse grains, new frame lines invading the picture area, and so forth, could also have been avoided. The currently flourishing digital restoration technology is greatly enhancing the opportunity to start new restorations of film classics from scratch.

Under such circumstances it is now all the more important to keep nitrate as long as possible. Filmarchiv Austria never destroys any nitrate films; on the contrary, it built a new nitrate

vault in 2010 to actively collect them, not just from private collectors, but also from public film archives within the FIAF community.

The nitrate holdings at Filmarchiv Austria amount to approximately 30,000 reels (6 million metres). Among them there are quite a few Austrian or Austrian-related silent films, even predating the fall of the Austrian Empire in 1918, which Filmarchiv Austria collects with the highest priority. Even so, some original negatives of this kind are still waiting to be preserved. And the budget for preservation is never sufficient. With our new vision to develop into a nitrate archive, we increasingly need to preserve original nitrate material. For me, as a Japanese archivist, it is deeply astonishing that there are still so many precious originals in the archive still unpreserved, whereas in Japan any little piece of nitrate that has survived until today would be precious enough to be worked on immediately.

1 As a Substitute for Optical Printing

Even after the acquisition of the digital facility, we prefer staying on the analogue-photochemical side, as long as the state of the original element allows contact printing. We are working in collaboration with a local laboratory in Vienna, Synchro Film, and are satisfied with the picture quality produced by their continuous contact printing. As long as this solution works well, we actually see no need to go digital. In other words, for digital restoration we prefer to give priority first of all to those sources which otherwise would require optical printing. For us, the question of which method we should select for preservation, analogue or digital, is not determined by the budget scale, nor by the significance of the title, but first of all by the condition of the original element itself.

Around 1925, the way of producing projection prints changed considerably. Until then, most of the prints were developed by hand, using wooden racks and frames, and tinting was applied to each print in a variety of colours. There was no need to edit the negative into a single completed form. Instead, the negative was divided into segments according to the colour of their tinting, and prints made from each part of the negative were edited into a complete print after tinting. Therefore, splices were absolutely inevitable whenever the colour changed.

After 1925, the automatic developing machine came into use, and it changed the whole procedure of post-production. To suit automatic developing, negatives were edited before printing; thus, in principle, show prints would not need splices. Tinting was not yet abandoned, but colour variation was reduced to a single colour or two, mostly amber, and blue for night

sequences. This was one of the biggest transitions that the motion picture experienced in its history: at this point film prints became industrial products, whereas previously they could be considered handcrafted artefacts.

Prints dating from before 1925 generally had many splices from the original release, which caused many of the resulting problems, like tears and broken perforations. As contact printing has certain technical limitations caused by the condition of the prints, unfortunately sometimes one has to give up and, if working in the analogue domain, apply optical printing. We are generally not very happy with the results from optical printing, because as a rule the contrast of the preservation element becomes higher than the source and thus loses certain details. In these cases, to preserve the original picture quality in the best way, digital methods can be a better solution than optical printing.

As a matter of course, if a print from after 1925 shows heavy shrinkage or damage, we also apply digital methods. If the source material is 16mm, it has to be blown up onto 35mm; if analogue, one inevitably needs to use optical printing. For that reason, in principle we prefer to work on 16mm preservation only digitally.

2 To Facilitate Reconstruction Work

If a reconstruction is required using several sources that survive for a single film, it generally makes sense to do it digitally. If analogue, in principle one cannot simply cut the original sources to integrate them into a reconstructed version; instead, one has to duplicate all the source elements and then start editing (although direct cutting of source elements has in fact been practised within archives, and not rarely). Besides, if there are both negatives and positives among the available sources, one has to duplicate some of them more than once, in order to have everything either as negative or as positive. If digitally, one can start directly from the sources without cutting them, and it does not matter if the source is negative or positive; thus one can easily avoid adding some generations.

If reconstruction work has to be done not just by sequence, but frame by frame – if jump cuts have to be compensated for by other sources, for example – digital methods have a great advantage. When I worked on some of the analogue reconstruction projects of Filmarchiv Austria, for example, DER ROSENKAVALIER (1925), DER SONNWENDHOF (1918), and DAS LEBEN DES BEETHOVEN (1927), I often hesitated to make a cut when just a few frames were missing. It is possible to tell precisely how many frames are missing, and which frames

should be brought in from another source, but on the other hand, if a cut is made, newly created splices would also cause a certain ›gap‹ in the picture: difference in density, contrast, picture position in the frame, and so on. Therefore, it is always a difficult decision if a jump should be filled or ignored. If digital, even one single frame can be integrated without problems. Frame by frame reconstruction is possible only by digital means.

If we start from an original negative which is not edited, or if intertitles are available just as flash titles, a relatively complicated editing project may also require a digital workflow.

3 To Reproduce Applied Colours from the Silent Era

As our source elements are mostly from the silent era, most of them are coloured. As most film archivists have regularly experienced, photochemical solutions for the reproduction of applied colour are not quite satisfying. If a tinted print is duplicated on internegative, for example, black and white images and colour information are mixed together; black does not stay black, and tinting looks like toning. It is also quite often the case that an internegative cannot reproduce the incredible brilliance of stencil colour; the colours get pale and start dissolving into the picture.

The so-called Desmet method, making a colour print out of a b/w negative, gives good results in reproducing tinting, if it is carefully done. This method is even capable of dealing with double toning, a combination of tinting and toning, but because of the double flashing (one for tinting, the other for toning), the picture quality is inevitably inferior.

If one follows a digital workflow, it affords wider choices to reproduce various kinds of colours appropriately:

a) Picture and Colour Separated

Scans are used as b/w information (1 channel), even if the scanning work itself has been done in colour (3 channels). To digitally grab the original picture information optimally, it theoretically is best to subtract colour information during scanning, obtain picture information as close as possible to b/w, and bring back the colour information afterwards. If tinting is too dense, however, as in typical Pathé Frères intertitles, which are very densely tinted in red, it is not possible to subtract the base colour with the *Arriscan*; in these cases one has to work fully with colour.

To add colour to b/w images, there are some options which are derived from both the digital and analogue fields:

- Add colour digitally, and record the final data on colour negative.
- Record on b/w negative, and print in colour with the Desmet method.
- Record on b/w negative, print in b/w, and tint chemically with dye. This process is commercially available, as far as I know, at IMAGICA West in Osaka, Japan, and Synchro Film in Vienna, Austria.

b) Picture and Colour Combined

If more than two colours are applied, as with hand-colouring or stencil colour, there is actually no other way than doing the whole process in colour, but with digital scans one can see the various colours defined more clearly, and one can even enhance each colour individually. If colour decomposition forms certain characteristics, generating another colour than the original, we prefer keeping them as they are to newly adding monotone colour.

When I was still in Japan, I ordered scanning work solely from Haghefilm in Amsterdam, simply because they already had considerable expertise in scanning problematic sources. Since these projects received quite a lot of public attention, some domestic Japanese laboratories were motivated to equip themselves to deal with such problematic source elements. In the end, however, they regarded this effort as so inefficient and risky that they decided to stay on the safer side: to duplicate once analogue, and then scan. For me it was very regrettable that this complex bridging between archival sources and digital technology did not come into practice. And now, I'm the one who has to build the bridge.

The aim of digital restoration at our institution is to preserve the original quality as precisely as possible. For that purpose, scanning should definitely start from the sources that come closest to the original, in order to make the best use of the original information. In this way, accidents do happen, and one cannot guarantee 100% the safety of the source. Such a challenging attitude is a sort of privilege for archival restoration done in-house, as with us, because we are not only the operator, but are at the same time responsible for the source material. If I were working in a commercial laboratory, I probably would not dare to put our fragile nitrate onto the scanner either. Our sources are sometimes extremely brittle, or the perforations are much smaller than normal ones; in fact, I sometimes have to give up scanning when the wet-gate simply does not let them run through. We are indeed testing the limits of this digital equipment, from the analogue perspective.

In order to avoid damaging precious source material during scanning, we take several preparatory steps. The source is first inspected carefully using a KEM viewing table, and a
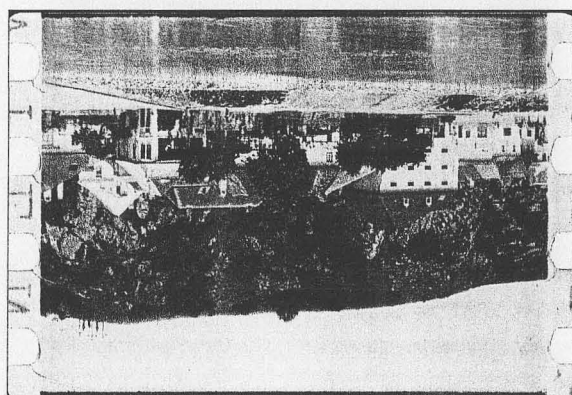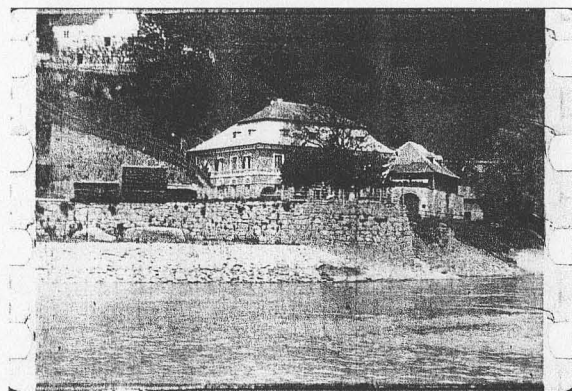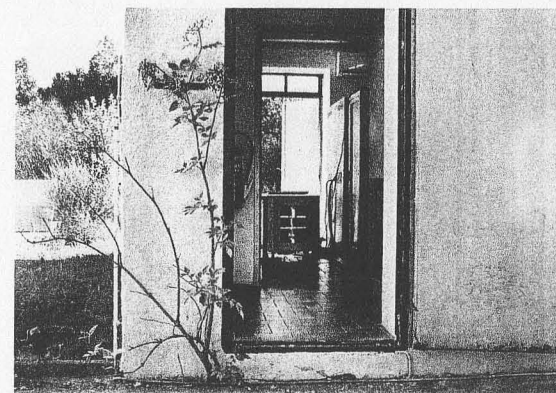
EINE FAHRT DURCH DIE WACHAU (1912)
Top: Double toning – a combination of
tinting in pink and iron toning in blue,
with decomposition
Bottom: Upside-down scanning

Laxenburg:
Scanning room with ›optimal‹ ventilation

Getting Along with Wet-Gate

As the wet-gate consists of a pair of glass plates, dust control is a very critical point for users. It is advisable to completely separate the scanning room and the monitoring room, since the liquid in the wet-gate is categorised as dangerous and should not be absorbed into the human body. Furthermore, one is advised to keep the air pressure of the scanning room higher than outside to keep dust from entering. However, as the liquid has a considerable odor, and one has to enter the scanning room quite often to get rid of the bubbles which appear at splices and tape repairs, and to adjust the liquid value, and so on, in reality we have to keep two doors of the scanning room constantly open.

For wet-gate printing, perchloroethylene and then trichloroethylene were for decades widely in use. Because of their toxicity to the environment as well as to the human body, they have now been replaced with a new sort of liquid especially developed for wet-gate, called Kodika. Perchloroethylene, which has been used on a great scale by laundry services, is highly volatile and had the supplementary effect of cleaning the films during printing. On the contrary, Kodika evaporates so slowly that after scanning the film stays wet and needs to be cleaned, in order to avoid negative effects deriving from this chemical on long-term conservation.

During the machine calibration, *Arriscan* detects dust and dirt on the glass plates and creates a sort of digital filter to subtract them from the scanned images. It is a useful function, since one can never control dust and dirt perfectly, but it has a characteristic side effect. Even if

sequence list with frame numbers is prepared, so that each sequence can be calibrated according to its characteristics. If the film is brittle, we leave it in a box filled with ethanol and camphor for several days, so that it softens and will run through the gate smoothly. Any damage has to be repaired with tape, but the wet-gate does not let a film strip go through when it is too thick, so tape repair should be minimal. If just the upper side of a perforation is damaged, as is often the case with old prints due to physical stress during projection, we simply thread the film from the end and scan it in reverse. Of course, this adds extra work, necessitating the correction of the frame numbers and so on, but the effect is tremendous, and definitely worthwhile.
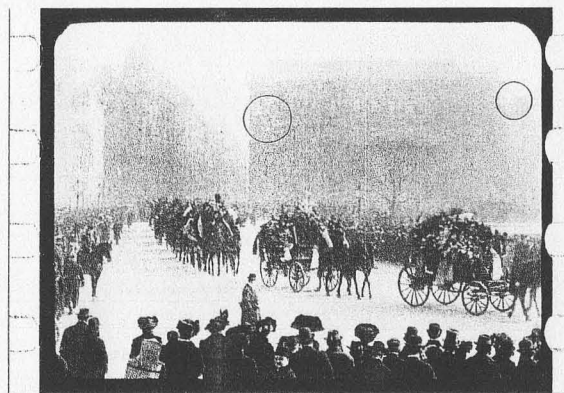
LEICHENBEGÄNGNIS ALBERT BARON ROTHSCHILD (1911): ›Digital ghosts‹

dust detected by the machine should fly away afterwards, the filter keeps on subtracting it; one then finds the negative image of the dust in all the scanned pictures. As this dust-image is in white – if the source material is a positive print – and stays in the same position in every frame, one can easily overlook it during scanning. I have often been haunted by these ›digital ghosts‹ after completing a big job.

Despite all these difficulties, however, we are quite content with the effects of wet-gate, and we regard all the extra efforts as worthwhile.

Advantages of Digital Scanning Over Analogue Printing

a) Real-time Monitoring and Frame-by-Frame Correction

If an accident occurs during scanning – if for example, a perforation slips out, the frame-line comes out of the gate, the focus goes wrong, bubbles come into the wet-gate, and so on – one can detect it in real time and correct the problematic frames one by one. With analogue printing, minor defects of this kind have been accepted or overlooked, since any correction would mean new splices or redoing the whole reel. Relying on digital methods, one can much more easily be a perfectionist without too much extra work and cost.

b) Sequence-by-Sequence Calibration

This is for me the most valuable feature of scanning with the *Arriscan*. Before starting a job, one previews a key frame of the sequence and controls the distribution of dynamic range visually as a histogram, and adjusts it to the most appropriate position and range. In the photo-

chemical process this corresponds to negative grading, which has to be done in the laboratory, quite out of reach of archivists. It is therefore a great advantage for us to be able to handle this ourselves, digitally. Once the original picture information is lost, one can never recover it afterwards. If one scans a negative which is relatively new, or whose density and contrast are well controlled, it is probably not necessary to do sequence-by-sequence calibration, but most of the time our sources do indeed display an extremely ›dynamic‹ range of latitude.

The images overleaf show a frame from a 1912 film, EINE FAHRT DURCH DIE WACHAU. As it is an exterior shot, extreme highlights and shadows coexist in a single frame; under default settings, the shadows are obviously gone [1]. Since the dynamic range of this image is far too wide for the capacity of the scanner, one needs to compress it, but then the quality of the picture gets inferior [2]. To save the shadows without losing highlights, and also without losing too much picture quality, one has to find the best balance [3]. If calibration is appropriately set, one doesn't have to work too much for grading afterwards. Sequence-by-sequence calibration requires a lot of work, but all in all it simplifies the whole workflow and reduces the chances of digital defects.

Necessity for Historical Research

During work on the original negative of VOM TABAKBLATT ZUR VIRGINIER, a film from 1927, we encountered quite a serious problem. The scans got so grainy and full of digital noise that we could not even stabilise the pictures with *Diamant*. We tried some denoise and degrain tools, but we could not ignore the obvious side effects of these digital solutions. As a rule, it seems that the more we fiddle about with digital data to get rid of defects, the more defects ultimately arise. We tried scanning it again, with no fewer than 17 patterns of settings all in all – of diverse resolution (4K, 3K, 2K, down-converted from 6K to 4K, 3K to 2K) and bit depth (10-bit logarithmic, 16-bit linear), with ready-made settings (so-called Look Up Table) and without, wet and dry, and so on. Nothing worked. There was no improvement in the defect beyond our first attempt.

To our eyes, which are used to modern negatives, this original negative is extremely dense, like a print, and a densitometer indeed tells us that it has a density reading of no less than 2.2. Referring to a 1930 article from *Die Kinotechnik*, a German magazine for cinema professionals, which describes the historical transition of negative density, it is clear that the characteristic curve of an original negative was generally much higher in the 1920s than nowadays. A density
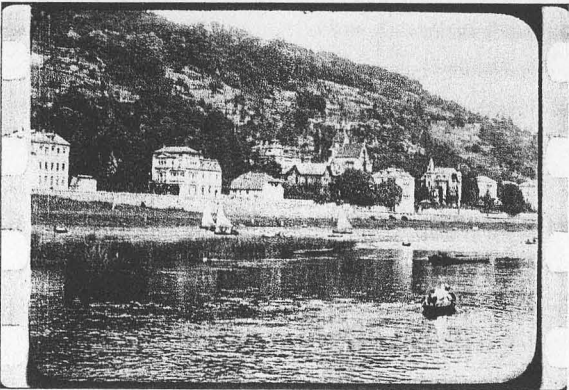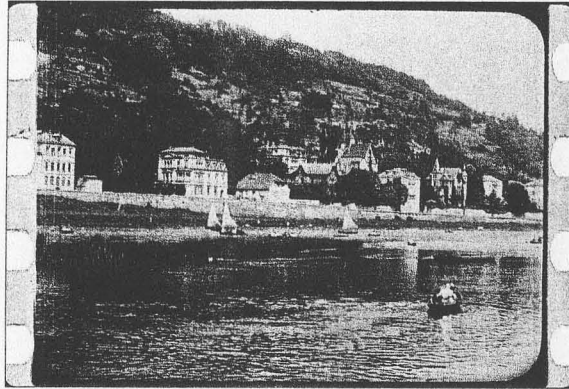
EINE FAHRT DURCH DIE WACHAU (1912)
[1] Image scanned under default settings
[2] Brightened image after compression and relocation
[3] Optimised image
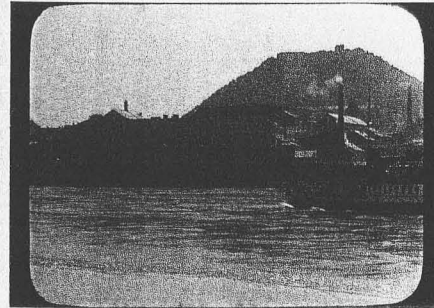
VOM TABAKBLATT ZUR VIRGINIER (1927) Dark noise in the white area due to high density of the original negative

»Die Entwicklung des kinematographischen Rohfilms« Prof. Dr. John Eggert, in *Die Kinotechnik* (5th April 1930), 186

of 2.2 is relatively high, even compared to the standard for 1927, although not extraordinary for that time. With digital image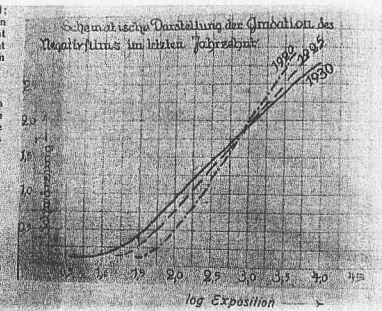s, it seems that dark noise is something one cannot yet fully avoid. If your source is a projection print, a density of 2.2 can be common, but since dark noise stays in the dark area of the final result, our eyes are not so much disturbed. Our problem with this source was that we had a negative with this high density and we got the grainy noise in the white part of the final result. From our research we had to conclude, to our regret, that this material does not suit digital restoration at this time, so we simply made a fine grain master positive. The result was terrific. Currently, for analogue printing this density poses no problem.

What we learned from this experience is that one has to make a careful choice of what to restore digitally. Digital technology is still in the process of development, and there is still much room for improvement. In fact, just a few months after this case, our *Diamant* software was updated, and stabilisation did work in spite of these grains. In contrast, photochemical technology is so mature that we are quite aware of its capacity, as well as its limitations. For us it is important to compare digital and analogue means on an equal level and to find the most appropriate method of restoration for each individual source. Although it may sound paradoxical, in order to compare to preservation carried out by optimal contact printing for picture quality, our current solution is ›digital restoration with as little digital interference as possible‹.

Authorised, revised version of an article first published in October 2011 as »From a Wooden Box to Digital Film Restoration« in the Journal of Film Preservation *(84): 63-72.*

Stretching the Borders. Preserving the Installations of Marijke van Warmerdam

Introduction

It is always a strange and exciting encounter when a restorer is confronted with the premiere of the final preservation work. Usually this involves a public screening of a restored film. In this case, however, it involved the opening of the exhibition at the Museum Boijmans van Beuningen in Rotterdam dedicated to the Dutch visual artist Marijke van Warmerdam. For the exhibition, which opened in October 2011, the EYE Film Institute digitally transferred and restored several of the artist's film loops. For many, this would be the first time that most of her films would be experienced differently: projected by beamers instead of the 16mm and 35mm modified loop projectors for which she became internationally known. As for myself, I had never seen her work exhibited before the camera negatives entered our archive, but this did not prevent me from wondering how the perception of her work would change after migrating it from one format to another, very different one.

The state of anxiety felt upon entering the exhibition space betrayed a concern, no doubt shared by the artist herself, stemming from having spent months working towards a common goal: to ensure that the visual quality of the exhibited images met the high standards we had set for ourselves. Yet we had different perspectives. For the archive, one of the concerns of this major project was whether her work would change in nature when translated from its original, analogue form to digital, and how we could make sure to do justice to the essence of the work in so doing. For the artist, meanwhile, the main concern had less to do with authenticity and more with guaranteeing that the work would retain its aesthetic impact on
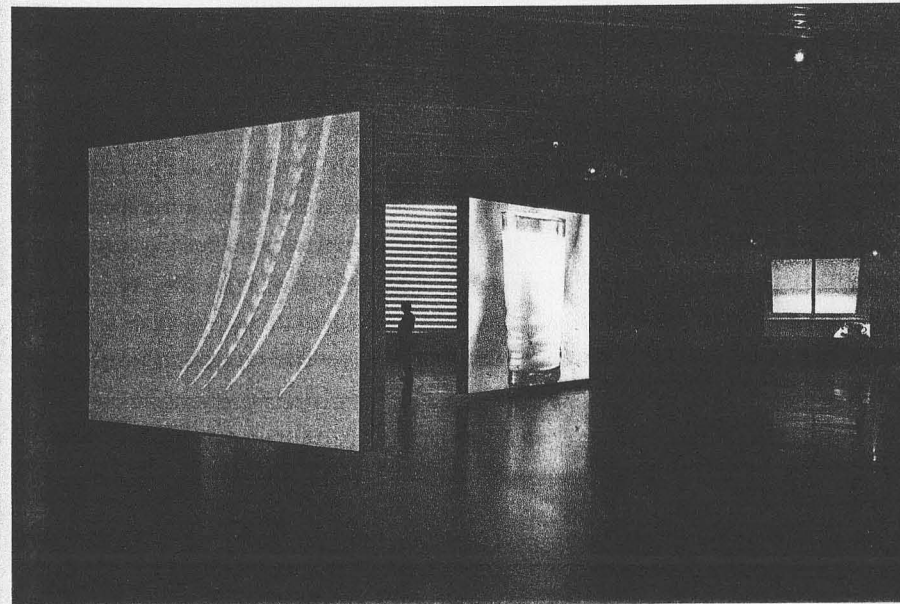
Marijke van Warmerdam – Close by in the distance Exhibition curated by Jan Debbaut, Museum Boijmans van Beuningen Photo: Lotte Stekelenburg. The image is reproduced with the kind permission of Marijke van Warmerdam.

the audience within the new medium. The exhibition became the space where these different approaches converged and where the visual perception of the work could be experienced and judged.

Only through state-of-the-art projection does the restored work come to life. Until recently in the analogue world, you could still rely on a certain quality standard when using good projectors, even though some variables always had to be taken into account. But this world is rapidly changing, analogue projection is disappearing from cinemas (and even some archives) and the knowledge required to maintain and operate the equipment is becoming scarce. When you enter the world of digital projection on the other hand, the scenario is far different: standards have yet to be established and there are several, complicated steps between the final restoration and its presentation with the results depending on a variety of factors, not least the exhibitor's budget.

This radically changing landscape is gradually forcing artists like Marijke van Warmerdam, who until last year had still been working within the medium of film, to adopt different strategies. Tacita Dean's FILM, an exhibition shown at the Turbine Hall of the Tate Modern in London from 11th October 2011 to 11th March 2012, is in a way a response to this. The obsolescence of film technology is not only affecting display methods but also duplication practices, and archives that deal with the preservation of artists' films or installation works are at times caught unprepared in what is still a learning process in this transitional period from analogue to digital.

In this paper I will address the subject of perceptual change when translating an artist's film from the analogue to the digital realm. In doing so, I will focus on one particular case study, which I feel is emblematic of the problems and difficulties encountered when dealing with a body of work that has very specific visual characteristics and thus defies standard archival practice: Marijke van Warmerdam's film loop HANDSTAND (1992).

Lost in Translation

»Film is not translatable. Lossless conversion is a fallacy. Conversion entails translation and modification – a facsimile or imitation. The reading may confuse the conversion for something else, for something else is the certain result of the conversion.«[1]

In which way does the translation from analogue to digital influence the aesthetic perception of film and installation artwork? What do you lose or gain when translating an analogue-born artefact into a digital one? How does this translation influence the essence of the work, and does this even matter? As audiovisual archives are embracing the digital era at an even faster pace than would be desirable, questions like these become crucial, even though the answers are not always immediately forthcoming. Moreover, they should lead to regular open discussions or evaluations, as the choices made by preservationists dealing with these issues today will influence and determine not only how contemporary and future generations will experience the audiovisual content being provided by these heritage institutions, but also what will be visible in future.

Unfortunately, it is rarely the case that such a discussion arises. A certain blindness to criticism or even doubts in favour of pragmatism rules this ›transitional‹ field and the only voices of resistance seem to be coming from a small but determined group of artists, rather than archivists. There are exceptions, however. Michael Friend clearly points out where our responsibilities lie in the accompanying publication to Tacita Dean's FILM exhibition: »For the archivists, there is a looming curatorial issue concerning the extent to which the physical values, the original aesthetic, of celluloid-based moving images can accurately be captured and rendered – back to film and on digital screens. We will have to improve our methods of capturing and displaying historical film images, we will have to define what we consider acceptable, authentic or false.«[2]

When speaking about the concept of capturing and translating analogue images in the digital world, I am referring only to High Definition scanning or projection techniques. Anything below HD resolution (1920x1080 pixels) should be considered inappropriate by an archive when its goal is to display the images at a sufficient quality in a cinema or museum space. But this option poses some problems. High quality digital projectors are still very expensive, and thus off limits to a lot of institutions. Even the biggest modern art museums would not be able to afford the highest quality digital projectors for a large-scale exhibition. Compromises, therefore, have to be made, which in turn affect the quality of the images to a certain extent. Most of the current projectors are meanwhile better equipped to serve modern, digital-born media art than archival images with different aspect ratios and speeds. A certain specialist care and understanding is therefore necessary when testing the machines, as different parameters might be needed, calling for a better collaboration between archives, art museums, artists and technical suppliers.

But it is not just the quality of images that are at stake here. Another problem related to the translation of images in the digital era is the medium specificity of most experimental and artists' films, and the ethical issues related to the change of format. Some experimental filmmakers and artists take this medium awareness to the extreme, using celluloid as a canvas for their artistic expression. Yet these extremes push the very limits of restoration practices. In restoring the films, a custom approach is often required, resulting at times in conflicting practices within the same institution or in principles being bent according to necessity. This does not have to be considered strictly a bad thing if it opens up possibilities and begs reflection.

Interest in the medium, research and experimentation within the medium, and awareness of using the medium in a specific way to achieve an aesthetic result are just some of the attributes that characterise experimental or artists' films. In a way, they also determine their fragility, for the perception of these films might, in fact, radically change when made digital.

There might come a day when the quality of digital images will not be any different from their analogue counterparts, but the conceptual link between the content of the image and its medium of expression will be lost, together perhaps with the historical ›look‹ of those images. When translating to digital, the boundaries of intervention and simulation become vague, while the possibilities become infinite, making the decision process during preservation an arduous one. Moreover, there is a world of difference between films produced for the cinema and films created for an installation or exhibition. For a few years now, EYE Film Institute has become increasingly aware of the potential value for our collection of works produced by visual artists as installations in gallery spaces. This interest has led us to approach a selected group of artists and museums for collaborative preservation projects, but has also exposed our limits, as installation work often comes with some very specific issues that do not fit with standard practices. For instance, an installation work can often come with several components in different formats thus requiring a different approach to that with which we are more familiar when dealing with cataloguing, preservation and presentation. Another art-critical issue is the ›limited edition‹ status of some of these works. Artists that sell their work in a limited edition to modern art museums deal with a different economic system than the archives are used to and communication between these two worlds, whilst not impossible, has not always proven to be easy.

Marijke van Warmerdam

Marijke van Warmerdam is an important Dutch visual artist, best known for her 16mm and 35mm film loops. Since the early 1990s, her film loops have been presented in semi-obscured spaces within galleries or museums using purpose-built EIKI projectors with xenon light lamps for optimal image quality. Her films are not meant to be screened in the cinema. Her background is in sculpture, but she turned to film as a way of maintaining through movement the sculptural element of her work and its relationship with the space. Apart from the position of the images within the space, the size of the projected images also plays a key role in the creation of the desired sculptural effect. Some of her work is meant to be projected in life-size, starting from the ground, in order to impart a feeling of reality to the spectators.[3] Her film projection methods have always stressed this sculptural aspect by placing the loop projector prominently within the space, allowing the audience to interact with both the projector as well as the projected image. In so doing, she has proved influential in turning film loop projection into an autonomous form of artistic expression. »Her screenings – film loops requiring complex projector set-ups – are a far cry from conventional projections in darkened spaces, for her films are shown on screens and walls in bright exhibition rooms or public spaces where the viewer can move around freely and enjoy an unconstrained, flexible response to the play of images.«[4]

Marijke van Warmerdam has always been very specific about the look of her films and has put the visual quality of the image at the forefront of her working method. She chose to shoot her work on 16mm and, more recently, 35mm film because of its high photographic qualities, working with professionals from the field and putting extreme care in the choice of colour grading, camera work, editing and special effects. Her interest in the visual quality of her work does not stop at the pre- and post-production levels. The presentation of her work is every bit as important as its making. When a museum purchases one of her artworks for its collections, she provides the curators with detailed instructions on how to display it properly. On a different level, she has also developed a quite unique awareness, amongst artists and filmmakers, of the necessity to care for the medium film in its own terms. Since the beginning, Marijke van Warmerdam has protected her original camera negatives by depositing them in the acclimatised vaults of the film laboratory, producing preservation elements and master negatives to avoid the risk of damaging the precious camera originals during the process of striking prints for exhibitions. Logistically the laboratory was the perfect housing place for her films, as she was able to produce new prints on demand at the galleries' request. The need to deposit her films in an archive was not felt. Thus, when we first approached her in 2007, our offer to assume responsibility for the safeguarding of her films was politely refused. Back then, we could not provide large-scale digital preservation and film laboratories were not yet closing down.

This situation changed within a couple of years, initiated by the retrospective being planned by the Museum Boijmans van Beuningen, where no less than twenty of her film loops were going to be exhibited posing the immediate problem of just how to exhibit them. Finding several 16mm and 35mm modified loop projectors was almost immediately discarded as an impossible task. The moment had come for Marijke van Warmerdam to consider a radical change of strategy. The seeds of this new approach towards digital display technologies had already been sown in 2010, however, when she presented HANDSTAND, her first film loop made in 1992, digitally at Huis Marseille in Amsterdam.

HANDSTAND and the Obsolescence of Technology

Made in 1992, HANDSTAND consists of two different shots of a young woman performing a handstand against a white wall. These two shots are then looped to become what looks like a continuous movement where beginning and end disappear. This film loop was one of her first works and was shot on 16mm Kodak camera negative. Parts of the image are presented in slow motion, the effect of which was achieved using an optical bench to copy the original negative onto intermediate positive, printing every second frame twice. From this intermediate positive an internegative was struck, which served as a printing master for the production of exhibition prints.

Like many artists in this field, Marijke van Warmerdam produces her work in ›editions‹. In the case of HANDSTAND, the film came in five copies, or ›editions‹, which have been sold to modern art museums and galleries together with instructions on how to project them. When they buy the edition, the museums also buy the rights to exchange the exhibition prints at production costs whenever it is needed during the installation or exhibition's run. Running on a continuous loop through the projector, prints are apt to wear out rapidly and it is estimated that they usually need to be replaced once a week.

Since 1992 a lot has changed in analogue film technology. Projecting 16mm loops on Marijke van Warmerdam's preferred modified EIKI projectors with xenon lamps has become quite difficult to organise. Both the equipment and the knowledge necessary to run that equipment are rapidly disappearing. 35mm loop systems are even rarer to find, likewise the right spare parts needed to maintain them. Ruud Molleman, the wizard behind most of the technical modifications made to van Warmerdam's projectors, has recently retired. Although he still participates in the occasional small project, he would not be able to facilitate a large-scale exhibition, which utilises these loop machines over an extended period of time.

With her chosen display technique having now become obsolete, Marijke van Warmerdam was, in a way, forced to consider a different path for the exhibition at the Museum Boijmans van Beuningen. Up until then, she had developed a reputation for being a purist in her approach to her chosen medium. During a series of interviews conducted with the artist in 2003/2004, Mark-Paul Meyer, senior curator of the EYE Film Institute, asked about her view on the future of digital technologies in relation to her work. From a curator's point of view, this was a necessary question as it could help determine preservation and presentation strategies for the future should the work one day enter the Film Institute's collections.[5]

Back then, the photographic quality of the films was still the main reason behind the choice of the medium. In 2003, nobody could have predicted the full effect that digital technology would eventually have on the analogue forms of preservation and presentation. The radical developments in digital technology that have occurred since then, together with the urgent questions posed by the upcoming exhibition at the Museum Boijmans van Beuningen, accelerated the need for Marijke van Warmerdam to adopt a new approach. This created fertile ground for a new collaboration between the artist and the EYE Film Institute. By then, we had developed a suitable digital preservation workflow within the *Images for the Future* preservation and digitisation project, which could guide the transition of her analogue work to digital.

Although the project proved to be challenging, it also helped us to establish a standard workflow, which could then be applied to other Marijke van Warmerdam films, as well as films by other, similar artists. It was clear from the beginning, meanwhile, that our task would not end with the digital restoration of her work and saving the files on hard drives. The significance of the upcoming exhibition meant that we had to preside over the projection techniques as well, ensuring, together with the artist, that the way the work was going to be shown would conform to the standards of quality that we had set at the beginning. This involved the collaboration of several different partners including the Museum Boijmans van Beuningen, the laboratory CINECO (for the digital restoration work) and the company Beam Systems (in charge of the digital projection technique).

Digital Workflow(s)

»With digital film, I'm constantly wondering whether all the data is still well preserved.«[6]

In spring 2011, half a year prior to the opening of the exhibition at the Museum Boijmans van Beuningen, a digital version of HANDSTAND was shown at the Stedelijk Museum in Amsterdam. This gave us a valuable opportunity to test run a possible workflow. CINECO laboratories in Amsterdam collaborated in the technical realisation of the restoration work. Using an *Arriscan*, they first scanned the original camera negative at 2K resolution. The scanned data was then graded and cropped to the film's original image aspect ratio, while the slow motion effect was reconstructed using digital editing techniques. The colour grading was carried out on the Nucoda grading suite under the artist's supervision. Once we had approved the final result, the film was delivered to the Stedelijk in the form of sequential TIFF files. The

Stedelijk took over the project and arranged for the film to be projected in their exhibition space. The files were compressed to a QuickTime movie file, which was then projected using a Panasonic 7700 single-chip beamer. However, when we saw the final result projected on a screen, we were confronted by an unwanted and disturbing presence of grain, perceived as ›noise‹, on the white background wall. This was the starting point of an extensive research project, which only came to an end with the opening of the exhibition at the Museum Boijmans van Beuningen.

To ascertain the root of the problem it was decided to conduct a comparison between the original, analogue projection and the new digital one at the Stedelijk Museum. Meanwhile, different compression codecs were tested to see if any unwanted side effects had occurred when converting the original uncompressed logarithmic DPX files to linear TIFF files, but no problems were found. A 16mm print of HANDSTAND was projected using the original EIKI loop projector and compared to the digital image. From the comparison, we realised that due to its resolution, contrast and grain structure, the original camera negative was probably not best suited for transfer into a high resolution digital format. The master negative used to produce the 16mm print, meanwhile, was already two printing generations removed from the original camera negative. The print therefore showed a more organic and natural presence of grain than its digital counterpart.

The slow motion effect, which magnifies the movement of the grain in certain parts of the image, might have also contributed to the perception of the grain as a disturbing factor in the much sharper, digital version. In a way, a whole new different version had been created by going digital, which at this stage had little in common with the look of the original, analogue version. However, the decision to adopt digital technologies in allowing van Warmerdam's work to be exhibited in the near or distant future was now set. Creating an improved digital workflow to guarantee the highest possible image quality within the available means therefore became our absolute priority.

We started by going right back to the beginning and re-scanning the film at 2K resolution. The decision to scan in 2K was mainly driven by the fact that current HD projectors can project at a higher resolution than before. Even though most exhibition venues could not show films at full 2K yet, they would be able to present films with a 1.33:1 aspect ratio at a resolution of 1600x1200 pixels, when using a beamer with UXGA resolution. This automatically leads to the issue of the file format. We agreed to work with Apple ProRes files in the exhibition as the format can accommodate either a resolution of 1600x1200 pixels or HD 1920x1080 pixels, and can be opened easily in QuickTime player.

Once it was clear that we were going to deliver ProRes files, we asked CINECO to convert the original 2K DPX files to different ProRes variants (422 HQ and 444) and to compare them side-by-side on the Nucoda to assess any eventual loss of information or quality. As no critical loss could be detected, we opted for the slightly lower quality, yet more convenient, ProRes HQ 422 format. This also meant that the file conversion could take place within CINECO's regular workflow using their standard calibration settings, making it easier to control the quality at each step. The final, approved ProRes files were delivered to Beam Systems, who proceeded to test them on several different types of projectors of different price and quality ranges. The projector that showed the highest quality level during our test was, perhaps unsurprisingly, also the most expensive. For an exhibition containing 20 projected films, this was simply not an affordable option. The final choice of a projector ultimately depends upon the available budget – such compromises are a necessary fact when dealing with various conflicting demands, expectations and possibilities. For the exhibition, we settled on using Panasonic PT-DZ570E projectors.

While testing the projectors, we were surprised to be confronted with a different image to that which we had seen back at the lab. It seemed that the calibrations used by CINECO differed from the ones used by Beam Systems and this gave the files a different appearance on playback. To bring back the original, approved look of the file, Beam Systems started re-grading them and changing their gamma. This unfortunately led to visual noise – the same problem that we had encountered in the projection at the Stedelijk Museum. Rather than manipulate the ProRes files, we realised that for optimal results the difference in appearance had to be researched and solved back at the laboratory. Once the problem had been located and solved, we were able to develop a workflow where no extra steps were needed between the creation of the final, approved ProRes files at the laboratory and their projection in the exhibition.

Conclusion

As we were not involved in the final setting up of the beamers at the Museum Boijmans van Beuningen, the exhibition opening was the moment when we were first confronted with our preservation work. Having gone through such a long period of testing, we felt confident that we would not face any surprises. Once we entered the main exhibition room, we found our-

selves surrounded by beautiful hanging screens, upon which the digital versions of Marijke van Warmerdam's film loops were projected back to back. Both the singular arrangement of the screens within the space, and the combination of the films triggered a playful dialogue amongst the films on the one hand, and between the film loops and the audience on the other.

The immediate sensorial reaction was to the silence in the main room. I wondered how it would have been different had the noisy analogue loop projectors been installed instead, even though Marijke van Warmerdam has stated that she does not consider the sound of the analogue projectors to play a crucial role in the experience of her work.

The level to which the sculptural nature of her work changed in the transition from analogue to digital remained a difficult question to answer. From now on, this aspect of her work will be defined by the resolution used, as well as the size of the projection screen, the placement of these screens within the exhibition space and how the audience interacts with them. With HANDSTAND, it was proved that the efforts taken to ensure its visual quality did pay off. The image did not reveal unwanted noise and we could finally enjoy the mesmerising quality of this work anew in life-size projection.

This leads us to the heart of the question: how can the essence of an art work be defined and how does it change when translated from an analogue, three-dimensional work into a digital one? In the case of Marijke van Warmerdam it is possible to say that the quality of the image forms the essence of her work and her working method, with its ›sculptural nature‹ coming second. Selecting a lower resolution scan or display method would, therefore, do a major injustice to her aesthetic and artistic intentions.

Stripped of their analogue machinery, van Warmerdam's film loops have entered a new dimension. While they appear more clean and stable than their analogue counterparts, they still bear the unmistakable ›look‹ of film, thanks to their masterful cinematography and inherent film grain, which was deliberately not eliminated during the transfer process. In a way, the focus of the spectator is now, more than ever, directed solely towards the images and their aesthetic power, and less towards their display context. This, of course, then influences the way the spectator perceives these images.

It cannot be denied, however, that an essential element of her work has now disappeared in its new, digital dimension. The formal strategy of the 16mm and 35mm film loop projection technique has disappeared behind the ›invisible‹ beamer and with it to a certain extent the

materialisation of time. Whether or not this will affect the perception of her work remains to be seen. Surprisingly, this was not a topic of reflection in the exhibition's accompanying catalogue. Hopefully, it will remain a topic of concern for archivists and conservators in this time, when rapid technological change is seriously affecting the preservation and display of museum collections. Keeping the debate about ›best practices‹ alive and sharing experiences, while never forgetting that whatever decision we make, we are responsible for the long-term visibility of the collection for future generations, become in this transitional period a call for action that simply cannot be ignored.

[1] Rhodes, Lis (2011). »Play it Again?« In: Cullinan, Nicholas (ed.) (2011). *FILM Tacita Dean: A book about film and the importance of analogue in the digital age.* London: Tate, 113.

[2] Friend, Michael (2011). [UNTITLED]. In: Cullinan, Nicholas (ed.) (2011). *FILM Tacita Dean: A book about film and the importance of analogue in the digital age.* London: Tate, 73.

[3] Guldemond, Jaap & Mark-Paul Meyer (2012). »Marijke van Warmerdam: ›I should see it‹«. In: Beerkens, Lydia et al. (eds.) (2012). *The Artist Interview. For Conservation and Presentation of Contemporary Art Guidelines and Practice.* Heijningen: JAPSAM Books, 143.

[4] Unterdoerfer, Michaela (2011). »Meaningful nothings«. In: Bloemheuvel, Marente (ed.) (2011). *Marijke van Warmerdam: Close by in the Distance – a catalogue raisonné.* Cologne: Verlag der Buchhandlung Walther König, 11.

[5] Guldemond, Jaap & Mark-Paul Meyer (2012). »Marijke van Warmerdam: ›I should see it‹«. In: Beerkens, Lydia et al. (eds.) (2012). *The Artist Interview. For Conservation and Presentation of Contemporary Art Guidelines and Practice.* Heijningen: JAPSAM Books, 139.

[6] Van Warmerdam, Marijke (2011). »The Thinking Hand and Film as Sculpture«. In: Cullinan, Nicholas (ed.) (2011). *FILM Tacita Dean: A book about film and the importance of analogue in the digital age.* London: Tate, 135.

The Preservation of Home Movies: A Field Report

This article distills some of the expertise gathered over a quarter of a century in the field. It reports on the difficulties of respecting the ethical principles of conservation and restoration from within the specific field of home movies, especially with the ongoing move from analogue to digital. It illustrates the vast area of experimentation by small gauge amateur filmmakers, and how digital techniques today can give us greater opportunities for both preservation and access to this very special heritage.

An Ounce of Ethics

To begin with, a little refresher on ethics could be useful. The following three principles have governed our restoration work for years. At our lab, we believe a restoration can only be considered such if:

• the probability that a work is available in its integrity in the future is increased;
• all the options that existed before taking an action remain open after the action;
• every step is carefully documented.

If, after restoration, the probability of survival decreases, then you are certainly doing something wrong; and if the probability remains the same, you are simply losing your money. We believe that restorers today do not have the right to close off the doors to the next generation. On the contrary, their work has to keep all the possibilities open for future restorers. Even if it is not always possible to do this in practice, it should still remain our ideal goal and we should at least always keep it present in our minds, even if we cannot follow the principle to the letter. We must know when we are doing something ›dangerous‹. And the third point should be the evidence. Every single step must be carefully documented. In documenting the restoration process, the following questions must be answered:

• What is the state of the original element before taking action?
• What kind of intervention is done? And how? And why?
• What is the state of the original element after taking action?
• Which new elements have been produced? And how? And why?

Please keep in mind that if you go through an analogue or a digital restoration process, you end up with more elements to take care of, not less.

Everything has been Explored

The small gauge formats currently still in (albeit limited) existence are: 9.5mm (Pathé Baby), 16mm, various 8mm flavours and Super 8.

The image is often reversal but can also be negative-positive. Sometimes the majority of a reel has been shot in black and white with some key scenes shot in colour. Many colour systems are to be found in home movies: the spectacular Kodachrome, the natural colours produced by the fascinating lenticular systems like Kodacolor and Agfacolor, or the technically tricky to achieve Dufaycolor.

The possibilities to add sound to the image are vast: from a music cassette player started more or less simultaneously with the projector, to a fully mixed magnetic or optical soundtrack (commag or comopt), or the synchronous separate magnetic reels used by television (sepmag). And, of course, both mono and stereo formats have been extensively used.

Typical issues inherent to small gauge amateur films include flicker, blurriness, instability, creatively adventurous splicing techniques, over- and underexposed shots, non-standard projection speed – and, of course, all kinds of scratches. Many of these issues are frequently to be encountered all at once on a single reel of film.

Analogue and Digital Workflows

There are several possible workflows for the restoration of 9.5mm films. To date, we have explored the following in our lab:

- Analogue blow-up to 16mm
- Analogue blow-up to 35mm
- Digital blow-up to 16mm
- Digital blow-up to 35mm
- Digitisation in HD quality

There are other possible workflows, which we have not yet attempted, including:

- Analogue reduction onto Super 8
- Digitisation in SD quality
- Digitisation in 2K (or higher) quality

Currently, we are exploring the exciting possibility of recording digitised images onto 9.5mm film. In reality, this experimental project will entail the recording of the images onto 16mm stock, which will then be cut to the 9.5mm format.

But in the Meantime ...

I strongly suggest we continue to follow the best practices which archivists have been following in the analogue world for decades. Please continue to take care of the ›original‹ film elements. I am convinced that in the future we or our successors will be a lot happier if we still have the option to go back to those ›original‹ film elements. For this reason, ›original‹ film elements should be kept for as long as possible, even in the ›digital era‹ (and, I guess, also the post-digital era).

Every archivist should be effective. In the end, only one cost-efficient solution exists in the real world:

- Keep the ›originals‹.
- Take more preventive actions on ›originals‹
  (improve storage conditions by improving insulation, air conditioning and packaging).
- Less handling of the ›original‹.
- Create digital copies for easy access.

›› Matteo Lepore, Raoul Schmidt

Nine Point Five. A Rediscovery

The Austrian Film Museum is not, strictly speaking, a ›National‹ or ›Regional‹ Film Archive, entrusted with the mandate to collect and safeguard solely national or local film production. More akin to an art museum, the Film Museum has been relatively free in its choice of what to acquire and why. As such, the collections preserved within its vaults located in Vienna's 19th district constitute a broad and fascinating crossover of national and *super-national* (international) film heritage.

Since its foundation in 1964, the Film Museum has adhered to a very precise and well defined curatorial orientation in its collection and preservation activities, namely: »[the] representative portrayal of the medium [film], [...] through outstanding examples of all its variants«.[1]

Its collection therefore ranges from vintage 35mm nitrate prints of early hand- or stencil-coloured films such as those by Segundo de Chomón, right the way through to Stan Brakhage's experimental 8mm films; from the masterpieces of the great Soviet directors such as Eisenstein, Dovženko and Vertov, to deposits and donations entrusted to the Film Museum by artists and filmmakers still active today.

In recent years, the Film Museum has increasingly turned its attention to orphan and amateur films. This new focus has manifested itself in several large-scale projects involving the acquisition, cataloguing and digitisation of small gauge films that were (or are now) part of the Film Museum's collection. The amateur film collection currently consists of around 8,000 individual elements, including ›home movies‹ or home-made films, as well as reduction prints of commercial films for home viewing in 8mm, Super 8, 16mm and 9.5mm formats.

The 9.5mm films in particular offer material of incredible historical relevance, ranging from eye-opening images that document the annexation of Austria by Hitler's regime in the 1930s, to simple visual records of family vacations in the 1960s and '70s. Almost all of the films are unique items existing only as single prints. Their high value therefore demands a great sense of responsibility from the Film Museum in its commitment to their ongoing preservation. Unfortunately, the 9.5mm format has now become obsolete and printing of new copies by analogue means is only possible in a few, highly specialised laboratories.

At the same time, the Film Museum faces a great challenge in deciding how best to simulate and/or clarify the original viewing context of these films, especially when the films themselves are in such a precarious condition that they can no longer be screened using a conventional 9.5mm film projector. Every archivist is familiar with the fact that the films should first be preserved before they can be safely screened, and the films belonging to the Film Museum's amateur film collection are no exception.

An Archival Dilemma

For the routine preservation of small gauge films with such a high degree of obsolescence, film archives are effectively faced with two options: digitising the original film elements in a variety of different standards and resolutions, or blowing them up to 16 or 35mm film photochemically in one of a few specialised laboratories, such as Synchro Film in Vienna, which is equipped with optical wet-gate printers for this purpose.[2]

From a long-term perspective, however, neither of these solutions can be considered entirely adequate. On the one hand, digital preservation alone is not sufficient. As has already been determined by several major investigations, digital preservation requires the frequent migration of data, which in turn necessitates a constant and considerable financial investment far outstretching the budgets normally afforded film archives.[3] Moreover, the obsolescence of digital standards and platforms is so rapid that one cannot even begin to calculate the total long-term investment in terms of hardware/software upgrades and personnel. However, there is no doubt that this is the direction in which technology is currently heading.

16mm analogue film, meanwhile, offers a format which is most similar to 9.5mm in terms of image dimension, portability and functionality. Moreover, preservation on film offers a less problematic scenario, as it is far less expensive and logistically much safer – under optimal storage conditions, a film print can last for several hundreds of years. However, the nature of cinema is rapidly changing and the film industry is adopting new technologies: film is fast being overtaken by Digital or ›D-Cinema‹. 16mm is today virtually an obsolete format itself: film laboratories are systematically phasing out the printing and processing of 16mm films, while film stock manufacturers threaten to cease the production of 16mm raw stock. As a result, the costs of analogue preservation on 16mm are ever increasing and the possibility of actively preserving entire collections of 9.5mm films ›on film‹ appears less feasible.

In addition to losing its market, the obsolete 9.5mm gauge has also lost its ideal screening environment, namely private homes, in the presence of the families and friends of each individual filmmaker. This aspect of the amateur film heritage is not restorable, pertaining as it does to the sphere of individual experience and the emotional connection to the film content. A key question concerning these films is therefore how best to reflect the way private content was conceived, realised and shown in the past century. If, on the one hand, the content is digitised, it could be easily distributed via platforms like the internet or TV-on-demand. Ethical and legal problems could emerge from such an approach, however. The way the content is received by a wide, ›massified‹ audience on the web risks overlooking the historical and contextual specificities of the films concerned. The need to show these films in the cinema's ›black box‹ corresponds to the need to discuss their content and the technical history of the medium that generated that content.

In contrast to commercial cinema and a significant fraction of experimental cinema, it is no longer possible to re-create the exact same historical viewing experience of amateur films in their natural form of ›home screenings‹. Nonetheless, it is at least possible to open up the discussion around them and to propose increased access to the films by opening the original film collections to the public or curating programmes at specialist film festivals and similar initiatives. The opportunity to see how the original was created should be endorsed with the active involvement of the filmmakers and/or their families where possible. In the case of ›orphan‹ films, where the identities of the authors are unknown, screening the films could meanwhile prove an invaluable aid in locating and identifying their rights holders.

The Approach of the Austrian Film Museum

In addition to its regular preservation and presentation activities, the Austrian Film Museum has been a partner – together with the Austrian Film Gallery, Krems, and Filmarchiv Austria – in a pioneering project to develop and operate working laboratory facilities for the digital

restoration of archival films. With a rare opportunity to use top-grade software and hardware on a regular basis, the Film Museum decided to devote some of its energies to the ambitious experiment of restoring a selection of digitised 9.5mm films and reprinting them on 35mm. Its aim was to lay the foundation of a future standard procedure for the restoration of films on small and obsolete gauges that could be implemented by other film heritage institutions as well. The candidates to be restored and preserved on 35mm are selected following an analysis of their historical and archival representative value in line with the Film Museum's restoration policy.[4]

As the Film Museum has no possibility to digitise 9.5mm films at its own facilities, this task had to be outsourced – in this case to La Camera Ottica, the University of Udine's film and video laboratory in Gorizia, Italy. Together with Home Movies – Archivio Nazionale del Film di Famiglia (the National Home Movie Archive) in Bologna, the lab developed a custom scanner capable of digitising 9.5mm films in up to 2K (2048x1556 pixels) resolution. Before the films are sent to the laboratory for digitisation, they are carefully inspected and, where necessary, repaired. The archive staff analyses each film print, measuring its length and determining its physical condition. In some cases, the archivist will need to add new start and end leaders and repair damaged splices, taking great care to ensure that no frame is lost in the process. The 2K, 10-bit logarithmic scans are delivered as sequential images files in Digital Picture Exchange (DPX) format, which are subsequently imported into the *Diamant* film restoration software for deflickering, stabilising and cleaning.

The use of digital image restoration software on films like these must be carefully monitored, as the use of ›radical‹ tools for deflickering and degraining introduces the risk of ›overdoing‹ the restoration work. The use of these tools has been proven necessary, since the inherent defects of the 9.5mm original will be significantly magnified when presented on the ›big screen‹ intended primarily for 35mm projection. This has the negative side-effect of distracting the audience, preventing them from focussing on the content of the film. When applying restoration tools, however, it is necessary to establish precise limits. These limits are determined by the restorer based both on his or her understanding of the historical material and own aesthetic judgment. The result is therefore a compromise between the original and the possibilities offered by modern restoration technology.

Before the restored digital images are recorded out to film, they are first graded to ensure the end result will achieve a ›look‹ similar to the original. The *Scratch* software developed and marketed by Assimilate Inc. in the US is used for this purpose. Like most of the tools employed in digital restoration, it was developed essentially for use in contemporary film and television post-production and must therefore be adapted to the restorer's purpose. In the final step of the process, the graded data (the so-called ›digital intermediate‹) is recorded onto 35mm intermediate negative film stock using an *Arrilaser* film recorder.

All data produced during each step of the digital intermediate process are committed to LTO magnetic tape for long-term storage. Backups of the *Diamant* and *Scratch* sessions are also preserved together with all valuable metadata, serving to document the technical proceedings of the restoration. At the end of each restoration, exhaustive reports are compiled, which are retained for internal reference with an aim to eventually publishing them (in abridged form) on the Film Museum's website. From the graded, restored DPX image files, a digital video file, encoded in Apple ProRes 422 HQ format at full 2K resolution, is also produced. These files, which are considerably smaller than the DPX sequences but still of extremely high quality, are then retained on a local NAS-server as a more convenient form of access for researchers, artists, filmmakers and other Film Museum collaborators.

Case Studies and Conclusions

By the end of 2011, the Film Museum had restored only two ›pilot‹ films, FAMILIENGRUP-PENBILD and ERÖFFNUNG DER PACKSTRASSE. Both films originate from the mid-1930s and their total duration (at the appropriate projection speed of approximately 16 frames per second) is less than six minutes. However, the Film Museum's aim with these two restorations was to establish a standard method for the digital restoration of 9.5mm films, which could be applied to all future restorations. With that, the total number of restorations should increase progressively, growing from around twenty minutes worth of films in 2012 to a predicted forty minutes in 2013. The practice adopted for these first two projects necessitates the use of digital technology to ›blow up‹ the original 9.5mm frame to 35mm. This means that an image of 55.25mm² area is stretched to fill the entire silent aperture 35mm frame with an aspect ratio of 1:1.33 and 464.7mm² image area (i.e. more than eight times its original size). In 35mm projection about 10% of the peripheral picture information stored in the 35mm film frame is masked off. Therefore, the perforations located at the top and bottom of each 9.5mm frame are not visible on screen even though they are retained from the original in both the digital facsimile (2K scan) and the 35mm ›blow up‹. In contrast, if the 9.5mm film original were to be projected,

the perforations would be clearly visible. An important aspect of the 9.5mm viewing experience is therefore lost in its ›transformation‹ to the 35mm format.

With the ›blow up‹ to 35mm, the inherent grain of the 9.5mm original is enlarged. To work around this, grain management has to be carefully applied. However, the resulting visual impression of the 35mm ›blow up‹ is somehow uncanny and unfit. The comparatively extreme width of the projected 35mm image bears little resemblance to a projected 9.5mm image, which was intended to be shown on a small screen in a home setting.

One solution to maintain the essence of the original 9.5mm viewing experience would be to print the digital intermediate letter- and pillar-boxed onto the 35mm frame, i.e. with a reduced image concentrated in the centre of the frame, surrounded by a ›blank‹ area on all sides. The image would therefore appear smaller in projection, simulating at least part of the film's original screening experience more closely. However, the extreme discrepancy between the visual content and the 35mm film frame (approximately only 40% of the full frame image is used) makes this a highly uneconomic option.

As an alternative, the Film Museum is working to adapt its existing 35mm projection equipment to optimise it for the presentation of ›blow ups‹ from small gauge formats. With the use of a lens with a longer focal length and a more accurate mask, an uncropped image can be focused on the cinema screen at a smaller, more appropriate size. In this way, current analogue and digital technologies can be used in conjunction to mediate the production and presentation context of the original 9.5mm amateur film works more satisfactorily by contemporary means.

[1] From the Film Museum's »Mission Statement«, available online at: http://www.filmmuseum.at/en/about_us/mission_statement

[2] For alternative approaches to the preservation of small gauge formats, see also the contribution by Reto Kromer in this volume.

[3] *The Digital Dilemma* 1 & 2, and *Long Term Management and Storage of Digital Motion Picture Film Material*, The Science Technology Council. Available to download at: http://www.oscars.org/science-technology/council/publications/index.html

[4] See also the contribution by Alexander Horwath in this volume. Complete version: http://www.filmmuseum.at/en/collections/film_collection/digital_film_restoration

›› Peter Schallauer, Hannes Fassold, Albert Hofmann, Werner Bailer

Film and Video Quality Assessment Tools for Digital Preservation

Quality assessment of audiovisual files is an important task in several steps of the media production, delivery, preservation, restoration and content re-use processes. Today, mainly technical properties of the files can be checked, e.g. file integrity or standards compliance of file wrappers and encoded streams. Checking the audiovisual quality manually results in extremely high labour costs. In this paper we present a semi-automatic quality assessment approach that combines the efficiency of fully automatic detection with the interpretation capability of humans to provide verified high quality assessment results. We present a set of tools for automatic content-based detection of common video/movie defects like noise and film grain, test pattern, video breakup, sharpness, freeze frame, and dust and dirt. The detectors are robust against common image degradations and operate in real-time for content in standard definition resolution. The detection results are shown in a Graphical User Interface by providing various synchronised components for visualisation and verification increasing the operator efficiency. We further propose extensions to the metadata standard MPEG-7 in order to represent quality and impairment metadata in a well-structured and long-term interoperable way.

1 Introduction

Quality control for audiovisual (AV) files is an important task in several steps of the media production, delivery, preservation, restoration and content re-use processes. In these processes AV files need to be checked on different levels. On the file level data integrity is

checked by means of fixity information, e.g. with checksums or hashes implemented within storage, content or preservation management systems. On the file wrapper (e.g. MXF) and on the stream encoding (e.g. MPEG-4 AVC/H.264 or JPEG2000) level standards compliance is checked by means of available industry tools. On the content level only a small set of tools for spotting visual or audio distortions is available. Today, manual checking of the visual and audio quality results in extremely high labour costs or, and if these costs cannot be afforded, in not assuring the content quality. The transition to file-based production and preservation environments enables automation of quality assurance tasks with the goals of reducing quality assurance costs, increasing the quality of the content produced and assuring quality of content ingested in and re-used out of a digital archive.

In this paper we focus on recent results in content-based visual quality assessment (QA). Section 2 presents archive related use cases for content-based visual QA. In Section 3, general approaches about how to do content-based QA are explained and selected. Section 4 provides an overview of our novel tools for automatic quality detection, Section 5 on efficient, interactive quality verification tools, and in Section 6 we give an overview on our framework proposed for the standardised description of visual impairments.

2 Archive Use Cases for Content-Based QA

Content-based quality assessment can be beneficial in various digital video or movie archive related use cases.

For archive content ingest or migration, to
- monitor the film scanning process, e.g. for white and black points, instability, lack of focus, flicker, etc.
- monitor if the video player shows problems, e.g. for head clogs, drop-outs, video breakups, off-lock situations, etc.
- check the encoding or trans-coding, e.g. for blocking, sharpness, etc.

For archive content selection, access and usage to
- select the ›best quality copy‹ in case the content is available in more than one copy,
- select a video or movie with minimum quality for a certain usage, e.g. is the actual resolution of the content suitable for Standard Definition to High Definition up-conversion/ broadcast/Blu-ray production.

- select a movie where additional post-processing costs can be avoided, e.g. a movie with low film grain noise/flickering/image instability, avoiding restoration costs.

For restoration planning to
- estimate the cost and time of restoration, e.g. based on amount of dust, noise, flicker and image instability present in the unrestored content.
- select the most appropriate restoration tools/systems for content with specific impairments.

3 How to Conduct Content-Based QA

Although humans are able to provide very reliable quality assessments, in practice this approach is too time-consuming and therefore extremely costly. Alternatively, fully automatic QA approaches can be implemented very cost-efficiently, but cannot provide the same functionality and reliability as human judgments. We thus aim at an approach combining the benefits of both worlds, i.e. the cost efficiency of automatic tools with the interpretation capability of humans. Figure 1 illustrates this semi-automatic approach where audiovisual files are first analysed fully automatically and then these analysis results are verified interactively by humans, providing a final quality report.
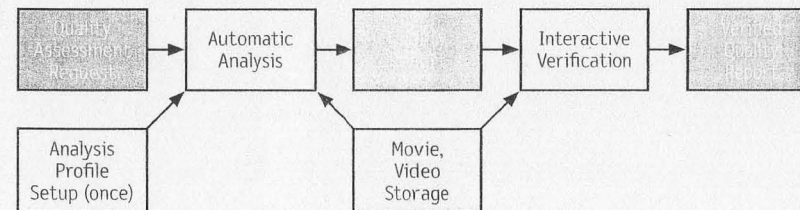

Figure 1 Semi-automatic quality assessment workflow consisting of fully automatic quality analysis and interactive quality verification

An analysis profile defines the type and parameters of automatic impairment detectors to be applied for a certain QA task, e.g. film scanning QA, video tape migration QA and restoration preparation QA.

4 Automatic Content-Based Detectors

Video/movie quality detection methods can be categorised by the amount of information available from the original undistorted video/movie. Full-reference methods need access to both, the current copy and the original undistorted video/movie (the reference). Reduced-reference QA methods work with only partial information of the original video/movie. Reference-free methods rely only on the current copy available. In the application areas preservation and restoration the original undistorted video/movie is practically unavailable in almost any case; therefore reference-free QA methods allow the widest range of application. In the following, a set of state-of-the-art detectors based on reference-free methods are described.

Electronic noise (of analogue or digital source) or film grain noise is present to different degrees in any video or movie content. Also, modern digital movie cameras create a significant amount of noise when shooting e.g. in low-light conditions. The noise/film grain detector supports noise level estimation for different types of noise, from very fine electronic noise, over different kinds of digital sensor noise up to very coarse film grain noise. Interlaced as well as progressively sampled video/movie is supported. The signal dependency of noise (different strength of noise in different luminance and chrominance channels) is also estimated. The detector is robust against a wide range of image degradations including flicker and image instability. The noise/grain value is estimated for every n^{th} frame statistically from measurement values of a temporal sliding window centred at the frame. A graphics card with CUDA[1] support is needed for the computationally expensive local motion estimation task, allowing the detector to operate in real-time for Standard Definition (SD) material. The detector can be used for determining whether noise restoration/reduction is required, e.g. in post-production or before archive content re-use or before play-out. It can also be used to monitor the film scanning process in regard to noise produced by the scanner.

The video breakup detector described in Winter et al. (2010) and Rosner et al. (2012) detects temporal segments in the video containing major image disruptions, for example caused by head clogging, assemble edits, lost lock, recorded serious digital error corrections, severe TBC hits and damaged tapes. A typical video breakup defect is shown in Figure 2 at the lower-right. Although it is primarily targeted to detect ›analogue‹ defects (showing horizontal line distortions), also severe digital errors (typically exhibiting blocking defects) are detected. The output of the video breakup detector is a list of temporal segments where video breakup occurs, and a severity value for each segment which gives an indication of how severe the video breakup defect is. Due to a CUDA supporting graphics card for calculating key components such as motion estimation, the detector is able to operate in real-time for SD material.

The sharpness detector measures the actual sharpness of the content, relative to the nominal video/movie resolution. The sharpness value is calculated for every n^{th} frame in the video. It can be used, for example, to detect if content has been up-scaled from Standard Definition to High Definition video, or to monitor the film scanning process for out of focus quality control. Freeze frames occur when, due to various reasons, no valid content data for the current frame can be retrieved. In this case, most video player or transmission devices deliver the previous frame (or field) instead, leading to several consecutive frames with identical content in the video stream. The freeze frame detector described in Schallauer et al. (2009) detects temporal segments where freeze frame defects occur. The detector is able to differentiate normal static image content (e.g. titles and captions) from an actual freeze frame defect and is robust against noise which can be superimposed on frozen frames. The detector operates significantly faster than real-time for SD video material.

Dust, dirt and blotches are very frequent defects in archived film. They appear as bright or dark spots of irregular shape and have in common that a single defect of this category occurs usually only in one frame. Utilising this characteristic, the Single-Frame-Defect (SFD) detector described in Schallauer et al. (2007) measures the amount of dust, dirt and blotches in a frame as percentage of the image area occluded by these defects. The SFD defect amount is calculated on a temporally sub-sampled video, e.g. for every 20th frame. The SFD detector operates in real-time for material in SD resolution.

5 Efficient Manual Quality Verification

Efficient visualisation and verification of impairment analysis results shall support an operator to get a quick overview of the condition of the material and to allow for manual corrections and final quality judgment by the operator.

In the following, we describe the user interface shown in Figure 2. It is composed of four main parts:
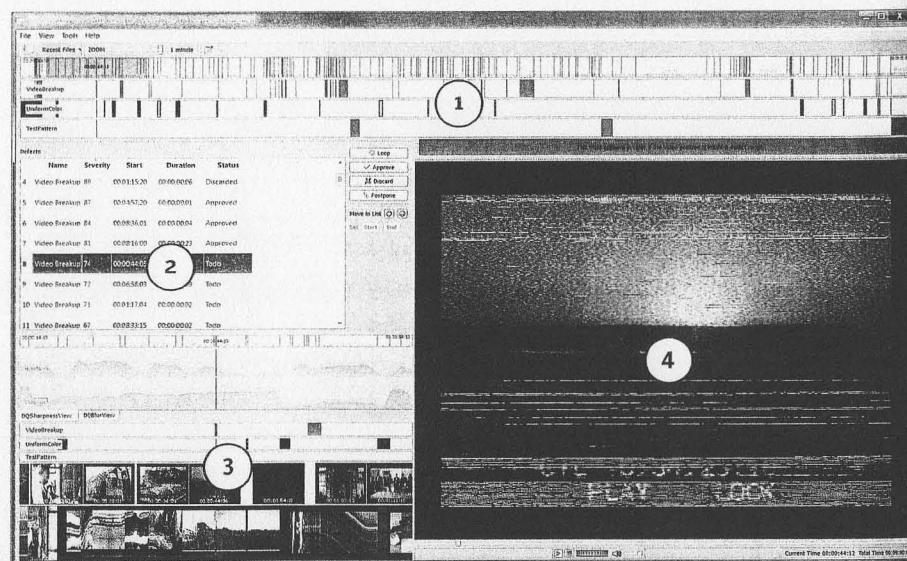
Figure 2 User Interface for efficient interactive verification of automatic detections

① Timeline views showing defect events for the full temporal range of the video. These include a global timeline view showing the shot structure and the temporal zoom period for the timeline views in part 3.

② A defect list component showing defect events and their properties for efficient verification.

③ Timeline views showing a zoomed temporal resolution providing a level of detail that can be freely adjusted.

④ A video player with frame accurate positioning support and audio playback.

The video player is the central component of the user interface. All other components synchronise with it. The video player can be positioned on an extra monitor for playback in full resolution. The other components, like the event list component and the timeline views, can also be deployed on a second monitor.

All components provide additional navigation functionalities. The key frame and stripe image timeline views shown in the bottom of part 3 in Figure 2 provide a quick visual overview of the video content. Key frames and stripe images are aligned on the timeline according to their

respective time points. Navigation is possible by clicking on the timeline, or by moving the scroll wheel for frame accurate positioning.

Timeline views showing impairment detection results may either visualise continuous quality measures in the form of line or bar charts such as the visual activity and the noise/grain level within specific time ranges. Detections having an event-like character are also visualised on timeline views by indicating the temporal segment of the detection. These are, for example, video breakups, uniform colour and test pattern segments. The different views appear both over the full video range (part 1 in Figure 2) and for the selected zoom period (part 3 in Figure 2). For uniform colour detections the respective segments are additionally filled with the colour detected.

The time an operator can spend to verify automatic analysis results is typically limited and it may be the case that not all defect detections can be manually verified. So the time the operator has available should be utilised best. For this it is very useful to be able to handle the most relevant detections first. To support this, the detections listed in the defect list view can be sorted by all columns. So, when sorting by severity, an operator can efficiently verify the most relevant detections first. A detection can either be approved, discarded, or postponed for later verification by the operator. After such a manual verification the next detection in the list not verified yet will be selected. This verification process is supported by a special mode where the video will play in a loop around the currently selected detection including a configurable pre-roll and post-roll time.

6 Representing Quality Metadata

The description of the quality of audiovisual content and the defects it might contain is part of the content's preservation metadata. Thus, the metadata cannot be dependent on the specific tools used for quality analysis, but must be understood by all the different preservation and restoration tools in the workflow. In addition, preservation metadata is only useful if it can still be interpreted many years after its creation. These requirements call for a standardised approach for representing quality metadata.

The quality description shall allow for getting an overview of the condition of the audiovisual material. It shall thus be a compact description and contain details only if absolutely necessary. The description is mainly produced by automatic tools, only validated by the operator, and it shall also be possible to process the description automatically. Therefore,

- the time point or range for which a description is valid must be specified,
- quality has to be quantified numerically or by sets of defined terms,
- defects need to be unambiguously identifiable, and
- optionally, properties of defects may be further described numerically or by sets of defined terms.

As the descriptions support the user in getting a quick overview of the materials' condition, they shall be defined in a way that they are easy to visualise. Especially quality measures and defect descriptors that represent a larger time range shall allow condensed visualisation over time. Quantitative descriptions of impairments shall correspond to the perceived severity of the defect.

6.1 State of the Art

MPEG-7 is a standard for the description of multimedia content, including structuring the content as well as describing a number of low-, mid- and high-level features for each of the segments in the structure. In MPEG-7 some impairment descriptors and description schemes have already been standardised. The *MediaQuality* descriptor (ISO/IEC 2001) contains (I) a quality rating, expressed as a floating point value, (II) a rating source and (III) a list of perceptible defects, discriminated into visual and audio defects, each of them being a term in a classification scheme. Classification schemes are MPEG-7 description schemes for defining hierarchies of controlled vocabulary. It is, however, not possible to describe the defect in more detail or its exact (spatio-)temporal location. The *AudioSignalQualityDS* (ISO/IEC 2004) can be added to each audio segment and contains some segment-based audio parameters and a list of error events. Each of these error events is described by the error class (a reference to a term in a classification scheme), time stamp and channel number, detection method (manual, automatic), relevance, status and optional text annotation.

6.2 MPEG-7 Extension for Visual Defect and Quality Description

Based on an analysis of the state of the art and the requirements defined above it becomes clear that MPEG-7 is a suitable standard to serve as a basis for the description of visual impairments. MPEG-7 allows to structure descriptions on different levels of granularity and already offers some tools for quality description, especially in the audio domain. Thus, we
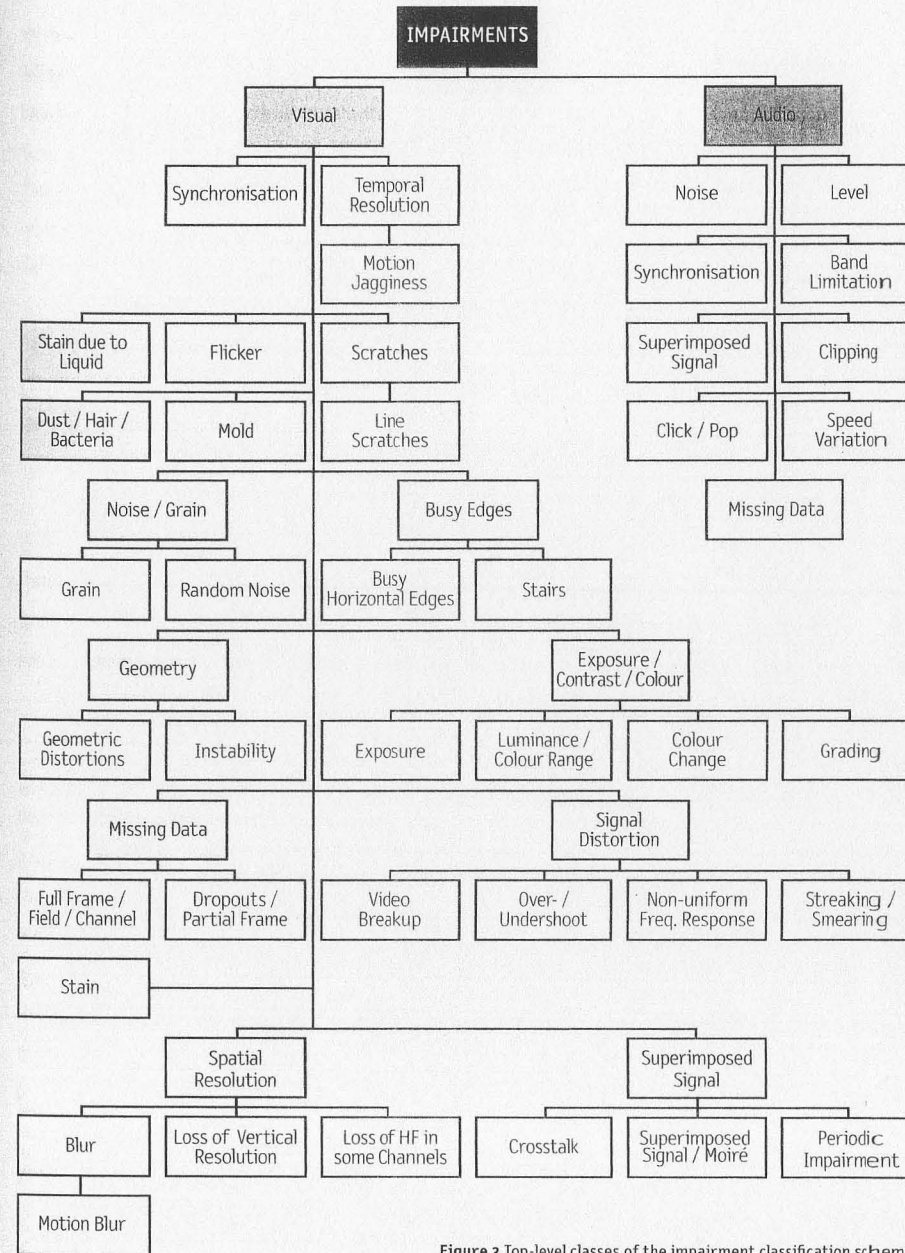

Figure 3 Top-level classes of the impairment classification scheme

have proposed an extension to MPEG-7 for describing visual impairments, similar to that for audio quality and defects defined in ISO/IEC 2004, a set of detailed descriptors for specific quality measures and defect descriptors and an extended classification scheme for visual and audio impairments.

The extension is based on the MPEG-7 Audiovisual Description Profile (ISO/IEC 2012) which has been proposed for detailed description of audiovisual content in production and archiving. The MPEG-7 extension for defect and quality description is available at Bailer et al. (2011).

There is a generic visual descriptor for defects which specifies general properties and references in a classification scheme. This is the minimum description of a defect, specifying its type and the segment of its occurrence. In addition, specific descriptors for a number of defects and quality measures have been defined, which allow to describe their respective properties.

Starting from the Brava broadcast archive programme impairments dictionary (Brava 2002), we have defined a comprehensive impairment classification scheme that provides for hierarchical organisation and multilingual description of defects. The main organisation criteria of the classification scheme are the visible and audible effects of defects. The top levels of the visual and audio defects in the classification scheme are visualised in Figure 3.

Conclusions

Content-based quality assessment is a beneficial tool in video/movie preservation related use cases, as it covers archive content ingest and migration, archive content selection, access and usage and restoration planning. Automation of QA is essential to reduce costs; a semi-automatic QA approach optimally combines the efficiency of fully automatic detection with the interpretation capability of humans to provide verified results. A set of tools for automatic content-based detection of common video/movie defects like noise and film grain, test pattern, video breakup, sharpness, freeze frame, and dust and dirt was presented, operating in real-time for content in SD resolution. In order to verify results, automatic detections need to be checked by human operators. A tool was presented providing various timeline views giving a quick overview of the condition of the material and supporting an operator in efficient verification and final quality judgment. In order to ensure that quality analysis results can be exchanged with tools throughout the workflow and remain understandable in the long term, a

description based on the MPEG-7 metadata standard has been proposed. Our future work will focus on the development of automatic quality detection and interactive verification functions needed for the large number of additional impairments occurring in movie and video production, preservation, migration and re-use scenarios.

[1] Compute Unified Device Architecture (CUDA) is a parallel computing architecture developed by nVidia for general purpose processing on graphics cards.

Bibliography

Bailer, Werner et al. (2011). *Audiovisual Defect and Quality Description (v1.6), Technical report.* Retrieved from: http://mpeg7.joanneum.at

Brava (2002). *The Brava broadcast archive programme impairments dictionary.* Retrieved from: http://brava.ina.fr/brava_public_impairments_list.en.html

ISO/IEC 15938-4:2002/AMD1: 2004. *Information Technology – Multimedia Content Description Interface,* Part 4: Audio, Amendment 1.

ISO/IEC 15938-5:2001. *Information Technology – Multimedia Content Description Interface,* Part 5: Multimedia Description Schemes.

ISO/IEC 15938-9:2005/AMD1: 2012. *Information technology – Multimedia content description interface,* Part 9: Profiles and levels, Amendment 1: Extensions to profiles and levels.

Rosner, Jakub et al. (2012). *Real-time video breakup detection for multiple HD video streams on a single GPU.* SPIE real-time image and video processing.

Schallauer, Peter et al. (2007). *Automatic quality analysis for film and video restoration.* IEEE International Conference on Image Processing.

Schallauer, Peter et al. (2009). *Automatic freeze frame detection for video preservation.* IEEE International Conference on Image Processing.

Winter, Martin et al. (2010). *Efficient video breakup detection and verification.* Workshop on Automated information extraction in media production.

CASE STUDIES

Nikolaus Wostry, Silvester Stöger, Karl Wratschko
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Digital Restorations of Filmarchiv Austria (2009-2011)

Giovanna Fossati
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Lost and Found. Restoring James Benning's
AMERICAN DREAMS (LOST AND FOUND)

# Mapping the Space/Time of Austrian Film Heritage. Digital Restorations of Filmarchiv Austria (2009-2011)

Filmarchiv Austria considers preserving and restoring the Austrian film heritage as one of its most important tasks. Within the process of restoration and preservation the entire Austrian film heritage needs to be taken into account. The following text covers the core topics of our restoration projects and gives an overview of the films that have been successfully restored and preserved by digital means. The established workflow covers scanning at a resolution of 3K using an *Arriscan* with wet-gate, followed by automatic and manual retouch in the restoration software *Diamant* by HS-Art. During the digital manipulation we follow a strict philosophy of ›less is more‹. After colour correction, carried out using *Scratch* by Assimilate Inc., the final data is recorded back onto 35mm internegative film stock using an *Arrilaser*. The analogue outcome is then considered to be the new archival master material, while the digital data of the scanned and restored films is saved on LTO tapes as DPX files for future use. Hybrid restorations/reconstructions are carried out, thereby combining the best results of analogue and digital technology. Additionally, all films are also made available as positive prints for screening purposes. This secures an ideal combination of high level preservation and proactive presentation.

The Oldest Austrian Fiction Film Productions: Saturn

The erotic shorts by the Viennese production company Saturn can be labelled the oldest Austrian narrative motion pictures. Formally impressive and picturing erotic attractions in a diversity of genres, they can be considered as some of the most interesting productions from the time of pioneer filmmaking. Due to severe ageing and decay in some parts, poor recording technologies
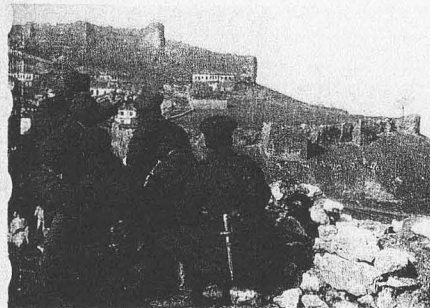
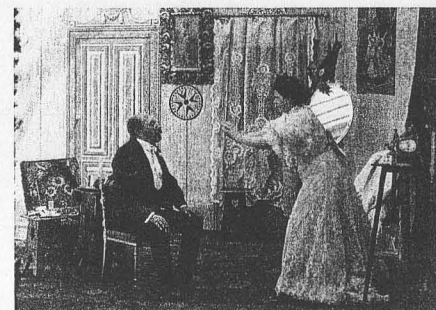MESSTER KRIEGSWOCHENSCHAU NR. 20/1916: KRIEGS-BERICHTE VOM BALKAN (1916)
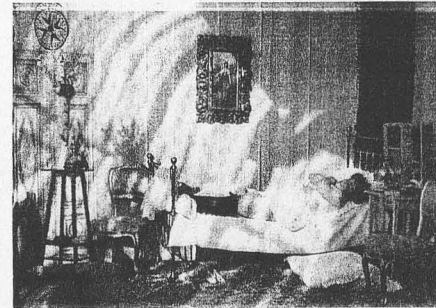
AUFREGENDE LEKTÜRE (1908/10)

[DAS STATTHALTEREISPITAL FÜR KRIEGSVERWUNDETE IM HAUSE DES FLOTTENVEREINSKINO IN WIEN VI, MARIA-HILFERSTRASSE 85-87] (approx. 1914)

BADEN VERBOTEN (1906/07)

DIE MACHT DER HYPNOSE (1908/10)

as well as heavy censorship, the quality of the source material is, in some cases, extremely poor. Here, digital manipulation and editing possibilities are very helpful in overcoming the problems caused, for instance, by severe censorship, which has left the sources as very disparate fragments suffering from heavy physical damage. Without manual retouch it would not have been possible to preserve these early films in such excellent quality. Thanks to the full digital restoration of 22 of the 31 existent Saturn films – in some cases original negatives – it was possible to enhance their visual appearance and pay them the respect they so truly deserve.

» **BADEN VERBOTEN** A 1906/07, b/w, 21 metres » **DIANA IM BADE** A 1906/07, b/w, 26.2 metres » **SCHLEIERTANZ** A 1906/07, b/w, 12 metres » **DAS SANDBAD** A 1906/07, 29 metres » **DER TRAUM DES BILDHAUERS** A 1907, b/w, 79 metres » **[EIN MÄDCHEN ANS FENSTER GENAGELT]** A 1908/10, b/w, 22 metres » **DER HAUSARZT** A 1908/10, b/w, 126.5 metres » **DIE MACHT DER HYPNOSE** A 1908/10, b/w, 130.6 metres » **WEIBLICHE ASSENTIERUNG** A 1908/10, b/w, 70.4 metres » **AUFREGENDE LEKTÜRE** A 1908/10, b/w, 61 metres » **[DIE ZAUBEREIEN DES MANDARINS]** A 1908/10, b/w, 30 metres » **JUGENDSPIELE** A 1907, b/w, 25 metres » **LEBENDER MARMOR** A approx. 1908, b/w, 106 metres » **IM BADE** A approx. 1909, b/w, 70.6 metres

Austria in Historical Film Documents, the Habsburg Monarchy and the First World War

Today, Filmarchiv Austria is responsible for housing the largest collection of film material dealing with the era of the Habsburg monarchy. Historical film documents from 1896 to 1918 provide a striking depiction of the impressive changes of the early 20th century. Following extensive acquisition activities, Filmarchiv Austria has managed to increase the size of its core collection dedicated to Austrian film heritage and to systematically preserve these films over the last years. In 2011, the first four films of this collection were digitally restored in full and consequently the safeguarding of these holdings is slowly being transferred to the digital department. Especially in regard to the historical colouring techniques that were so important for the Austrian war propaganda, the enhancements possible with digital colour correction have made this step more than worthwhile. Also, when looking at parts that have suffered severe nitrate decay, it is very helpful to carefully correct the colour of the remaining image while keeping the decay visible to be preserved in the same state as the originals.

» **WIEN. NEUE POLNISCHE LEGIONÄRE ZIEHEN INS FELD** Germany approx. 1914, Eiko-Woche, colour, 75 metres » **[DAS STATTHALTEREISPITAL FÜR KRIEGSVERWUNDETE IM HAUSE DES FLOTTENVEREINSKINO IN WIEN VI, MARIAHILFERSTRASSE 85-87]** A approx. 1914, colour and b/w, 29 metres » **MESSTER KRIEGSWOCHENSCHAU NR. 20/1916: KRIEGSBERICHTE VOM BALKAN** Germany

LEICHENBEGÄNGNIS ALBERT BARON ROTHSCHILD (1911)
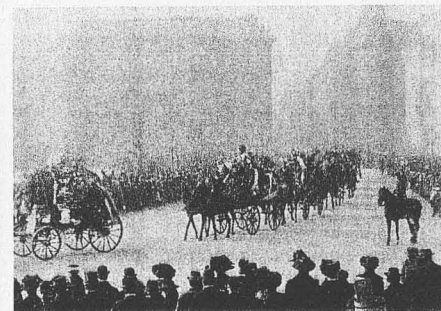
LEICHENBEGÄNGNIS ALBERT BARON ROTHSCHILD (1911)
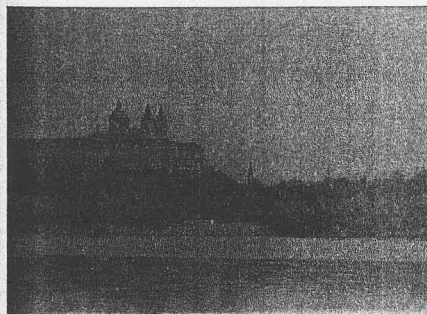
EINE FAHRT DURCH DIE WACHAU (1912)
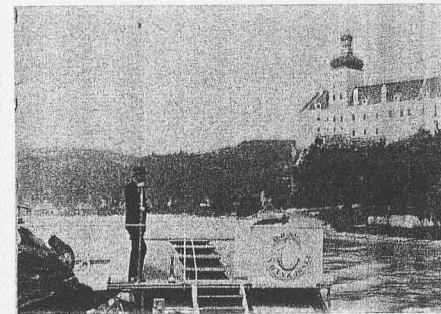
EINE FAHRT DURCH DIE WACHAU (1912)

VOM TABAKBLATT ZUR VIRGINIER (1927)

1916, Messter-Film Berlin, colour, 65 metres » **KRIEGSBILDER VOM BALKAN** A approx. 1917, Sascha-Messter Film, b/w, 61 metres »

SASCHA-MESSTER KRIEGSWOCHENSCHAU VON DER HOCHALPENFRONT ZU ITALIEN A approx. 1916, Sascha-Messter, Wien, b/w, 45

metres » **SASCHA KRIEGSBERICHT NR. 79B. AUFNAHMEN VON DER RUSSISCHEN FRONT IM AUFTRAG DES KRIEGSMINISTERIUMS**

A 1916, Sascha-Film, Wien, b/w, 81 metres

Austria in Historical Film Documents: A Historical Topography

One of the long-term preoccupations of Filmarchiv Austria, including its digital restorations, has been the systematic development of a cinematic topography of Austria's regions and counties. Mediated through DVD publications and ›on site‹ screenings, this topic constantly receives a highly positive response. By screening documents that not only show and help to understand crucial caesuras of Austrian history but also communicate local and regional stories of every-day life, the Austrian audiovisual heritage gains a new and heightened value. In EINE FAHRT DURCH DIE WACHAU, digital colour correction once again proved its merits. The colours of this tinted and toned film are faded to such a degree that they could not be regained by analogue copying as attempts to enhance the visible colours led to hard contrast and oversaturation in the duplicates. Only by working with *Scratch* was it possible to shift the different colours separately, while also taking care of the contrast in the process. It is also worthwhile to mention the resto-ration of VOM TABAKBLATT ZUR VIRGINIER here. This film shows the production of cigars in a factory, the grounds of which housed the very facilities where the film was digitally restored.

» **LEICHENBEGÄNGNIS ALBERT BARON ROTHSCHILD** A 1911, Österreichisch-ungarische Kinoindustrie Gesellschaft m.b.H., Wien, b/w, 60.5 metres » **DAS EINKÜCHENHAUS** A 1923, b/w, 523 metres » **VOM TABAKBLATT ZUR VIRGINIER** A 1927, Ing. Karl Köfinger-Film, b/w, 564 metres » **EINE FAHRT DURCH DIE WACHAU** A 1912, Sascha-Filmfabrik Wien, colour, 96 metres

Historical Film Documents: The Period of National Socialism in Austria (1938-1945)

In some cases, the use of digital restoration is considered an important means to facilitate a more direct immersion for viewers, which often triggers a personal or even emotional reac-tion. Especially in the case of film material from the era of National Socialist Austria, strong feedback from the public can be observed in respect to films shown in previously unseen picture quality, natural colours and with digitally corrected fading. It seems that digital res-toration helps to underline the historic content of those documents and its importance when their quality speaks in a more contemporary visual language.
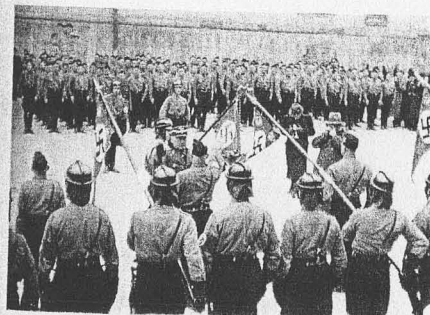
[NATIONALSOZIALISTISCHER AUFMARSCH UND FAHNEN-WEIHE IN KREMS AN DER DONAU] (approx. 1938)

[ADOLF HITLER BESUCHT AM 3./4. APRIL 1938 DIE STEIRISCHE LANDESHAUPTSTADT] (1938)
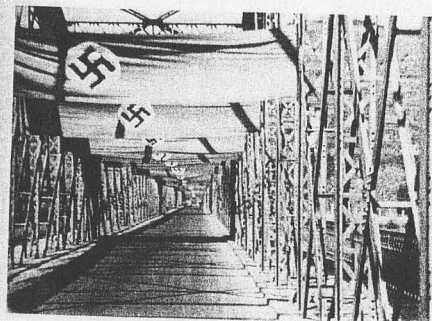
[NATIONALSOZIALISTISCHER KREISTAG IN KREMS AN DER DONAU] (approx. 1939)

[DER BAU DES SÜDOSTWALLS IN DER UNTERSTEIERMARK] (1944/45)
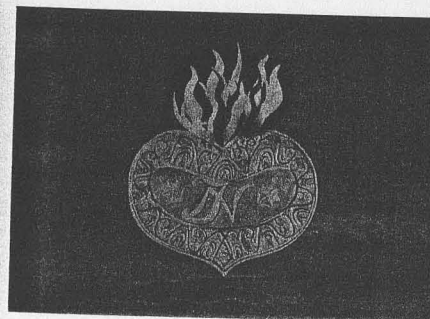
BRÄUTIGAM AUF KREDIT (1921)

BRÄUTIGAM AUF KREDIT (1921)

» **[NATIONALSOZIALISTISCHER AUFMARSCH UND FAHNENWEIHE IN KREMS AN DER DONAU]** A approx. 1938, b/w, 148 metres »
[ADOLF HITLER BESUCHT AM 3./4. APRIL 1938 DIE STEIRISCHE LANDESHAUPTSTADT] A 1938, colour, 41 metres » **[NATIONAL-
SOZIALISTISCHER KREISTAG IN KREMS AN DER DONAU]** A approx. 1939, b/w, 65 metres » **[DER BAU DES SÜDOSTWALLS IN
DER UNTERSTEIERMARK]** A 1944/45, b/w, 271 metres

Austrian Feature Films of the 1920s

In the 1920s, Austrian feature film production reached its peak expansion. Catalysed by the
immense inflation the Austrian currency went through during that period, it was possible to
export feature films below the global market prices. Thanks to the subsequent widespread
distribution, many Austrian silent feature films – in contrast to Austrian documentary films
– could be conserved as unique elements in international archives. Through repatriation ef-
forts, Filmarchiv Austria has been able to build up an exceptional collection, which not only
includes a high variety of oeuvres but has also made it possible to create a work-centred clas-
sification of this production period for the first time.

As multiple sources are frequently available, a ›hybrid‹ restoration workflow is partly used in
the reconstruction of films from that period. Sometimes unique, hand-coloured elements are
digitally restored and colour-corrected while other parts of the same film are contact-printed
and then joined together with the digitally treated parts in the final reconstruction. In addi-
tion, a renewal and extension of badly preserved flash titles is carried out digitally whereas
the moving image parts are copied photochemically. For instance, the copy of DER JUNGE
MEDARDUS contained very poor flash titles, a significant number of which were documented,
but no longer available as actual titles. Thus, by combining digital compositing techniques
with letters of the existing titles, it was possible to clean them and even reconstruct the miss-
ing ones in their original typeset.

These ›analogue/digital hybrid‹ reconstructions combine the best of both worlds and help to
bring important Austrian silent films back to life and onto the screens of film festivals like Le
Giornate del Cinema Muto in Pordenone.

» **BRÄUTIGAM AUF KREDIT** A 1921, Volo-Film, Wien, directed by Hans Steinhoff, colour, length of restored colour se-
quences: 57.7 metres » **DER JUNGE MEDARDUS** A 1923, Sascha-Film, directed by Mihály Kertész, b/w, reconstruction
of intertitles, extension of flash intertitles » **DER MANN, DER ZWEIMAL STARB** A 1922, Allianz-Film, directed by Franz
Herterich, colour, reconstruction of intertitles, extension of flash intertitles

GUCKLOCH (1970; before restoration)

GUCKLOCH (1970; after restoration)
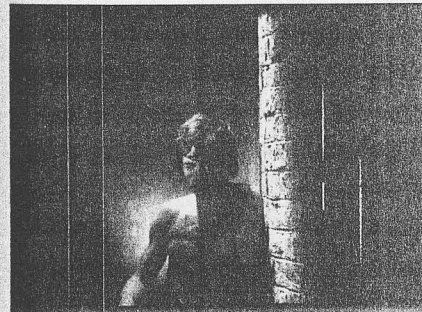
HO ANTHROPOS (1970)

SCHILLERS RÄUBER (1926)
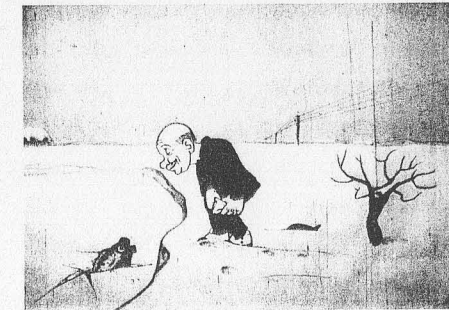
[LERNE SCHWIMMEN] (1926)

Austrian Avant-Garde Film

Another focus of Filmarchiv Austria's digital restoration department concerns Austrian avant-garde film. 2011 saw the rediscovery of one of the most important Austrian auteur filmmakers of the '70s and '80s, Mansur Madavi. Two of his early works, HO ANTHROPOS and GUCK-LOCH, both key works in the director's oeuvre, could be made accessible again through full digital restoration and were shown during the first big Madavi retrospective at Filmarchiv Austria's Metro Cinema as well at the Czech film festival in Uherské Hradiště and in Mexico City following a guest lecture by Filmarchiv Austria at the Centro de Capacitación Cinematográfica. The only elements known to be in existence, each a 16mm b/w reversal film with a variable area optical soundtrack, served as source materials for the two restorations. Only in the case of GUCKLOCH a magnetic sound tape could also be located, which served as a source for the sound. After the image restoration and the creation of a new sound negative from the magnetic audio tape of GUCKLOCH, the synchronisation turned out to be a confusing obstacle as the film is highly experimental in character and no synchronisation marks were manifest. The only way to proceed was a painstaking trial and error routine which, in the end, generated a mesmerising result once the right synchronisation point had been found.

» **HO ANTHROPOS** A 1970, directed by Mansur Madavi, with sound, b/w, 264 metres » **GUCKLOCH** A 1970, directed by Mansur Madavi, with sound, b/w, 356 metres

History of the Austrian Advertising Film

In the course of an ongoing research project, Filmarchiv Austria has been working in cooperation with leading Austrian enterprises to review the history of Austria's advertising and industrial films. In 2011, two of the earliest films, directed by Peter Eng (who, like Ladislaus Tuszinsky, was one of the pioneers of Austrian animated film), were digitally preserved. Due to the generally poor tradition of preserving such material, the two films now count as treasures of the Austrian film heritage.

» **[LERNE SCHWIMMEN]** A 1926, directed by Peter Eng, b/w, 44.4 metres » **SCHILLERS RÄUBER** A 1926, directed by Peter Eng, b/w, 56 metres

» Giovanna Fossati

The Restoration of BEYOND THE ROCKS

The long-thought-lost film, BEYOND THE ROCKS – directed by Sam Wood in 1922 and starring Gloria Swanson and Rudolph Valentino – was found by the Nederlands Filmmuseum (since 2010 known as EYE Film Institute Netherlands) in 2004 and 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.

News of the retrieval and restoration of this title has travelled 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 specialised 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 while describing the restoration of BEYOND THE ROCKS and the decisions taken along the way.

Until 2004, BEYOND THE ROCKS was one of the many silent films considered lost for good. Between 2000 and 2004, an almost complete nitrate print of the film resurfaced, literally reel by reel, at the Nederlands Filmmuseum. The film was held in several unlabelled cans

scattered throughout a large film collection donated to the Nederlands Filmmuseum by the family of a Dutch film collector after his death in 2000. Under the supervision of Collection Specialist Elif Rongen-Kaynakçi, it took approximately three years 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 the Nederlands Filmmuseum to reconstruct the film's editing and its title cards.

ING Real Estate financially supported this restoration project, which was carried out in collaboration with the Haghefilm Conservation Center. 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 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 Nederlands 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 same 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 Le Giornate del Cinema Muto in October 2005.

BEYOND THE ROCKS was by far the most ambitious restoration and distribution project carried out by the Nederlands Filmmuseum at that point, in terms of investment, exposure and techniques employed. The whole project cost around 200,000 Euros, including the costs for the analogue and digital restoration process, the new preservation film elements, the distribution film prints, the realisation 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
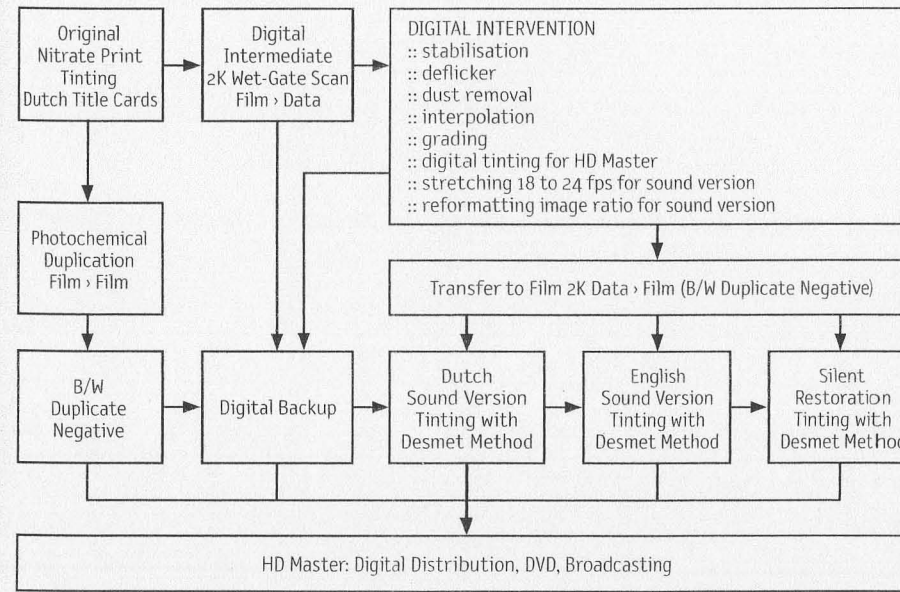
Restoration workflow of BEYOND THE ROCKS (Sam Wood, USA, 1922 – courtesy of EYE Film Institute Netherlands)

feature-length silent film is, even today, still significantly less than that of a digital restoration. Nevertheless, 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 the 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 the Haghefilm Conservation Center in Amsterdam, which specialises in the restoration of archival films. 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 digitising the nitrate print, a series of 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 colour depth of 10-bit logarithmic. The scan was carried out at Haghefilm on an Oxberry scanner custom fitted with a wet-gate to eliminate the appearance of superficial scratches on the base side of the film. 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 one terabyte of data. The files were subsequently imported in *Diamant*, a high-speed image manipulation software especially developed for use on digitised archival films. 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 stabilisation, deflickering and dust removal.

Digital stabilisation was needed because, mainly due to the shrinkage of the nitrate print, the image often shook on the screen during projection. Although it is possible to correct this instability with digital tools, the restorer's goal should not be that of total stabilisation. Film-born films, especially silent ones, have never been ›rock steady‹. For BEYOND THE ROCKS, some 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 stabilisation, the choice was not for a complete deflickering, 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) 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

BEYOND THE ROCKS 1922
Image before (top) and after (bottom)
digital restoration of a patch in a frame
(Courtesy of EYE Film Institute Netherlands)

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.
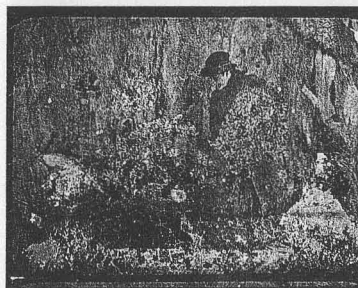
BEYOND THE ROCKS 1922
Image before (bottom) and after (top)
digital restoration of a patch in a frame
(Courtesy of EYE Film Institute Netherlands)

BEYOND THE ROCKS 1922
Example of nitrate deterioration to
a point beyond restoration
(Courtesy of EYE Film
Institute Netherlands)

Once stabilisation, deflicker 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. 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. One extreme example of a digital intervention carried out on BEYOND THE ROCKS was the

creation by necessity of a completely new image to replace one that had been heavily damaged. This image did not exist before and we can only assume it to be very similar to the damaged one. From a restorer's perspective this is an ethically questionable intervention. Most restorers, though, would accept it as long as it is well documented and 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. 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 data (known as the ›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 the Nederlands Filmmuseum before printing the graded digital intermediate on 35mm black and white negative (in this case Kodak 5234 film stock was used). Re-recording back to film was done on an *Arrilaser* 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 flashing method developed by Noël Desmet from the

Cinémathèque Royale de Belgique in Brussels. With this method, the tint is artificially recreated in the projection print by printing the black and white negative onto colour film stock and then flashing it with the appropriate coloured light. Projection prints were printed on a particular colour film stock, namely 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. As no reference for the original style of the English title cards had survived, and 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. 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 affects 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 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, the Nederlands 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 was the subject of much criticism from within the archival community. Indeed, although the music itself was widely appreciated, the heavy use of sound effects (such as opening doors, barking dogs, and such) became the main point of criticism from fellow archivists and scholars. Mainly for this reason, the Nederlands 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.

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 digital projection, the production of a DVD, and for television broadcasting.

The two most radical 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. At present, these are still the only ways to add a soundtrack to a silent film and to make it projectable (as film) in any commercial cinema. With digital projection, which is now more widespread than it was at the time the restoration of BEYOND THE ROCKS was carried out, the need to stretch a silent film to show it in regular cinemas is technically no longer necessary. This is still a controversial point of discussion, however, as Hollywood studios' Digital Cinema Initiatives (DCI) and the Society of Motion Picture and Television Engineers (SMPTE) have fixed the standard projection speed for digital cinema at 24 and 48 frames per second. Technically, the stretching effect could have been obtained 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 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. The stretching process that was chosen for BEYOND THE ROCKS in the end, namely to double every third frame of the film, going from 18 to 24 frames per second (i.e. 123345667899...), is in contrast 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 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 colour filters, simulating the original tints, were added digitally to the black and white digital image.

The restoration of BEYOND THE ROCKS made use of everything that film technology could offer in 2005, on both the photochemical and the digital front. Although the use of digital tools made it possible to make the film cleaner, more stable and more pleasant to the viewer's eye, great care was also taken to ensure the characteristics of the original artefact were respected. The nitrate print was also 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.

BEYOND THE ROCKS is also a good example of the practical application of the Nederlands Filmmuseum's progressive policy for presenting and distributing historical films. The film has been shown within a reconstructed original setting (i.e. in the 1921 Tuschinski theatre 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 cinemas 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 silent film with live accompaniment at festivals and cinémathèques worldwide.

Finally, the case of BEYOND THE ROCKS shows how users, with the turn to digital, are gaining a growing level of inclusion in the film archival technological frame. 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 rose everywhere. This clearly influenced the restorers, also with respect to the choice of using multiple presentation platforms (traditional film projection, digital cinema projection, television and DVD). And, in turn, it is thanks to this choice that the restoration of BEYOND THE ROCKS has reached many more users than restored silent films usually do.

Authorised, abridged extract from: Fossati, Giovanna (2009). From Grain to Pixel. The Archival Life of Film in Transition. Amsterdam: Amsterdam University Press, 235-245.

›› Anna Dobringer, Silvester Stöger, Karl Wratschko

Changing Perspectives. DAS EINKÜCHENHAUS* as an Example of Film Historiography and Contemporary Restoration

In 1923, the film DAS EINKÜCHENHAUS was produced under the direction of Leopold Niernberger, a pioneer of Austrian documentary and educational filmmaking. The film's centrepiece is a social architecture project of the same name, realised during the interwar period by the architect Otto Polak-Hellwig in the 15th district of ›Red Vienna‹. Construction of the single-kitchen house, ›Heimhof‹, began in 1922 and was completed five years later. The main element of this new housing model was the controversial idea of centralised housekeeping. The building in Pilgerimgasse was thus equipped with facilities such as a central kitchen, a kindergarten, a service lift, a laundry, a vacuum-cleaning system, central heating, waste chutes and more besides. If requested, domestic chores such as cooking, cleaning and laundering were taken over by centrally employed staff paid for by the tenants.[1] Thus, the multi-story apartment complex did not amount to a mere accumulation of conventional residential units, but was much rather an attempt at a socio-political restructuring of human living space.[2]

DAS EINKÜCHENHAUS covers numerous aspects that lend themselves to investigations in the context of spatial theory. After a brief summary of the film's contents, this will be attempted in three points, as follows:

1. a localisation of the film within aesthetic and film-historiographical space;

2. a content-level analysis of social spaces undergoing transformation, as featured in the film;

3. an examination of the transformative processes at the material level of the film, which cover a range of different media and their respective spaces.

The concept of the single-kitchen house is based on the socio-political idea of reducing and easing housewives' domestic chores, so as to enable them – at least potentially – to pursue a profession outside of the family. In the film, this is expressed through the following intertitle: »The single-kitchen house is a requirement of the times, which force women to earn a living. Since the family mother is relieved of her housework, she can dedicate herself to her husband and children in spite of being gainfully employed.« Despite the underlying ambition to change traditional societal conventions, it already becomes apparent at this point that the notion of domestic care as a woman's primary responsibility as yet remains unchallenged.

At the beginning of the film, the present-day life of the film's heroine, Bessy Hull, is described in all its tediousness: »Who knows the worries, the disappointments, that every housewife must endure. And which are doubly felt by the woman who straddles both housework and employment?« Thus we enter the narrative at Bessy's workplace, at a typewriter in an office, where she earns her living. A look at the clock signals the end of the working day, whereupon she slips on her coat and hurries home. There the day's true toil awaits her. In horror, she realises how her two unsupervised children have been whiling away their time: her daughter is playing with the ashes in the stove (intertitle: »A girl, though still so young, seeks domestic occupations«), her son swings to-and-fro on the chandelier (intertitle: »The boy has always found his fun. In a game of some perilousness.«). Without a moment's rest, Bessy prepares a meal, which her impatient husband finds inedible and refuses to eat, and pays the coal porter, who soils the apartment. Then the dirty dishes await her, work that an intertitle describes thus: »It is usually only the afternoon that brings the housewife quieter, thoughtful work.« The family cannot go on like that. When the father reads about the single-kitchen house on a billboard ad, the family decides to move.

The construction of the residential complex in Vienna's 15th district is shown in several sequences, by means of documentary footage. This is followed by scenes presenting Bessy Hull in her newer, improved domestic surroundings. The advantages of the new domestic circumstances presented here clarify the extent to which the spatial constellation of her life constitutes – or constituted – Bessy Hull's social situation. Whereas its negative aspects are portrayed as a product of the times, their dissolution for the better now appears as a logical consequence of restructured domestic and living spaces (for example, the aforementioned pooling of all cooking activities in a central canteen kitchen: »The central kitchen: in 5 pots, 2 cooks prepare what 40 housewives used to cook in 200 pots and pans.«).

DAS EINKÜCHENHAUS (1923)
We enter the narrative at Bessy's workplace, at a typewriter in an office

The new living space was designed to enable the ›normal woman‹ – as portrayed in the film – to do the housework faster and with greater ease, and thus to pursue paid employment more effectively. This becomes apparent in the film when Bessy's boss offers her a promotion and a pay rise.

1. Aesthetic and Film-Historiographical Localisation

Stylistically, DAS EINKÜCHENHAUS is located between documentary, fictional narrative and advertising film. In its hybrid form, it corresponds to a standard practice of 1920s film production, which increasingly understood film not only as entertainment, but also as an educational medium. In order not to bore audiences with purely documentary images and explanations, fictional narrative threads were woven into the documentary material. In Austria, this kind of film came to be especially established in the field of health policy. Well-known examples from Austria include such titles as DIE GEISSEL DER MENSCHHEIT (1917), produced by Wiener Kunstfilm (Vienna), TUBERKULOSE (1922), produced by the Staatliche Hauptfilmstelle (Vienna), and HYGIENE DER EHE (1922), produced by Pan-Film AG (Vienna). Educational films such as these were mostly produced with state support and thanks to their frequently voyeuristic character – in the field of health, frequent subjects included hereditary diseases and sexuality – reached wide audiences.

DAS EINKÜCHENHAUS (1923) Bessy's daughter is playing with the ashes in the stove

DAS EINKÜCHENHAUS (1923)
Intertitle: »It is usually only
the afternoon that brings
the housewife quieter,
thoughtful work«

By contrast, DAS EINKÜCHENHAUS champions the virtues of the new model of residential living described above, which is distinct not only in its overturning of traditional family values, but must also be seen as an ideological manifestation due to its political roots in the Social Democratic camp. These controversial origins are skilfully blurred for propagandistic purposes by means of a semi-documentary narrative form that mixes uncommented, documentary shots of the building's construction with a narrative plot centred on the family life of the film's fictitious heroine, Bessy Hull. With methods akin to the modern advertising film, viewers are thus offered opportunities to relate, so as to learn to accept and appreciate the advantages of the new living space shown in the film and the affirmations of its culturally progressive nature. The film promises a happier and easier life, which seems to be just a few simple social and technological changes away. As will be described in more detail later on, these changes also result in a transformation of living space.

The strategies for deploying film as an instrument of advertising or propaganda remain almost unchanged to the present day. It is still usual for advertising films to offer simple solutions promising a comprehensive transformation of living circumstances. However, the characteristic cross-over between genres in educational films of the 1920s has for the most part fallen into disuse. In DAS EINKÜCHENHAUS and other films of the time, viewers can clearly distinguish between documentary and fictional shots (at least from today's perspective). From the point of view of production techniques, it seems as if a complete mix and thus unified reception of the different levels of reality was not possible.

This is different in contemporary productions: reenactment in documentary films today is almost impossible to identify, due to better production standards on one hand, and more skilled media usage by these films' protagonists on the other. Specific genres, such as scripted reality formats or mockumentaries, deploy these possibilities in order to irritate, agitate or simply entertain the audience. On the other hand, an increasing number of new feature films employ documentary-film elements in order to more effectively underscore the authenticity of fictional events.

DAS EINKÜCHENHAUS can clearly be seen as a predecessor of genres such as scripted reality. Director Leopold Niernberger appears to have intended to completely blend real and

fictional scenes, for the purposes of which the reenactment method was used in a number of ways. Thus the film, while clearly designed as a documentary, mostly shows fictional scenes in interior rooms that cannot clearly be identified as having been shot either in a studio or on location in the actual building in the 15th district.

2. Transformation of Social Spaces

As late as 1967, Michel Foucault in his essay *Other Spaces* still stated that the connection of private and public space was doomed to fail due to a lacking »de-sacralisation« of these spaces – the fact that we are still »guided by oppositions that cannot be challenged, that institutions and practises have not yet dared to take on«.[3] This underscores the revolutionary character of the Viennese communal housing project, which as early as the 1920s dares to put forward solutions for an array of domestic problems by integrating semi-public, communal facilities into the private sphere of the family.

Implementing such unusual socio-political ideas as relieving the wife and mother of her fundamental duty to prepare daily meals for her husband and children even under the most arduous circumstances (as shown in the film) and relocating these duties into a communal organisation (the private family union opens up to a semi-public canteen kitchen), the concept of the single-kitchen house seems to shake the very foundations of the traditional family image of the 1920s.

As shown in the film's opening scenes, the place ascribed to women with respect to their position and role in a traditional family setting is the domestic environment, and their foremost duty consists of caring for the family's well-being. Getting to know the film's heroine in a different social space and different social role, namely that of the working woman, does not mask this fact for very long: Bessy Hull's paid occupation is the result of financial hardship (a point clarified by the initial intertitle, quoted above) and at no point serves individual fulfilment or the equal participation of women in employment outside of the family space. As a further consequence, the wife's achievements in the workplace, as shown at the beginning, are nowhere honoured. But she is immediately faulted for her failure in the household, which is explicitly portrayed on several levels, be it in the field of childcare, food provision, or domestic hygiene.

The housewife's socially ascribed position eventually ends up burdening her to such a degree that when her unmarried female friend comes to visit, they are unable to take a walk together

DAS EINKÜCHENHAUS (1923)
Documentary footage:
The construction of the
residential complex in
Vienna's 15th district

due to unfinished domestic chores. Furthermore, Bessy Hull advises her friend never to marry, so as not to fall prey to the traditional division of labour that does not allow housewives to leave their proper place for the purposes of individual recreation and makes the family's privacy appear almost like a prison. The housewife-and-mother's failure to cope with her daily duties thus ultimately corresponds to the failure of the traditional family model per se. This socio-political catastrophe is averted by the concept of the single-kitchen house, which upholds the traditional domestic division of labour and other long-standing role attributions while simultaneously dismantling part of the nuclear family's privacy by expanding it into the semi-public realm. The wife and mother is thereby relieved of one of her core duties, namely food preparation for her family. Ending the family mother's excessive burden of domestic labour thus casts the basic family model in a new light: by expanding it into the communal realm, the family's private harmony is once again restored.

The shifting of domestic duties – away from the individual housewife, towards the communal canteen-kitchen – therefore also transforms the kitchen as a specific space: formerly characterised by excessive workloads, stress and compulsory work, it is now a place of domestic pride and representation. Freed from dirty, time-consuming chores and supported by up-to-date domestic equipment, Bessy Hull no longer cooks the food but serves it, while the newest

electrical household appliances are shown. This social ascension, triggered by a change in domestic duties and a reappraisal of the family's living space – now supported by kitchen staff and organised childcare – does not only bring about an improvement for the fictitious housewife's family situation, which now allows her to have relaxed conversations with her husband and enjoy her role as a mother. It also exerts a direct influence on her public and social living environment, in which she herself experiences a positive reappraisal – for instance through the sudden recognition of her role as working woman (evident in the job promotion and salary rise she receives thanks to her improved performance).

The fact that the film stops short of fully pursuing these implications of the single-kitchen house and does not present us with a scenario whereby the housewife's improved social recognition also encourages her to desire equal participation in public space – while instead enthusiastically reappraising her role as mother and wife within the confines of the family's private space – may appear half-hearted from today's perspective. However, it fully corresponds to the socio-political idea underpinning the single-kitchen house project. After all, it was conceived as a social-housing project to support families. That the basic premise of female domesticity was never seriously questioned in Niernberger's film is already confirmed early on by the intertitle describing the small girl as she stirs, unsupervised, in the oven's ash tray – an activity somewhat cynically deemed to be an almost instinctual domestic occupation, given that it is actually too much housework which prevents her mother from taking care of her. The figure of Bessy Hull is not freed from her presumed, matter-of-course wish for private domesticity. It is still her task to serve food to her husband and children (if now punctually) although it is now cooked by others (still women). This principle is also explicated towards the end of the film, when Bessy Hull's friend, characterised as unmarried and free, seemingly cannot but react to the latter's improved living situation by exclaiming: »If I get an apartment like this, I'll get married immediately!«, a reaction that is nonetheless fully in line with the demands of the family-focussed social housing movement.

The film seeks to emphasise that the positive outcomes of a practical alliance between the private family and semi-public support organisations go well beyond the individual benefit of those immediately affected, with the harmony inside the private family – framed as a political issue – eventually affecting the entire space of society.

3. Transformative Processes

The following section seeks to analyse the media-specific space in which DAS EINKÜCHEN-HAUS is located. This necessitates a closer look at the medium on which the film has survived to the present day. The sole remaining element of the film, namely the original camera negative, is in the possession of Filmarchiv Austria (a rare stroke of luck, given how little usually remains of silent films). This is the film material that was inside the camera during the shooting on location. When viewed in section, film as a physical medium – the familiar celluloid roll with perforated edges – consists of two basic layers: the supporting material and the thin, light-sensitive emulsion applied onto it – the storehouse for the individual images that can then be projected. The supporting material used for DAS EINKÜCHENHAUS is nitrocellulose, the first synthetically produced plastic which was almost the only material used for professional filmmaking until the 1950s. Composed of organic substances, nitrocellulose is subject to a natural process of decay that endangers the film's materiality and thus the visual images inscribed on it. In the worst case, nitrocellulose can even enter a stage of almost explosive oxidisation, which can generally only be slowed down by means of controlled storage conditions. For this reason, nitrocellulose does not constitute an adequate preservation medium for films. Film archives and similar institutions are permanently involved in the – costly – process of copying their films onto modern polyester film. This film material is substantially more durable and at present constitutes the best medium for archiving moving pictures. Nonetheless, the original materials on nitrocellulose base are conserved in the best possible manner, in order to preserve them for as long as possible. The reason for this is that the original should remain available for potential future duplication and restoration projects, be they analogue or digital.

Given the historical importance of DAS EINKÜCHENHAUS and its archival condition, as described above, Filmarchiv Austria decided to preserve the film and produce a restored version. This is the only way of keeping the film for a future audience and obtaining an approximation of the original image quality.

Since 2008, owing to a cooperation project with the Austrian Film Gallery and the Austrian Film Museum, Filmarchiv Austria has been able to digitally restore films. As this method has proven particularly helpful with respect to improving image quality – for instance image stabilisation, cleansing of dirt and mechanical abrasions – the decision was taken, in 2010, to restore DAS EINKÜCHENHAUS using digital technology.

130 In practical terms, the restoration began with a scan using an *Arriscan* and a 2K resolution (2048x1556 pixels). In the cooperation project's digital restoration facilities in Krems, the digitised images were stabilised, cleansed of impurities and abrasions, and variations in density – the typical flickering of historical films – were corrected using the restoration software *Diamant*, developed by HS-Art in Graz in cooperation with Joanneum Research. As a last step, images were treated one by one in a time-consuming manual process, in order for the cleaning to proceed as sensitively as possibly and to avoid the creation of digital artefacts. The original version of DAS EINKÜCHENHAUS features positive flash intertitles, meaning that they are – as opposed to the rest of the film – available as positive images, and only one to three film frames long. Thus the intertitles are not preserved in sufficient length for them to be readable in projection. Flash intertitles in the negative originally served as position markers for inserting the intertitles during montage of the positive, as well as for laying down the intended textual and visual design. The flash titles were only extended to the appropriate length for projection prints, in order to save on expensive film material.

In the restoration process, the best individual frame was selected from each of the surviving intertitle frames. After digital cleansing, these frames were then extended to the desired length using a video editing programme. Thus it is now possible to read the frames at a projection speed of up to 24 images per second.

After the restoration activities were completed, the new digital version of the film was printed on polyester material, thereby creating a new analogue negative as a back-up, from which a projection print was then made by means of classic analogue copying. The final restored version of the film was also archived as digital data on magnetic tapes. These now constitute a new digital master that has not yet suffered any loss of quality through duplication.

In view of contemporary difficulties with regards to the storage of digital data, the FIAF and thus also Filmarchiv Austria consider the archiving of analogue film materials as the only practically viable long-term solution: on the one hand in order to preserve the *dispositif* of the analogue motion picture, on the other hand for the simple reason that the lifespan of digital storage media cannot remotely compete with film material, at least when the latter is perfectly stored.

At this point, another transformation of spaces presents itself, relating to the nature of different media. In the case of DAS EINKÜCHENHAUS, this applies to the historical source material, the newly restored and exposed negative, and the new analogue projection print.

Owing to digitisation and the use of digital tools, the original has come to compete with the digital derivative. Even though the newly exposed negative as well as the distribution print both contain individual photographic images on celluloid, their source is the digital master, as described above. This transitional step between two fundamentally different methods of data preservation corresponds to the general direction of contemporary trends in the ›digital age‹, in which each and every known communication medium is subjected to digitisation. Cinema, film production and photography are evidently not exempt from this development. While analogue photography has become absolutely marginalised over the past years, the standard practice of shooting feature films in analogue due to qualitative advantages, then digitally post-producing them, before finally distributing them once again as analogue prints in the cinemas, has remained in place until the recent past. Today the entire industry is in the course of rapid transformation towards fully digital production and distribution methods. In the course of 2011, the last manufacturers of analogue film cameras already let their productions fade out, since the majority of contemporary films are now recorded in digital form. Even small cinemas are increasingly installing digital projection equipment and are thus conforming to the requirements of a cinema practice that has also seen distribution channels switch to digital projection. It is therefore highly questionable whether even the production of film stock will continue in future.

This same development is also affecting the practice of film restoration as described above. The scanning of analogue film, paired with subsequent digital image treatment, offers disproportionately more options for image manipulation than the long-established practice of reprinting by analogue means. Nonetheless, the best possible method for restoration has to be individually decided upon for every given case. It is not always obvious, which of the two methods is to be preferred. Often, a mix of analogue and digital techniques is the most viable option for producing restorations that are both of high-class quality and ethically justifiable.

In the case of DAS EINKÜCHENHAUS, it is not only the source materials that underwent a change of media in the course of digital restoration. Much rather, the materials also stand as representatives for the entire (film) world, in which an artefact is now expected to appear in multiple modes. The physical realities of the film medium are blurring, in that a historical film is supposed to be available both in the original format – a celluloid strip – and as a DCP for digital cinema projection, as a Blu-ray disc, as a DVD, and as an internet stream. The same

applies to contemporary productions, although the analogue film carrier here is becoming increasingly obsolete.

Film archives and kindred institutions are confronted with substantial challenges by these developments. On the one hand, archival holdings are expected to be available in multiple forms (on analogue and digital carriers) as distribution copies for the general public, on the other hand new films should and indeed have to be stored in their original media format. In the case of contemporary productions, this more and more often implies a digital artefact, which in future will come to represent a historical (and oftentimes obsolete) format, as well as a valuable source for historical research. This not only requires a commitment to storing film productions, but also an intensive expansion of infrastructure and know-how with regard to a range of different technological requirements for archiving digital and analogue films.

This immense challenge can only be achieved if accompanied by a change in public perception regarding these issues. Compared to the storage of historical film documents on analogue media, the mass storage of digital data and their reliable, continuous supervision is far more laborious and thus requires immense monetary means. Digital data only remains readable if correctly stored and leaves no leeway for restoring any losses of quality. Compared to visual media, digital archiving is a matter of ›all or nothing‹.

In this way, both the social and the media-specific spaces within which DAS EINKÜCHEN-HAUS is located are in a state of transformation. Both spaces are characterised by a certain degree of hybridity, which in this case is marked by digital technology and its multiple appearances as an additional factor. The film, while in principle analogue, transforms itself into a new space through digitisation. This new space opens up new possibilities with respect to restoration and distribution, but also complicates the archiving procedure, as well as changing the original character of the medium.

In DAS EINKÜCHENHAUS, social space is seen to evolve into a hybrid state of being – driven by societal pressure. And ultimately, the film medium seems to be on a similar trajectory: film can/must now also be digital. It is also destined to undergo a transformation which appears to be a requirement of the present time, while at the same time supposedly having to preserve its original character. In both cases, this double existence leads to an increased complexity of being. Without claiming to be able to compare social developments – such as the position of women within the family and society – to the development of a technical medium, certain parallel developments between the transformation of social and media-specific spaces do

suggest themselves: both developments necessitate a reflection and reassessment of the social surroundings, without the protagonists of these transformations, be they human beings or things (and both now existing in dual mode), coming into danger of entering a precarious state of being.

But what happened with the actual single-kitchen house? The rise of Austrofascism brought the social experiment to an end. The central kitchen was closed down and the flats converted into standard living units with individual facilities for their inhabitants.

English translation (by Fabian Faltin) of the German-language article »Perspektivenwechsel. DAS EINKÜCHENHAUS als Beispiel filmischer Geschichtsschreibung und aktueller Rekonstruktionsarbeit«. The German original was first published on 20th December 2011 in Medienimpulse: Beiträge zur Medienpädagogik *2011 (4), available online at: http://www.medienimpulse.at/articles/view/365. The English translation appears here for the first time.*

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* DAS EINKÜCHENHAUS, Austria 1923, Director: Leopold Niernberger, produced by Staatliche Filmhauptstelle (Wien), Format: 35mm, b/w, Length: 478 metres, Duration: 19 minutes at 22 frames per second.

The newly restored version of the film was premiered at the Viennale in 2010 as part of Filmarchiv Austria's series, ›Silent Masters‹. For this screening, the film was accompanied with live sound by the artists Angélica Castelló and Billy Roisz. The film is available as a DVD in Filmarchiv Austria's Department for Studies and Advanced Research and as a 35mm distribution print in its Preservation Centre in Laxenburg.

[1] Helmut Weihsmann (2002). *Das Rote Wien. Sozialdemokratische Architektur und Kommunalpolitik 1919–1934.* Wien: Edition Spuren, 341ff.

[2] The principle of the single-kitchen house was not invented by Viennese communal politics and can be traced back to ideas first developed by the German women's rights activist Lily Braun, which were realised in various forms in several major European cities. Cf. Günther Uhlig (1981). *Kollektivmodell Einküchenhaus. Wohnreform und Architekturdebatte zwischen Frauenbewegung und Funktionalismus 1900–1933.* Wetzlar: Anabas.

[3] Michel Foucault. ›Andere Räume‹. In: Barck, Karlheinz et al. (eds.) (1992). *Aisthesis. Wahrnehmung heute oder Perspektiven einer anderen Ästhetik.* Leipzig: Reclam, 34-46, 37.

METROPOLIS 2010:
A New Effort to Recapture
the Lost METROPOLIS

The unexpected discovery of an almost complete version of METROPOLIS in the Museo del Cine in Buenos Aires led to a new digital restoration less than ten years after the last restoration attempt. The paradoxical situation of having, for the first time, an element which contains most of the lost scenes, but of realising that their condition renders them beyond restoration, led to a project concept which put digital restoration technologies to the test. At the same time, the fully digital workflow opened up new opportunities for a collaboration of specialists with different backgrounds.

METROPOLIS (1925-27) is probably one of the most representative case studies in the field of archival film restoration. The story of the film's deliberate destruction by distributors and its own production company has become a myth and has evoked the desire of several generations of film archivists and historians to restore the lost premiere version. Each of the four restoration projects carried out between 1969 and 2010 – not to mention various archival and other versions – can be considered showcase restorations and in each case they brought both film restoration in general and the recovery of the premiere version to new levels. The first effort to restore METROPOLIS, undertaken by the Staatliches Filmarchiv der DDR between 1969 and 1972, was probably the first film restoration to assemble known versions and elements as they were available in the FIAF archives at the time. The restoration project by the Filmmuseum München between 1984 and 1988 led to the first critical edition in the field of film restorations.

In 2001, METROPOLIS was transferred to the digital domain. The Friedrich-Wilhelm-Murnau-Stiftung in Wiesbaden and the Bundesarchiv-Filmarchiv in Berlin and Koblenz carried out the first digital restoration in 2K resolution of a feature film in Germany. The film's first encounter with digital restoration technology was accompanied by another important aspect: it was also the first time in the film's restoration history that the surviving camera negative of the US version was used. This combination resulted in a considerable improvement in image quality and led to a discussion about the opportunities opened up by the advent of new technologies. This version could claim to be closer to the premiere version than ever before: on the one hand, it followed the philological approach of the Munich reconstruction and, on the other hand, it once again brought out the full quality of the photographers' work. Digital restoration algorithms allowed for the traces of time and the divergence of the different source materials used for the negative's completion to be coped with more efficiently than photochemical technologies would have.[1]

In 2008, the entirely unexpected discovery of an almost complete distribution version for the Argentinian market confronted us with a paradoxical situation: this was the only version in existence containing the scenes that had been eliminated in 1926 and 1927, but at the same time these scenes were veiled by a layer of dirt and scratches keeping us from catching sight of them. The negligent duplication of the now lost 35mm Argentinian distribution print onto a 16mm reduction negative introduced a profound difference between the original and the duplication: 1) the loss of image information caused by a duplication in sound format; 2) the lack of definition in large parts of the negative and an overall instability most probably caused by the lacking repair of the perforation of the outworn print, which, in addition to its possible shrinkage, prevented the film from remaining even during the duplication process; 3) and finally, a loss of image information caused by duplicating the print without any cleaning or wet-gate.

This time, the aim of the digital restoration technique was to extract as much information from the destroyed image as possible. The extreme, imprinted destruction rendered any of the classical physical restoration techniques, such as repair and cleaning of the source material or wet-gate scanning, useless and defined digital image restoration as the only possible way to restore this material.

As in 2001, the latest restoration was one of the most ambitious restoration projects in terms of cost, exposure, project complexity and agenda to have been carried out by the Murnau-
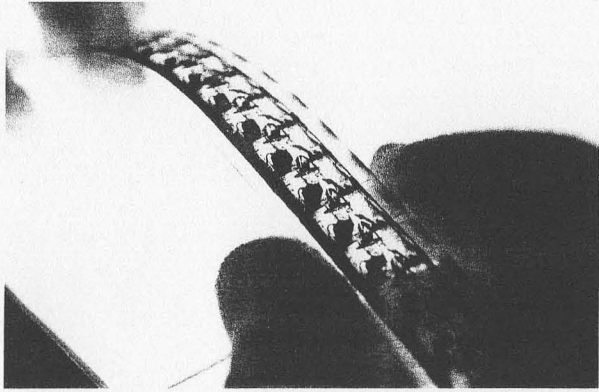
METROPOLIS
16mm print of the Argentinian version
(Courtesy of Uwe Dettmar / Friedrich-
Wilhelm-Murnau-Stiftung, Wiesbaden)

Stiftung, this time in collaboration with the Deutsche Kinemathek in Berlin and the Museo del Cine in Buenos Aires. After news of the discovery of lost scenes was confirmed in early summer 2008, the project's conception envisaged a completion of the 2K data of the 2001 version as well as added music to be produced by ZDF/arte on the basis of the original orchestral score by Gottfried Huppertz. The new version was scheduled to be presented at the 60th edition of the Berlin International Film Festival in February 2010. Based on their rich knowledge about the specific editorial problems that originated from the extensive restoration history of the film, a team of curators was established. This team consisted of Martin Koerber, who had curated the 2001 restoration together with Enno Patalas, conductor Frank Strobel, who was also responsible for the adaptation of the music score on behalf of ZDF/arte, and myself.

Clinical Trial

The degree of destruction of the Argentinian footage described above rendered the image restoration the most challenging part of the project. Hence, the careful selection of the technical service provider was the first step in this project. Nine laboratories and post-production companies were asked to submit suggestions for the image restoration process, as well as a cost estimation and a work plan. Five of these companies were subsequently invited to submit a series of work samples showcasing each relevant step in the restoration and mastering process:

- 2K scan from the 16mm reduction negative on hard drive
- Conversion of the 2001 8-bit linear data files into 10-bit logarithmic data files on hard drive
- Digital restoration sample of the 2K scan of the 16mm dupe negative including retouching, stabilisation, grain reduction and colour correction plus insertion into the converted 2001 data on hard drive and output on 35mm b/w negative
- 35mm b/w positive from the film-out of the restoration sample on 35mm b/w negative

The extensive test requirements reflect the project's complexity: apart from the challenge of image restoration, it was crucial that the quality of the test could be successfully transferred to the analogue world. With respect to the various plans for distribution, the new restoration of METROPOLIS was to be made available as 35mm prints and DCP for cinema release, as HDCAM SR for television and DVD/Blu-ray sales and also, in part, for cinema.

For the work sample from the Argentinian element, a sequence from a scene in the ›Auftakt‹ was selected in which Georgy, disguised as Freder, is driven through the upper city of Metropolis. This sequence was especially demanding as, in addition to dirt and scratches, it is affected by bright stains, clearly caused by oil remnants on the 35mm source. As their shape and position varies from one frame to another, they appear as flickering. They repeatedly emerge to ingreasing degrees of severity throughout the entire Argentinian footage. But for this scene Thea von Harbou's screenplay describes how light from street lamps and advertisements falls through the car's windows. In the reduction negative, flickering from those intentional lighting effects overlaps with flickering from the imprinted oil and makes the two difficult to distinguish.

For an evaluation of the work samples in digital formats we collaborated with the RheinMain University of Applied Sciences in Wiesbaden. Within the framework of a research project on the subjective evaluation of restored moving images, the Faculty of Design – Computer Science – Media organised a test phase. The work samples of each category (2K raw scan, conversion, digital image restoration) were organised in a programme developed by the university for the purpose of evaluating moving images in side-by-side comparisons. A sequence was established in which each sample was compared to the other four in the form of a split-screen presentation (A with B, A with C, A with D, A with E, B with C, B with D, etc.). Each comparison pair was judged by the test person by assigning it either 0, 25, 50, 75 or 100 points. By considering the evaluation result of each comparison pair, an overall assessment of each

sample was established. The origin of the work samples was unknown to the test persons. The test persons included a number of professionals and non-professionals in the field of film restoration and film archiving.

In addition to the evaluation programme, the samples were screened in 2K resolution to be discussed by Egbert Koppe (Head of Film Restoration and Preservation at the Bundesarchiv-Filmarchiv Berlin), Martin Koerber, the technical staff of the Murnau-Stiftung and myself. The participants had been provided with a compendium of the information provided by the five companies. It contained information about the scanners and restoration software that had been used, the studios' suggestions for the digital image restoration process and the cost estimates for the various work steps.

In the discussion of the scan samples, which originated from four different scanners, the result of the evaluation programme was confirmed: the scans carried out on DFT's Spirit 4K High-Performance Film Scanner/DataCine and on the *Arriscan* provided the best results from the reduction negative, although the trend in the discussion session – held without revealing the work examples' origins – was rather pro-Arri whereas the result of the evaluation session was pro-Spirit DataCine. As the restoration samples with a conservative approach that had been done based on an *Arriscan* provided more successful results than samples based on other scanners, we considered the *Arriscan* to be the one best suited to the Argentinian negative. While this evaluation programme was very helpful for the selection of the best scan, the selection of the best image restoration was another matter. As for the restoration work samples, the approaches of the different companies could be divided into two groups: conservative and aggressive. We received suggestions for a conservative approach from most companies. In addition, some companies provided alternative tests with a more aggressive version, which presented a more effective remedy for scratches, but also introduced heavy artefacts. In the discussion, it was pointed out that digital artefacts should not be accepted. On the other hand, a conservative approach was considered quite dissatisfying because of its poor results in comparison to the raw scan. Apparently it was necessary to define the goal of the restoration before selecting the service provider. Other evaluation criteria were the company's experience with archival film restoration and 2K workflows, the estimated cost, and the question of whether the responsibility for all work steps should be in the hand of a single service provider, especially in light of the necessity of putting the data back onto film material.

Finally, we decided on a rather unconventional route: all companies had pointed out that due to the massive damages, which are not single-frame events but rather continuous defaults throughout the length of the material, the limits of current software efficiency would be reached immediately. One company, Alpha-Omega in Munich, therefore went one step further and suggested a research project for finding software solutions for this degree of image destruction. This suggestion placed them beyond the evaluation concept. As the development of a restoration workflow was supposed to be part of the suggested research phase, Alpha-Omega could not provide a sample of a 2K image restoration that would be representative in terms of their proposal.

Instead, a restoration test was submitted which had been carried out with recent software solutions and which was comparable to the conventional approaches of the other studios. In addition to this work sample, the studio delivered a low-resolution test for which special software had been applied. The result was astonishing: almost all of the default flickering had been removed and the scratches had been repressed more effectively and free of artefacts than in any of the other samples. However, the evaluation group was doubtful whether the same result could be achieved for the whole 20 minutes of footage from the Argentinian source that were to be restored.

Since this restoration work sample appeared to be the only one that would lead further than the other offers, we decided to take the risk and selected Alpha-Omega for the digital image restoration. While this meant putting the film back into the hands of the people who had already successfully handled it in 2001, the *Arriscan* had clearly provided the best results from the reduction negative and it was therefore decided to separate the task of scanning from the restoration treatment.

The image restoration began in early September 2009 with the scanning of the reduction negative by Arri. For preservation purposes we decided to scan the entire 14 reels of the Argentinian 16mm dupe negative rather than only the parts that were required to complete the film. The image was scanned with an over-scan in order to receive a maximum of image content in the resulting digital files. Alpha-Omega received the files in 2K resolution and in a colour depth of 10-bit in logarithmic reproduction on hard drive. In parallel, they were backed up on LTO-5 tapes by Arri for long-term preservation. According to Alpha-Omega's work proposal, the digital image restoration started with a test phase. Within one month, a solution for the best representation of the damaged image was developed. This solution consisted of a

combination of various existing software options as well as the development of a new software approach specialised for this degree of damage due to vertical line scratches.

At the end of the research period, Martin Koerber and I surveyed the results. The degree of elimination of scratches and stains was astonishing, but the elimination had also introduced unwelcome digital artefacts. The automatic deflicker software Viva by AlgoSoft[2], by which the imprinted oil stains had been eliminated, had produced unwelcome side effects, resembling water running over the image in some scenes. For the scene showing Georgy inside the car, the deflicker tool had erroneously eliminated the intended lighting effects as this intentional flickering is similar to the moving, bright stains. Regarding the scratch elimination, the rapidly changing form of the stains was also responsible for the scratch tool's failure to recognise vertical line scratches. Apart from that, grey areas in the image further diminished the scratch tool's efficiency. The functionality of Alpha-Omega's proprietary RettMagic scratch tool differs fundamentally from other scratch tools. The latter are based on the principle of repairing damage by using pixels from intact parts of the image. As they operate on the assumption that damage is not present in the same location throughout the whole length of a shot, pixels from neighbouring frames of the damaged frame are borrowed for repair. For scratches that are not single-frame events, pixels adjacent to the scratches are cloned to replace the damaged pixels. In comparison, the functionality of RettMagic is based on a very different idea: instead of cloning the pixel, it carries the grey value of the intact pixel upon the default pixel. If the grey value of a pixel escalates between two consecutive images and returns to the value of the first image in the next frame, it may be concluded that the pixel with the divergent value is default.[3] Hence, this software ›heals images without copying external content of other images‹.[4] To what extent this software approach represents an image restoration more true to the original than conventional approaches would be worthwhile to discuss.

Nevertheless, fast movement of the image content can cause problems. Like damage, a quick change of image content causes an escalation of the grey value between two succeeding frames. Consequently, the software misreads movements as ›mistakes‹. Despite improving the software's ability to distinguish content-relevant movement from the continuous vertical line scratches, an artefact-free image ›and‹ a massive elimination of scratches could not be achieved within the given time frame of the project. While vertical lines could be removed effectively for images with comparatively little movement, the software was less effective for images with a lot of movement.

METROPOLIS
Frame enlargement, duplication of US version 1927 (Courtesy of Bundesarchiv-Filmarchiv, Berlin / Friedrich-Wilhelm-Murnau-Stiftung, Wiesbaden)

Collaboration: How to Reconstruct a *Gesamtkunstwerk*

For the recent restoration of METROPOLIS, the digital intermediate process provided the opportunity for an effective collaboration of different specialists. The Digital Intermediate (DI) process may be considered as »one of the most significant technological changes in relation to the reshaping of filmmaking and film archival practice«.[5] »In the DI process the whole film is digitised, including the scenes where no digital effects need to be added, so that the workflow, including editing, special effects, compositing, and colour grading takes place entirely in the digital environment. [...] The main reason for its success is that it satisfies the needs of all 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 colour character to

the directors of photography«.[6] The adaptation of the digital intermediate process for the restoration of METROPOLIS allowed for an efficient collaboration of different partners: service providers and their engineers, film archivists, film historians and musicians.

Digital Editing

The project started with the reconstruction of the premiere version's editing in February 2009. Access to the 16mm negative was not granted until the summer of 2009 and thus the only material on hand in early 2009 was a DVD transferred from a first print that the Museo del Cine had made from their 16mm negative. From this DVD, we could first identify all scenes, sequences or even single shots which were not present in the restored version of 2001 and therefore represented the relevant footage for the digital image restoration.

We started with the offline-editing by means of the *Avid* editing system at Omnimago's site at the Filmhaus in Wiesbaden. The Argentinian version was compared to the 2001 restoration in order to define the new parts and the places in the 2001 version where they would have to be inserted. A further source for the reconstruction of the editing was the study version of 2005 that had been created by the Universität der Künste in collaboration with Enno Patalas on the basis of the 2001 version. The editorial advantage over the 2001 version was that it took the music score by Gottfried Huppertz into greater account: Its basic idea was to start from the music as the piano score remains the only existing source to document the premiere version's editing and narrative structure. The study version contains the film's music in full length, and the missing sections are represented by grey space to »display the proliferation's disruptions and sensualise them in their temporal progress«.[7]

First of all, we created a split-screen version of the 2001 and the Argentinian versions. Based on this split-screen, the editing decision list (EDL), which consisted of an *Excel* file that had been produced for the 2001 restoration, was completed. It contained all information about the 2001 edition, including the source of every shot, scene descriptions from the screenplay and sync points from the piano score, including information for the missing parts. The EDL's shot order and numeration corresponded to the data structure of the 2001 2K files.

In the Argentinian version the editing of several scenes, which had been extremely shortened in 1926 and 1927 by Paramount and Ufa, is different from the 2001 version: in the ›Auftakt‹ this concerns the confrontation between Freder and his father eventually leading to Freder's alliance with Josaphat and Georgy, and the famous scene ›room of Hel‹; in the ›Zwischen-

spiel‹ differences concern Freder's fevered dream running in parallel to the dance of the false Maria; and several mass scenes in the ›Furioso‹.

One reason for this variation in editing is that the reconstruction in 2001 had to find solutions for gaps in a way that would allow to reconstruct a scene's intention and dramaturgy despite its incompleteness. Another possible reason might be changes made by the Argentinian distributor. The comparison with the 2001 version had shown that in the Argentinian version some sequences and single shots were missing. A comparison of the Argentinian version with the 1,028 sync points in the form of cue words in the piano score which documented the musical progress of the premiere version did not provide any indications of an alteration of the film's editing by the Argentinian distributor. Nevertheless, when we started to integrate the new parts into the version from 2001, we quickly realised that the reconstruction would not be as straightforward as simply filling the gaps. A closer collaboration with Frank Strobel, who was working on the reconstruction of the music score, seemed useful.

For the upcoming sessions we therefore established the following plan: Frank Strobel was provided with MPEG files of the problematic scenes. He synchronised music and image in his editing system by means of a computer sample from the piano score and sent us MPEG files of his editing suggestions in return. We compared them with our first reconstruction efforts by organising both versions in a split-screen. It turned out that if the editing of the Argentinian version was maintained, the interaction of image and music was usually most convincing. The *leitmotif*-technique, which Huppertz used to create a dramatic space in the music accompaniment by providing each character of the film with his or her own musical motif, allowed us to confirm the authenticity of the Argentinian version's editing and to reconstruct scenes in which the editing was corrupted by missing parts.[8]

Handcraft

The censorship file dated 18th November 1926 contains the entire text of the film as it appeared in the complete German version that premiered on 10th January 1927 in Berlin. Thus, it provided the corresponding German text for the Spanish intertitles and inserts of the additional scenes from the Argentinian version. The source for the original font was a 35mm fine grain master positive in the Murnau-Stiftung's archive, which was duplicated from a now lost, incomplete camera negative with German flash titles. As in the 2001 restoration, the intertitles were reconstructed by copying the font by hand. Since the original font of every

title is individual, each new title was drawn by hand to maintain an individual character. The screenplay provided the source for the line division.

Three inserts – a combination of text and image – could be completed on the basis of the Argentinian version: the note with Josaphat's address, Rotwang's letter and invitation to Fredersen, and a page from the Bible describing a scene from the Apocalypse. The partial text was reconstructed by using the German text from the censorship file and by copying the font of the Argentinian version, once more by hand. The line division of the Argentinian source had to be abandoned for both the letter and the Bible page because of varying lengths between the Spanish and the German texts. The rewriting of the texts of the intertitles and inserts was carried out by trickWilk in Berlin.

Composite

To achieve the combination of image and text for the inserts, the reconstructed German text had to be combined with the original partial image of the Argentinian source. All inserts of the film had been produced in different language versions by Ufa for the important export markets. Therefore, it may be concluded that the general artwork of the lost German inserts was identical with the existing Spanish ones. By use of a compositing tool, the company scientificImedia in Berlin merged the hand-written texts with the scan of the Argentinian inserts. In addition, the shadows were reconstructed according to the Argentinian source. For the invitation letter the movement of turning over the page also had to be reconstructed.[9]

Re-Grain

Due to the specific functionality of the RettMagic software, the grain of the Argentinian footage was removed along with scratches and dirt. The large amount of dirt and scratches prevented the software from distinguishing grain from dirt or scratches.

Photographic grain is a specific character of the photographic image and should, therefore, not be eliminated. In this case, the original grain structure of the Argentinian version as it was present on the 35mm nitrate print had already been manipulated by the duplication onto the reduction negative. Alpha-Omega suggested a reconstruction of the photographic grain based on the existing camera negative. The synthetic film grain was produced by scientificImedia. In the matching, process values which are visually identical to the grey scale of the camera negative were defined.[10]

Loss of Image Identification

A critical approach to the presentation of the missing parts in METROPOLIS has played an essential role in the film's restoration history since the restoration by the Filmmuseum München. Unlike the previous effort by the Staatliches Filmarchiv, the Filmmuseum benefited from rediscoveries such as Gottfried Huppertz' copy of Thea von Harbou's screenplay, large parts of the sheet music as well as the censorship file. The score's sync points combined with the screenplay's scene descriptions made a theoretical reconstruction of the film's original plot and narrative structure possible for the first time. By arranging the existing footage accordingly and by replacing the missing scenes with title cards with a description of the lacking content, the Filmmuseum, for the first time, created a version as close to the premiere version as possible. Several frames of black were used to indicate cases where single shots or a larger number of frames within a shot were missing.

This concept was continued and extended for the 2010 restoration. The Argentinian version provides most of the previously lost parts and thus replaces most of the black frames as well as the scene descriptions. However, this footage is not only corrupted by heavy damage but also lacks part of the original image: a comparison of the Argentinian shots with the same shots, as they were already present in the 2001 version, shows that parts on the left and top of the image are missing in the Argentinian footage. This cropping was caused by the duplication of the silent 35mm nitrate print using a sound aperture. Therefore, the reduction negative misrepresents the image proportions of the lost Argentinian distribution print. The original proportions as defined by the photographer could be reconstructed by adjusting the Argentinian image in relation to the scale of the camera negative. The missing image information on the left and top of the frame remains black.

Both the digital image restoration as well as the reconstruction of the editing and the inserts was an ongoing process of interpretation and decision-making. The digital image restoration in terms of scratch reduction eventually was a compromise between what could be done to achieve a cleaner image and what could be achieved regarding the development of the RettMagic software during the given time frame from September to December 2009. As the software's efficiency depended on the degree of content-related movement, we had to decide if shots with less movement, and therefore a more successful remedy of scratches, should be treated differently from shots in which a large degree of movement restricted the scratch removal. For the benefit of a homogenous representation of the whole Argentinian image
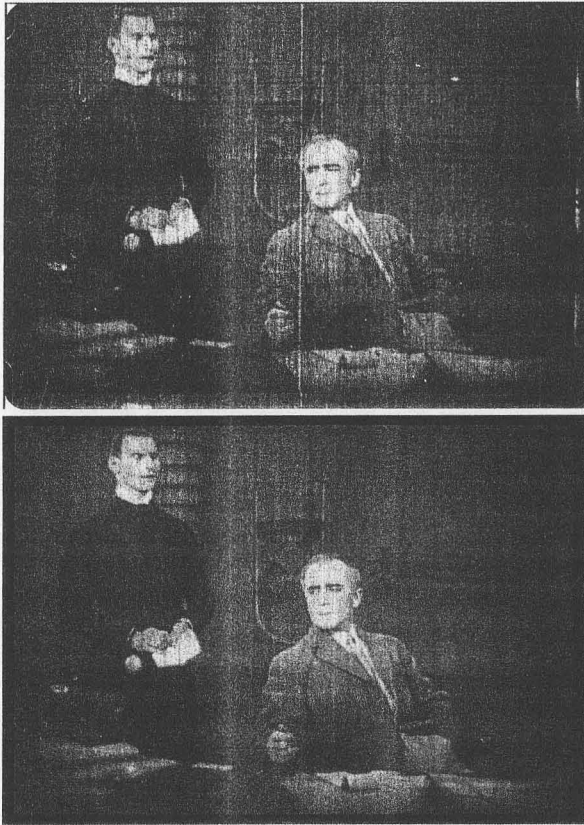
METROPOLIS
Before-and-after comparison,
restored version 2010
(Courtesy of Museo del Cine Pablo
C. Ducrós Hicken, Buenos Aires /
Friedrich-Wilhelm-Murnau-Stiftung,
Wiesbaden)

we decided to adjust the scratch removal in the less problematic parts to match that of the delicate sections.

The final result of the digital image restoration can hardly be judged without comparing it to the unrestored image. Despite the massive destruction still present, there appears to be an overall agreement that METROPOLIS benefits from the added scenes in terms of the narrative structure, the dramatic effects and editing.

What is probably more interesting about this case is that the reactions towards the final version did not, as in many other cases of digital film restoration, oscillate between the two

extremes of regarding digital restoration technology as either a kind of magic or as a means to alter the very nature of film itself. Rather the interpretative interventions and manipulations which were necessary to reconstruct this version were as extreme as never before in the history of the film's restoration. It seems that the large amount of interpretation that we could introduce in this version with the aid of the DI process allowed us to more closely approach the original intentions of the creators of METROPOLIS precisely because of its degree of manipulation. It was the very possibility of digital manipulation that let emerge ethical questions concerning the grain structure and the image proportions that would probably not have been discussed otherwise.

Had we not combined the reconstruction of the editing and the music – and if, therefore, archivists and musicians had not been able to simultaneously experience image and music – the interpretation of the image would most likely have been a very different one. Without this added musical dimension we would not have revealed the dramatic relevance of the destroyed Argentinian footage and the viewers would probably not have embraced every single shot as a benefit to the film as a whole.

[1] Koerber, Martin (2010). »Erneute Notizen zur Überlieferung des Films METROPOLIS«. In: Deutsche Kinemathek – Museum für Film und Fernsehen (ed.). *Fritz Langs METROPOLIS*. München: belleville, 58, 60.

[2] http://www.algosoft-tech.com/

[3] Naundorf, Karen & Matthias Stolz (2010). »Die Lang-Fassung«. *Zeit-Magazin* 7/2010, 31.

[4] http://www.alpha-omega.de/doku.php?id=showroom:METROPOLIS2010_2

[5] Fossati, Giovanna (2009). *From Grain to Pixel. The Archival Life of Film in Transition.* Amsterdam: Amsterdam University Press, 40.

[6] Ibid., 44-45.

[7] Bohn, Anna (2005). »Edition eines Torsos«. In: Universität der Künste, Filminstitut (ed.). *DVD als Medium kritischer Filmeditionen. Metropolis DVD-Studienfassung.* Booklet 10.

[8] Strobel, Frank (2010). »Rekonstruktion und Originalmusik von METROPOLIS«. In: Deutsche Kinemathek – Museum für Film

und Fernsehen (ed.). *Fritz Langs METROPOLIS*. München: belleville, 79, 82-83.

[9] Engel, Rainer M. (2010). »METROPOLIS 27/10: Digitale Filmrestaurierung in einem offenen Workflow«. *FKT Fernseh- und Kinotechnik* 11/2010, 565-566.

[10] Ibid., 562-567.

Un corps exquis. (Re-)Restoring Fedor Ocep's DER LEBENDE LEICHNAM / ŽIVOJ TRUP (THE LIVING CORPSE)*

Moscow, before the Revolution: Fedor ›Fedja‹ Protasov, a simple man from the upper classes, believes his wife Liza to be in love with another man. Not wanting to stand in their way, Fedja pleads for a divorce, only to be blocked by the rigidity of the Orthodox Church. After encountering Liza and her lover, Viktor Karenin, at home, a demoralised Fedja seeks solace in Moscow's gypsy quarter. When he meets Maša, a young gypsy girl, Fedja's *joie de vivre* is renewed. Liza, still in love with Fedja, goes to the gypsy quarter to convince Fedja to return to her but when she catches him with Maša, there can no longer be any salvation for their marriage. To forcibly bring about a divorce, Fedja is roped into a farcical arranged liaison with a prostitute but, unable to commit such a dishonest act, he flees. Rescued from an attempted suicide bid by Maša, a desperate Fedja finds himself reduced to faking his own death and taking to the streets as a ›living corpse‹. Fedja's tragic journey concludes in a Moscow courtroom where, unmasked and with his newly remarried wife now facing a bigamy charge, he is left with no other solution than to take his own life.

An early German-Soviet co-production, director Fedor Ocep's 1929 film adaptation of Tolstoj's socio-critical stage play ŽIVOJ TRUP (THE LIVING CORPSE) is a fascinating example of the kind of cross-cultural exchange which took place in filmmaking at the tail end of the silent era. A mixed Soviet-German film crew created an atmospheric depiction of pre-Revolutionary Moscow from almost entirely within the Jofa film studios in Berlin-Johannisthal. Writer-director Ocep, now out of the Soviet Union and on the way to developing a form of cinematic ›transnationalism‹[1], combines Soviet montage techniques with elements of German expressionism to produce a film that proved to be as commercially popular as critically polarising.

Sergej Eisenstein was among those who were openly critical of the film, claiming it reduced Soviet montage technique to »lifeless literary symbolism and stylistic mannerism.«[2] Others, meanwhile, hailed it as a masterpiece. The Austrian critic Friedrich Porges called it a film of »[...] high artistic qualities [...] A valuable, memorable [and] beautiful film! Those unfamiliar with Tolstoj's stage play will find themselves in the midst of an incredibly powerful motion picture.«[3] In an international poll conducted by the German newspaper *Der Deutsche*, THE LIVING CORPSE ranked fifth in the top films of 1929.[4]

Often at the receiving end of the critics' praise was the towering central performance of Vsevolod Pudovkin as Fedja. The film provided the great Soviet film theorist and director of such masterworks as MAT' (THE MOTHER, 1926), KONEC SANKT PETERBURGA (THE END OF SAINT PETERSBURG, 1927) and POTOMOK ČINGIS-CHANA (STORM OVER ASIA, 1928) with his only leading role. Recalling his experience in taking on this ›big and complex‹ task, Pudovkin later remarked: »my work in THE LIVING CORPSE was carried out to an extent with considerable and profound inner feeling and was heavily charged emotionally [...].«[5]

Although its anti-religious tone brought it into conflict with the censors in some countries, the film was a worldwide success; the ›thunderous applause‹ that reportedly followed the premiere screening at Berlin's Capitol Theatre on 14th February 1929 echoing internationally.[6] When the film arrived in Vienna on 9th April 1929, its Austrian distributor – the Allianz-Filmfabrikations- und Vertriebsgesellschaft m.b.H. – marketed it with the slogan, ›the film everyone must see‹; a claim, which turned out to be something of a self-fulfilling prophecy. Before going on general release on 17th May 1929, the film played in a four-week exclusive run at the Schwedenkino to a constantly packed house.[7]

Even before it was seen by audiences, the film already existed in two different versions: an initial 3,552m cut rushed together to fulfil the yearly quota was later reduced to 2,968m just prior to the film's Berlin premiere.[8] The film's widespread popularity led to the creation of several other versions, as international distributors each took it upon themselves to conform the film to local tastes. The extent of the changes made by distributors could at times be extreme.

By the time THE LIVING CORPSE had reached America in January 1931 (its delay in no small part due to the appearance of a ›talkie‹ version of the same Tolstoj play directed by

DER LEBENDE LEICHNAM / ŽIVOJ TRUP
Vintage publicity still of Gustav Diessl as
Viktor Karenin and Maria Jacobini as Liza
Protasov (Courtesy of the Austrian Film
Museum Stills Collection)

Fred Niblo and starring John Gilbert), the film was a pale shadow of its former self: shortened drastically and with an added soundtrack. Ironically, *Variety*, which praised the film, felt it might have been even better had it been one or two reels longer. »And,« the reviewer concluded, »there is no higher praise than that.«[9]

In the long run, the success of THE LIVING CORPSE has proven bittersweet: the film's original negative no longer survives. While the film's international popularity has ensured that prints and duplicates of varying lengths and quality have ended up in film archives around the world, none of these elements correspond exactly to the film that was seen by Berlin audiences in February 1929.

A major restoration carried out by Martin Koerber for the Deutsche Kinemathek in 1988 attempted to return Ocep's film to some semblance of its original form by combining footage from three different sources. However, owing to the deficiencies of the available film elements, there was still room for improvement. When it was decided that the retrospective of the 2012 Berlin International Film Festival would be dedicated to the work of the production companies behind THE LIVING CORPSE – the ›red dream factory‹ Mežrabpom-Fil'm and its German counterpart Prometheus – an opportunity arose to revisit the restoration.

In the quarter century that had passed since the first restoration, several film elements had resurfaced in European film archives that would allow for a more complete, authentic reconstruction of the film's original premiere cut. The increasing affordability and availability of digital technology for use in archival film restoration projects meanwhile opened up new possibilities for realising the complex technical work required.

The new restoration of THE LIVING CORPSE was a collaboration between the Deutsche Kinemathek and the Austrian Film Museum. For the Film Museum, who provided not only an important source element but also (thanks to a collaborative project with the Austrian Film Gallery and Filmarchiv Austria) key technical resources, the restoration would serve a dual function: on the one hand, it would ensure the preservation of a valuable artefact from the Film Museum's collection, and on the other hand, would allow contemporary (and future) audiences to experience Ocep's film in the closest form possible to its no longer existent premiere version.

The project was a complex undertaking, involving the use of both analogue and digital techniques to combine footage from four different film elements. The experience has proven an invaluable one for the Austrian Film Museum's restoration staff. Being their first large-scale digital restoration project involving several different source elements, a great deal of learning-by-doing was inevitably required. However, the knowledge gained from the experience will serve to aid future projects of a similar nature. This article charts the steps in the restoration, explaining the main curatorial and practical decisions that were taken and providing a detailed account of the technical processes applied.

The first step in the restoration was to collate the various film elements that had been provided for the project by the two partners and fellow members of the International Federation of Film Archives (FIAF). An assessment was carried out in May and June 2011.

Available from the previous restoration was a 35mm duplicate negative printed (for the most part) from a fine grain duplicate positive of the Danish distribution version belonging to the Danske Film Museum in Copenhagen. The analogue duplication work had been carried out by the Staatliches Filmarchiv der DDR in East Berlin, one of very few archives in Europe with a working film laboratory.

The Danish duplicate positive originated from a nitrate dupe negative, which itself had been printed from a vintage nitrate release print. While no less than four generations removed from the original camera negative, the dupe negative nonetheless bears images of high photographic quality. Unfortunately, a number of key scenes were missing from the Danish source element. Martin Koerber attributes these losses, which include virtually all of the ›kaleidoscopic‹ Soviet montage sequences, to the more conservative tastes of the original Danish

distributor.[10] For the sake of completeness, these scenes had to be inserted from an inferior quality duplicate, sourced from 35mm material held by the DDR film archive. These sequences are easily identifiable on account of their higher contrast and lower definition, as well as the presence of a thick double frame line at the bottom of the frame, the result of careless printing work undertaken in the past.

The original German intertitles play a significant role to serve the film's narrative, their highly stylised design providing a graphical expression of Fedja's inner emotional turmoil. These had to be recreated for the 1988 restoration by Thomas Wilk, modelled after flash titles which had survived in a nitrate duplicate negative held by the BFI National Film Archive in London. Flash titles, named as such because they typically measured just two or three frames and would thus appear as a short ›flash‹ if the film were to be projected at full speed, were often spliced into negatives as reference markers for domestic and foreign distributors. In prints struck from this negative, the flash titles were intended to be cut out and replaced by full length intertitles. By their very ›ephemeral‹ nature, they are not usually suited to reprinting. The opening credits, missing in the BFI's negative, were created from scratch, imitating the design of the originals. In addition, three vintage 35mm black and white nitrate prints were provided by the Austrian Film Museum, the Cinémathèque suisse and the Fondazione Cineteca Italiana respectively. The Austrian Film Museum's print is a first generation print struck on German Agfa and Zeiss Ikon film stock directly from the original camera negative, most likely at the time of the film's initial release. Since the original camera negative itself is not known to exist, such a print represents the earliest surviving element and therefore the most valuable source for a restoration. Triangular marks are present on the edge of the frame, left by the printer originally used to strike the print. The marks, which alternate between a single and a pair of triangles, were a convenient method employed by German film laboratories to denote the particular machine that had been used to print the film. In the event of a problem, the markings could be used to identify the printer in question and thus solve the problem more rapidly.[11] The same marks can be seen on the Deutsche Kinemathek's dupe negative, although they have been partially obscured as a result of several generations of reprinting. This suggests that the no longer existent Danish release print had, like the Austrian print, been produced in Germany. Like the BFI's dupe negative, the Austrian print contains the original German language titles as flash titles. However, the Austrian print also significantly contains the long-unknown original opening titles. The opening titles present in the Austrian print reveal subtle differences to

DER LEBENDE LEICHNAM / ŽIVOJ TRUP
Scanned frame from the Austrian Film Museum's nitrate print. Note the triangular printer mark top left (Courtesy of the Austrian Film Museum, Vienna)

the reconstructed opening titles of the 1988 restoration. Where Anatolij Mariengof and Boris Gusman are credited as scriptwriters in the 1988 restoration, director Fedor Ocep receives sole credit for the screenplay in the Austrian print. Another curious revelation was that the name of the Soviet production company – Mežrabpom-Fil'm – had been originally misspelled, the titler having inexplicably left out the ›b‹.

Since the flash titles were still present, the Austrian print had clearly not been prepared for public screening at the time of release. As a result, the print is in remarkable physical condition compared to a well-used projection print of the same vintage. Unfortunately, in the interim years the 83-year-old print has suffered some damage, including a number of splices and scratches on both the base and emulsion sides (its journey before reaching the Film Museum's archive still somewhat clouded in mystery). The editing of the Austrian print is identical to the 1988 restoration except for one short sequence, in which three shots were mistakenly printed twice in the DDR archive's source material used for the previous restoration. The print measures 2,357m but, on account of the flash titles, its missing footage amounts to only 190m (corresponding to seven and a half minutes of screen time). This makes it the longest of the surviving prints.

The nitrate print provided by the Cinémathèque suisse is, like the Austrian print, a first generation print struck directly from the original camera negative on the same kind of film stocks at the same German laboratory. The print features the same triangular marks on the edge of the frame as the Viennese print and which were also still present on the 1988 restoration nega-

tive. Unsurprisingly, as a result of their common origins, the Swiss print is virtually identical to the Austrian print in terms of photographic quality, though it tends to air on the darker side. The print represents a version produced for distribution in Switzerland, containing bi-lingual intertitles in German and French that have been rendered in a more conventional design than the more stylised titles of the German release version. In contrast to the ›unreleased‹ Austrian print, the Swiss print has suffered increased wear and tear as a result of heavy use. The majority of the damages are present within the film frame (e.g. scratches, flecks of dirt, blotches, etc.), while the perforated area remains surprisingly well-intact, despite some light misshaping. Like the Austrian print, the Swiss print follows the editing pattern of the 1988 restoration with the exception of the aforementioned superfluous shots. Measuring 2,644m with full-length intertitles, the Swiss print is missing more footage than the Austrian one. Most notably all of the Soviet montage sequences have been removed from the print in what appears to have been a deliberate act similar in nature to the ›conservatism‹ of the film's Danish distributor. Despite this, the Swiss print still contains several shots and sequences not present in the Austrian print.

The third nitrate print, coming from the Fondazione Cineteca Italiana in Milan, was not struck from the original camera negative like the Swiss and Austrian prints but rather from a duplicate negative. While edge-markings printed through from the negative reveal it to have been produced on Pathé safety film stock of French origin, the print itself is on nitrate film stock made by Ferrania, Italy's only manufacturer of raw stock, and was presumably struck at an Italian laboratory.[12] Belonging to a later printing generation, the Italian print falls much below the Austrian and Swiss prints in terms of photographic quality with soft images lacking in any fine details and featuring muddy shades of grey in place of strong blacks and whites. Damage printed through from previous generations is also apparent.

The Italian print is the only one of the available prints where the editing deviates sharply from the familiar pattern of the other prints, as well as the 1988 restoration. Many key sequences have been either moved to a different position within the film or removed altogether. Likewise, individual shots within sequences have also been rearranged or cut out. Indications in the print reveal that much of the re-editing work had already been carried out on the duplicate negative before printing.

The distributor's re-editing and re-titling work removes the anti-religious overtones of Tolstoj's original tale and places the character of Liza at the centre of the drama (the fact that she was played by the popular Italian actress Maria Jacobini seems hardly coincidental). Fedja, meanwhile, has been reduced to little more than a villainous supporting player now actively standing in the way of Liza and Karenin's happiness. A number of key supporting characters, in particular those of a dubious moral nature (such as the prostitute with whom Fedja must conduct his staged affair), have been removed from the story entirely.

At only 1,320m in length, the Italian print is the shortest of the surviving prints. Gaps in the narrative and surviving censorship records suggest that it may have once been longer (the Italian release version is recorded as originally being 1,930m). Its physical condition is also less than perfect, with much damage present to the perforated area.

While inspection work was being carried out, tests were made to determine a suitable restoration workflow. Although the Berlin Film Festival would provide a prestigious venue for the new restoration, it also imposed a strict deadline upon it. It was important therefore to establish a workflow that would ensure the project could be completed on time without compromising the archival and curatorial standards set by the archival partners.

A sample of the Austrian Film Museum's print was scanned on the *Arriscan* 084 installed at Filmarchiv Austria's archival storage facilities in Laxenburg. The scan data was then graded and recorded out to 35mm negative film. A 35mm answer print was struck from this negative and the result compared side-by-side with a 35mm print of the 1988 restoration. While the test print marked a definite improvement in visual quality over the previous restoration in some regards, the improvement was not deemed significant enough to warrant a full-scale digital restoration on the basis of the nitrate prints.

Tests carried out on the 1988 restoration negative at Synchro Film laboratories in Vienna proved that good results could still be obtained using standard analogue printing methods. It was decided, therefore, to retain this duplicate negative as a printing master, removing the poorer quality sequences originating from the DDR material (around 10% of the total film) and replacing them with the equivalent footage from the Austrian, Swiss and Italian prints to achieve a more uniform image quality. The 1988 restoration negative had itself already been preserved in the form of a duplicate positive and several screening prints. Records of this version therefore would remain for future reference, despite the inevitable ›destruction‹ of the negative as a result of the chosen workflow.

The comparison had shown that no major editing changes were required, other than removing the three superfluous shots carried over in the previous restoration from the DDR archive's

source material. New renditions of the film's original opening titles, created digitally from the flash titles in the Austrian print, were added in place of the reconstructed titles of the 1988 restoration. Although historio-ethically suspect by today's standards, occasional spelling mistakes had been corrected in some of the intertitles in 1988. For consistency's sake, therefore, the missing ›b‹ in Mežrabpom-Fil'm was re-instated.

Of the 51 individual sequences that would have to be replaced, 48 existed (either wholly or partly) in the Austrian print, while 40 had survived in the Swiss print, and 23 were available in the Italian print. Owing to the Austrian print's completeness and superior quality, it was decided, where possible, to take the replacement footage from this print. If the sequence was not present here, it would be taken from the Swiss print, determined to be in second best condition and photographically the closest match to the Austrian print. One sequence missing from both the Austrian and Swiss prints could be recovered from the Italian print, which despite its inferior picture quality still represented an improvement over that which had previously been available.

Since the Austrian print was to provide the majority of replacement sequences, and in order to produce a record of the archival artefact in the exact same state in which it survived, the Film Museum decided to scan its own print in its entirety. This record would then be retained for study purposes and could potentially serve as a basis for future restoration attempts, should it one day prove necessary to revisit the film again.

The required sections of each print were scanned on the *Arriscan* in ›soft archive mode‹, whereby less tension is applied to the fragile film elements as they are transported through the scanner gate. A wet-gate appliance was used to hide the appearance of superficial scratches to the film base on the scans, thus reducing the amount of correction work that would need to be carried out later on. Samples of the Deutsche Kinemathek's duplicate negative were also scanned to provide a visual reference when conforming the various digitised source elements later on. All elements were scanned at 3K resolution (3072x2160 pixels) and a 10-bit logarithmic colour depth. The scans were saved as sequential image files in Digital Picture Exchange (DPX) format. The scanning of the Film Museum's nitrate print took the entire month of June 2011, with the partial scanning of the Swiss and Italian prints being performed in August. The raw scan data was then transferred to the digital restoration facilities in Krems, where around 28,000 individual frames were digitally stabilised, cleaned and graded before being recorded back onto 35mm film.

DER LEBENDE LEICHNAM / ŽIVOJ TRUP
Example of Opening Title Restoration. Title as it appears in the Austrian Film Museum's nitrate print (top) and restored title with ›corrected‹ spelling mistake (bottom) (Courtesy of the Austrian Film Museum, Vienna)

Two different kinds of image instability present in the raw scans had to be corrected. The first, resulting from the scan process itself, appeared at points in the prints where particularly thick splices were present, causing the film to ›jump‹ as it passes through the scanner gate. The other form of instability derived from the mechanical imprecision of the printers used to produce the prints originally. In contrast to the jump effect caused by the scanner, which usually lasted for only one or two frames, this latter kind of instability could affect entire sequences or even whole reels.

Tests showed that automated digital tools could not suitably correct the instability caused by the scanner. This work was therefore carried out manually using the HS-Art programme

Dust Buster Plus in Clone mode. Up to 30 seconds were required to correct each individual frame in order to successfully remove the jump effect without altering the film's natural motion. Automated processes could be used to reduce the instability caused by the printing methods employed at the time of the film's original production. Excessive stabilisation was avoided so that the film's original historical characteristics would not be erased and that the new replacement sections would not appear over-restored alongside the parts retained from the existing duplicate negative.

A significant amount of dirt was also present on the scans that would have to be removed digitally. Here the Italian print, which was extremely dirty but could not be subjected to aggressive cleaning treatments prior to the scan on account of its fragile state, proved particularly problematic. To clean the one sequence required from this print took several hours of work and utmost care and attention, as digital dirt removal can often lead to unwanted visual artefacts. After the images were stabilised and cleaned, they were graded using the digital post-production software *Scratch* developed by Assimilate Inc. in the US. The sample scan of the Deutsche Kinemathek's duplicate negative served as a reference for the grading to ensure a level of consistency between the ›new‹ digitally restored material and the pre-existing negative. A second test was recorded out to 35mm negative film and printed to check the grading before proceeding to the final step.

Once the grading had been checked and approved, the graded files were up-sampled to 4K resolution (4096x3112 pixels) and recorded out to 35mm negative film using an *Arrilaser* 01. Since the Deutsche Kinemathek's duplicate negative had been printed on acetate film stock, the digital intermediate data was recorded onto Kodak 5234 acetate film to facilitate the joining of the two negatives by ›wet splicing‹. To avoid the loss of frames through re-splicing, it was decided to incorporate always the shot preceding and following the required sections. This meant that a new splice could be made at a point in the film where no splice had previously existed. The editing of the two negatives was carried out in two days at the close of 2011 by Edith Schlemmer, the Austrian Film Museum's senior archivist. The cut negative was then delivered to Synchro Film for the production of a new 35mm print. Inevitable differences in the two negatives, due to them having been produced by very different means at different times on different film stocks, could be compensated to a certain extent in the grading of the positive print. The debut screening of the newly restored 35mm print of THE LIVING CORPSE took place during the Berlin Film Festival on 12th February 2012 – in the same city and almost 83 years

to the day since the film's world premiere in 1929. The screening was accompanied by a live recording of the original musical score compiled by Werner Schmidt-Boelcke for the premiere. The score had been reconstructed from fragments surviving in the Library of Congress by Frank Strobel and Gerd Luft at the time of the last restoration and recorded for broadcast on the German television channel ZDF that same year.

The reinsertion of the original opening titles now brings THE LIVING CORPSE closer to matching its premiere version than had been previously possible. The improved picture quality of the replacement sequences, meanwhile, has produced a more homogenous result, which aids the viewing experience greatly. The result still remains, however, a compromise between curatorial fantasies and archival realities, influenced by the availability and state of the source materials, as well as the technological and practical limitations that every restoration is ultimately subject to. While a handful of the shots to be replaced had not survived in any of the nitrate prints, they may resurface in a better form in future. That these shots must for now remain in poor quality serves as a reminder that the restoration of THE LIVING CORPSE, despite the film's literary origins, is far from being a ›closed book‹.

* All Russian names and film titles are here transliterated from the original Cyrillic script following the scientific transliteration standard. This standard is employed by the Austrian Film Museum in all its publication activities.

[1] MacKenzie, Scott (2003). »Soviet Expansionism: Fédor Ozep's Transnational Cinema«. *Canadian Journal of Film Studies* 12 (2), 92-104.

[2] Eisenstein, Sergej (1929). »A Dialectic Approach to Film Form«. In: Eisenstein, Sergej & Jay Leyda (eds./trans.) (1949). *Film Form: Essays in Film Theory.* San Diego, New York, London: Harcourt, 55.

[3] Porges, Friedrich (1929). »Tolstoi-Film. DER LEBENDE LEICHNAM mit Pudowkin als Fedja«. *Der Tag* (2260 = Wednesday, 10th April), 4.

[4] Gilette, Don C. (1930). »German

Newspaper Selects Best Productions of 1929«. *The Film Daily* 51 (3 = Sunday, 5th January), 14.

[5] Pudovkin, Vsevolod & Ivor Montagu (trans.) (1949). *Film Acting,* New York: Lear, 147-149.

[6] Anon. (1929). »Tolstois LEBENDER LEICHNAM im Film«. *Wiener Allgemeine Zeitung* (Wednesday, 3rd April), 6.

[7] Anon. (1929). »DER LEBENDE LEICHNAM«. *Der Tag* (2274 = Friday, 26th April), 8.

[8] Meier, Gerd (1962). »Materialien zur Geschichte der Prometheus Film-Verleih und Vertriebs GmbH. 1926-1932« (Part 3 of 8). *Deutsche Filmkunst* 10 (3), 97.

[9] »Waly.« (1931). »THE LIVING CORPSE (Russian Made) (Synchronized)«. *Variety* (14th January).

[10] Koerber, Martin (1988). »Über die Restaurierung«. From the distribution leaflet produced to accompany the film, available on the Deutsche Kinemathek's online rentals catalogue, accessible at http://verleih-filme.deutsche-kinemathek.de/

[11] Wilkening, Anke (2010). *Filmgeschichte und Filmüberlieferung: Die Versionen von Fritz Langs SPIONE 1928* (=Filmblatt-Schriften Beiträge zur Filmgeschichte 6). Berlin: Cine-Graph Babelsberg, 19.

[12] Giuliani, Luca & Sabrina Negri (2011). »Do you have any 16mm nitrate films in your collections? The Case of Ferrania materials in the San Paolo Film Collection at the Museo Nazionale del Cinema in Turin«. *Journal of Film Preservation* (64), 36.

Lost and Found.
Restoring James Benning's
AMERICAN DREAMS
(LOST AND FOUND)

In 2007, the US-American avant-garde filmmaker James Benning deposited all his master film elements with the Austrian Film Museum in Vienna – among them the original 16mm camera reversal of his first ›text-image film‹ masterpiece, AMERICAN DREAMS (LOST AND FOUND) (1984). Benning's strict desire for complete independence as a filmmaker had left his films without the kind of protection offered by a large studio infrastructure. Many of the older films, including the aforementioned AMERICAN DREAMS, were suffering badly from the ›vinegar syndrome‹, a term commonly used to describe the inherent (and irreversible) degradation of the acetate film base. The production of acetic acid as a result of the decomposition leads to a strong, vinegar-like smell. The systematic preservation of the films was therefore called for. In the case of AMERICAN DREAMS, the image emulsion on the 16mm original camera reversal also showed serious evidence of colour decay, which had resulted in a strong dark blue cast as well as an increase in the image density overall. An attempt to try to restore the film's original colour grading via traditional photochemical restoration techniques would have met with limited success. Thus, the film became the candidate for the Austrian Film Museum's first large-scale digital restoration project – a project, which turned out to be as challenging as the film itself is fascinating.

Born in Milwaukee in 1942, James Benning began making films in 1971, whilst still a student at the University of Wisconsin (he was studying film under David Bordwell at the time). Benning's work is dominated by a strong sense of autonomy – working alone, he personally executed or supervised every step in the production process of each film. A predilection
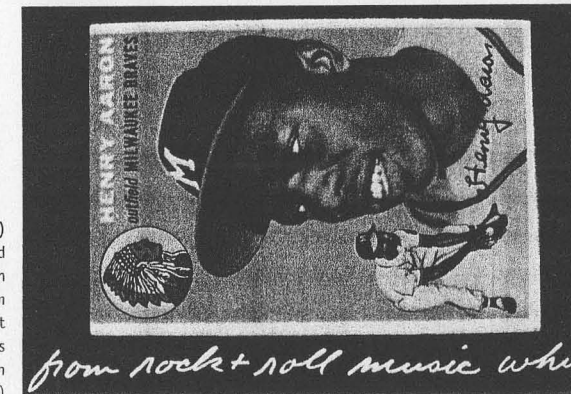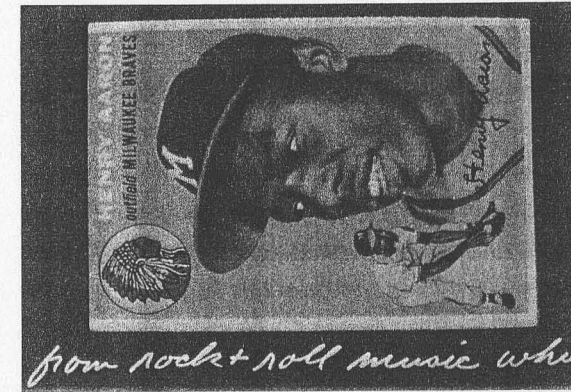
AMERICAN DREAMS (LOST AND FOUND)
Comparison of frame before and
after colour correction
Top: Ungraded ›raw‹ scan from faded 16mm
Original Camera Reversal (OCR) element
Bottom: Graded image with restored colours
(Courtesy of the Austrian
Film Museum, Vienna)

for formal experimentation in both the production and post-production stages is also a key feature of his work, employing whatever effect he deemed necessary in order to best convey his message: from optical printing effects such as dissolves and stretch printing to mixing different film stocks (positive and negative, b/w and colour); from rapid editing to the uninterrupted long takes (reaching upwards of 10 minutes) that characterise his later film works. Benning's formal experiments arguably reached a peak in 1984 with AMERICAN DREAMS (LOST AND FOUND), the first in a series of what the filmmaker calls his ›text-image films‹. This highly complex film consists of three separate yet interconnected layers of audiovisual information: memorabilia relating to Henry Louis ›Hank‹ Aaron, the legendary baseball player

who hit 755 home runs in a 23-year career playing for the Milwaukee (later Atlanta) Braves and the Milwaukee Brewers; extracts from the diary of Arthur Bremer, who became infamous for his assassination attempt on presidential candidate George Wallace in 1972; and the soundtrack, blending ›sound bites‹ from historical radio broadcasts and pop songs.

The baseball cards, badges and other merchandise, which Benning had been collecting with his daughter as a hobby since she was ten years old, are depicted in chronological order, starting in 1954 and ending in 1976, thereby tracing Hank Aaron's entire career. The film is divided into twenty-three chapters, one for each year, introduced by a title card stating the number of home runs hit by Aaron that year (13, 40, 66, etc.). The radio excerpts and music – including hits by Elvis Presley, Donna Summer and the Bee Gees – heard in each chapter correspond to the respective year. Running across the bottom of the screen from right to left in a single, unbroken movement, meanwhile, are the handwritten extracts from Arthur Bremer's diary, transcribed by Benning himself (Bremer, like Benning, had been born in Milwaukee). The whole film was produced in the filmmaker's studio apartment in New York in the early part of 1984. Benning describes the production process thusly:

»It took me a month to animate the text and shoot the cards and intertitles; I used 100 feet rolls, one roll per year [...] each roll was triple exposed, once for the text, once for the picture of the cards, and once for the special intertitles for the speeches, music, and card credits. I'd locked down the text I was animating when I changed rolls so the next roll would start where the text left off for the preceding roll. The text was almost 200 feet long and was animated thru at 1/16 of an inch per frame. It was quite tedious.«[1]

In addition to the original 16mm picture element, Benning had also deposited the edited 16mm magnetic soundtrack and several laboratory report sheets with the Film Museum. The filmmaker had retained possession of a 16mm screening print with a combined optical soundtrack, struck directly from the camera reversal on reversal stock, which he kindly provided to consult in the restoration process. Right from the beginning, James Benning was extremely cooperative and very open to the idea of restoring AMERICAN DREAMS digitally. This was in no small part influenced by the fact that Benning himself has become a digital advocate and, starting with RUHR (2009), has produced all his films entirely using digital technology.

A major concern of the technicians and archivists involved in the restoration was the idea of having to ›blow up‹ the 16mm to a 35mm internegative. The *Arrilaser* film recorder, like most machines constructed for this purpose, can only output digital data to 35mm film. It is, of course, technically possible to optically reduce the 35mm image back down to 16mm in the printing of the positive. However, in an age where 16mm film is no longer employed in commercial film production[2], fewer and fewer labs are still capable of carrying out this kind of work. The expense involved, meanwhile, is more than most archives can normally afford for any one project.

A film's format is very much a part of the work itself. This holds particularly true for James Benning, who, before his conversion to digital, shot all his films exclusively on 16mm and whose work is thus synonymous with the format. Changing the format would thereby mean the loss of part of the work's original ›character‹. This issue was considered a potential major obstacle to the project and for a long time kept us in doubt if using digital means to restore the film was indeed the correct decision to make. Only once a series of tests had revealed the extent of the benefits offered by digital restoration technology, did we tentatively begin the process of scanning the 16mm original camera reversal and a significant portion of the 16mm print provided by Benning.

The Austrian Film Museum restored AMERICAN DREAMS within the framework of a joint project with the Austrian Film Gallery, Krems, and Filmarchiv Austria for the digital restoration of archival films. Before digitisation, the 16mm camera picture element and magnetic soundtrack were cleaned manually on the premises of the Film Museum's archive using a common cleaning solvent. Due to the fragility of the material, it was impossible to clean these elements using an ultrasonic or a mechanical cleaner. The picture element was scanned in five days on an *Arriscan* 084, equipped with a 16mm ›wet-gate‹, which is currently located on the premises of Filmarchiv Austria's central film storage vaults in Laxenburg in Lower Austria. Although the *Arriscan* is one of the best scanners currently available on the market, it can be put to a severe test when digitising certain ›troublesome‹ elements. The high density and coarse grain structure of the camera reversal element caused a very peculiar effect in the digital transfer, with the grain somehow being augmented through the addition of digital noise generated by the sensor. The noise was prevalent in all three channels of the colour image (red, green and blue) but, due to the dark blue cast, was most extreme in the blue channel. The overall result was an excessive, often disturbing textural movement effect.

Testing showed no substantial difference between various scanner settings (16-bit linear, 10-bit logarithmic, etc.) and the use of different Look Up Table (LUT) presets and exposure

levels. Thus the film was digitised at a resolution of 2398x1830 pixels and 10-bit logarithmic colour depth in Digital Picture Exchange (DPX) format. The film was scanned using a single exposure, intentionally crushing the signal from the blue channel in order to avoid further digital artefacts during the final denoise/degrain and grading. Since the elements were not excessively shrunken, scanning could be performed using a registration pin to hold the film in place, resulting in a steady image and thus negating the need for any subsequent stabilisation. The film was scanned in two sessions and the files subsequently copied to a 1.5 TB external hard drive for transfer to the project partners' shared digital laboratory facilities in Krems. These ›raw‹ scans were later preserved on LTO-4 tape so that they could be retrieved in future should significant improvements in digital film restoration technology necessitate ›revisiting‹ the restoration – by which time the original camera reversal may have completely perished due to ›vinegar syndrome‹.

Where the original 16mm camera reversal and print were each contained on a single reel, the new 35mm negative and print would need to be split into three reels. The file sequence, consisting of about 77,000 frames, was split into 3 folders corresponding to each of the three reels. The first two folders contained about 30,000 images each, the equivalent number of frames contained on a standard 600m 35mm film reel. The reels were deliberately separated at frames presenting a splice, corresponding to one of the ›100ft rolls‹ shot by Benning. That way, in projection, the reel changeovers at two points in the film where there had never previously been any changeover would not appear too abrupt.

As the fragile camera element could only be cleaned manually prior to the scan, some dirt was still present on the scanned images, which then needed to be ›cleaned‹ digitally. Preliminary automatic dust removal was carried out using the *Diamant* film restoration software by HS-Art to first remove the smallest particles. Then a more complete and accurate dust removal operation was carried out manually. A deflicker effect was applied only to some very short sequences, where the exposure fluctuated strongly. Defects inherent to the film's production, such as original splices and various camera defects (the first frame of each shot ›jumping‹, mask irregularities, hairs in the gate, etc.) were deliberately not removed and only slightly obscured in the most severe cases.

The most problematic stage of the restoration was the grain/noise management. After conducting several tests, it was decided to adopt a two-step process using both the *Diamant DGrain* function and the *Neat Video 2.0* plug-in in *Adobe After Effects*. This procedure en-
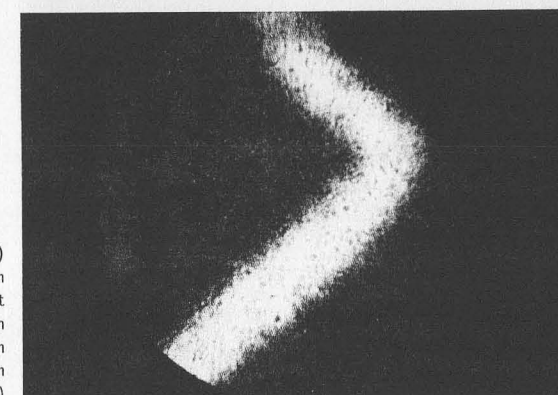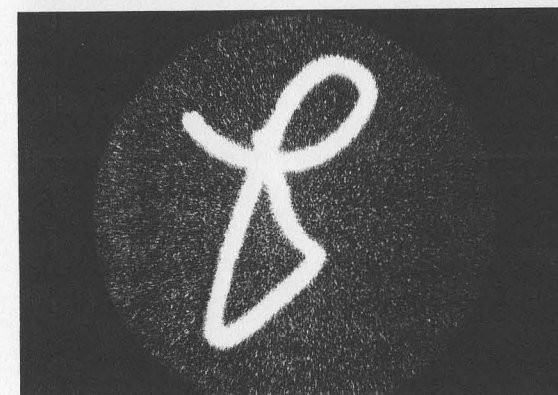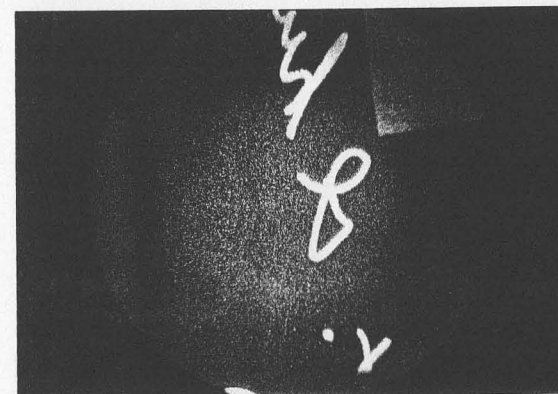
AMERICAN DREAMS (LOST AND FOUND)
Microscopic analysis of grain structure in
16mm Original Camera Reversal (OCR) element
Top: 400% magnification
Middle: 1000% magnification
Bottom: 4000% magnification
(Courtesy of La Camera Ottica, Gorizia)

abled us to preserve the 16mm camera element's characteristically thick grain, whilst removing most of the excessive and unwanted noise. It also allowed us to alter the film's texture slightly to adjust for the ›blow up‹ to the larger 35mm format. The image retouch and grain management took three months in total. The restored image data was saved along with the ›raw‹ scans on LTO-4 tape.

Colour correction and grading were conducted on a workstation equipped with *Scratch*, a post-production software developed and marketed by Assimilate Inc. in the US. To aid the grading process, several sequences (totalling approximately 5,000 frames) of James Benning's 16mm screening print were digitised using neutral settings to produce an undistorted image. These sequences were then used as a reference for recreating the film's ›correct‹ grading. The possibilities offered by digital technology for colour grading are far greater than those offered by photochemical methods. In this case, the original camera reversal element had a much finer texture than the print, revealing far more detail in the background. Gamma and contrast, although very high, were still lower than in the reference print. The final digital grading was mostly homogeneous and thus consistent with the reference print, which had been exposed using only a single printer light setting. Substantial improvements to the colour and white balance, as well as slight shifts in saturation and tone, were applied. All these operations were conducted in such a way, however, as to maintain the look of the film as defined by the context of its original (post-)production. The *Scratch* session files have been retained, thereby making it possible to retrace and reconstruct all the steps in the grading process in future.

A short sample (100m) was printed to 35mm film and the result was compared with the 16mm original. Upon approval of the final grading, the files were rendered and prepared for recording. The files were up-scaled to 4K in 1.37:1 ›Academy‹ format (3686x2668 pixels), respecting the aspect ratio of the 16mm original and ensuring that the projected 35mm image would be comparable to the 16mm. The digital intermediate image sequence was output to 35mm Fuji Eterna-RDI 4511 colour intermediate stock, using an *Arrilaser* 01. The recording process took a total of three weeks. The resulting 35mm intermediate negative, consisting of 80,016 individual frames, ran to 1,520 metres, split over three reels.

At present, the Austrian Film Museum has no possibility to digitise 16mm magnetic sound in-house. This task was outsourced to the University of Udine's film and video laboratory, La Camera Ottica, in Gorizia, Italy, where the original magnetic track was digitised at 32-bit, at a frequency of 48,000 kHz and a speed of 24 frames per second, using a Sondor OMA E.
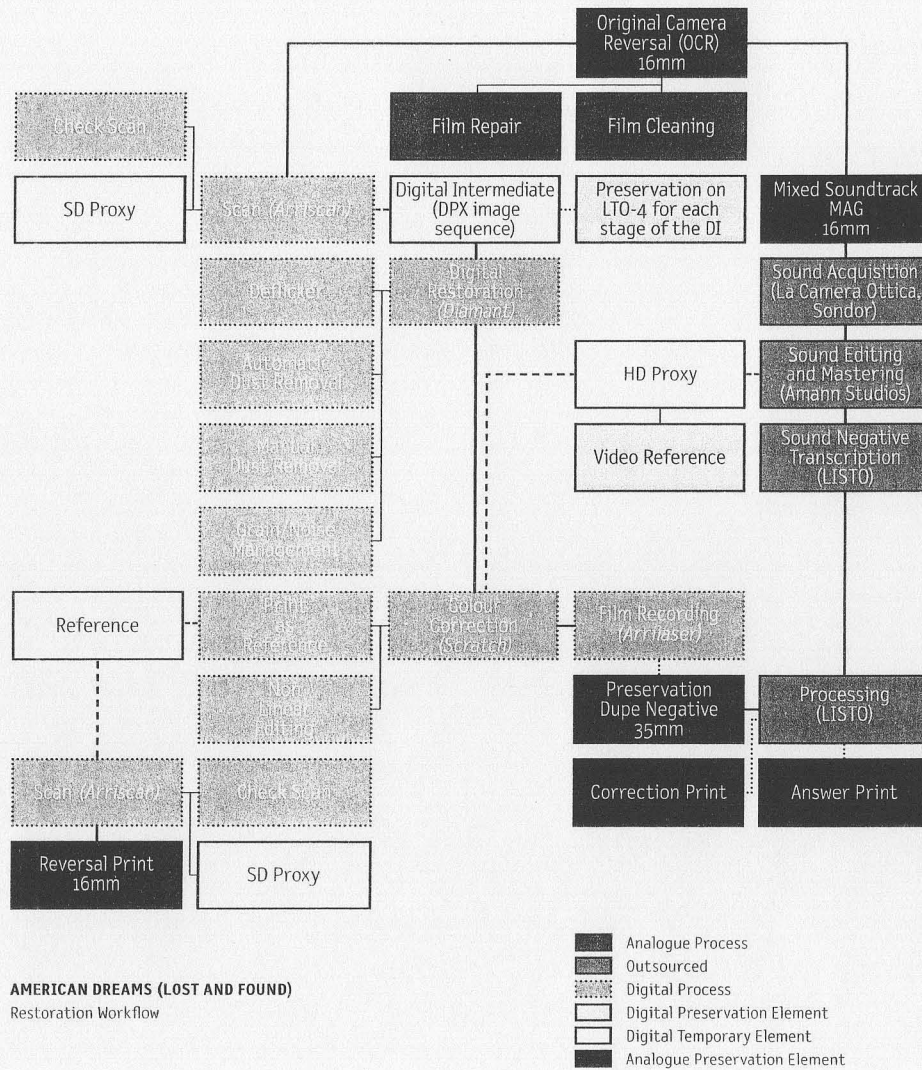

AMERICAN DREAMS (LOST AND FOUND)
Comparison of different intensities of noise filtration ranging from light (top), where the native film grain remains very prominent, to heavy (bottom), where the grain has been suppressed but image details have been lost as a result
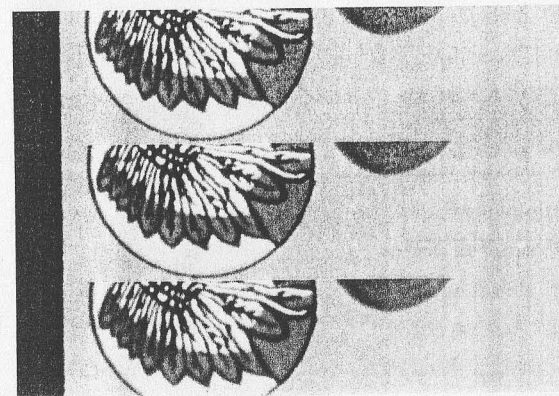
The sound restoration presented an entirely different set of problems: the original 16mm magnetic track consisted of two separate reels of 300 metres each, which had been spliced together. Unfortunately, they had been spliced in the wrong order. Luckily, no unique sound information was lost in the process. The digitised soundtrack was re-edited and mastered by Christoph Amann at his sound studio in Vienna before being delivered to the LISTO film laboratories for creating the new 35mm optical soundtrack negative. A new 35mm print was then struck from the restored picture and sound negatives on Kodak Vision 2383 colour stock.

The premiere of the restored version of AMERICAN DREAMS took place at the Austrian Film Museum on 16th November 2011, in the presence of James Benning. The screening was part of a short season dedicated to the filmmaker's most recent works as well as two restored ›classics‹ from the 1980s – the aforementioned AMERICAN DREAMS and LANDSCAPE SUICIDE (1986), which had been restored entirely by analogue means. The latter two films were also simultaneously released on DVD through the German label Edition Filmmuseum, marking their first appearance in that format. The restoration has since been shown at the 69th Venice Film Festival, where it was screened twice on successive days in a new section devoted to restored classic films ›Venice Classics‹, and the 10th MoMA International Festival of Film Preservation in New York.

AMERICAN DREAMS was the first feature-length film restored digitally by the Austrian Film Museum. It was a particularly challenging project, especially due to the complex grain and

Diagram — AMERICAN DREAMS (LOST AND FOUND) Restoration Workflow:

Original Camera Reversal (OCR) 16mm

Check Scan

Film Repair — Film Cleaning

SD Proxy

Scan (Arriscan)

Digital Intermediate (DPX image sequence) — Preservation on LTO-4 for each stage of the DI — Mixed Soundtrack MAG 16mm

Deflicker

Digital Restoration (Diamant)

Sound Acquisition (La Camera Ottica, Sondor)

Automatic Dust Removal

HD Proxy — Sound Editing and Mastering (Amann Studios)

Manual Dust Removal

Video Reference — Sound Negative Transcription (LISTO)

Grain/noise Management

Reference

Grain as Reference

Colour Correction (Scratch) — Film Recording (Arrilaser)

Non-linear Editing

Preservation Dupe Negative 35mm — Processing (LISTO)

Scan (Arriscan) — Check Scan

Correction Print — Answer Print

Reversal Print 16mm — SD Proxy

Legend:
- Analogue Process
- Outsourced
- Digital Process
- Digital Preservation Element
- Digital Temporary Element
- Analogue Preservation Element

AMERICAN DREAMS (LOST AND FOUND)
Restoration Workflow

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and a significant amount of time; something, which, even in the archival profession, can still often be considered a luxury. The actual restoration process took about five months and involved no less than four staff members from the Austrian Film Museum.

As exemplified by the restoration of AMERICAN DREAMS, digital technology offers seemingly endless possibilities to restore faded colours, to repair film damages, and to correct other flaws and signs of decay far beyond the reach of photochemical means. However, digital restoration also has its limits. Technological development is determined primarily by the commercial market. Most of the equipment and software in use are therefore intended mainly for contemporary post-production purposes and only in some rare cases, such as the *Arriscan* and HS-Art's *Diamant* software, were they developed to successfully accomplish archival tasks.

This situation will remain unchanged until a point where D-Cinema has completely replaced distribution on film. The wheels are already very much in motion.[3] Soon the use of *transmedial* equipment (like scanners and laser film recorders) will be made redundant and, at worst, dismissed or, alternatively, adopted for just a few extremely specific tasks like the production of medium-specific film-art works or archival restoration projects. As examples of the former are comparatively too few to make a difference, it will be up to the film archives to keep film alive in future. When film has finally served its purpose for the mainstream cinema market, there will be room to carve a new niche aimed exclusively at museological activities. Machines could be developed to more efficiently and respectfully preserve the treasures of the past, and digital tools for motion picture film restoration can be pushed beyond their current limits to reach their real potential.

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noise management. As confirmed in ongoing discussions and debates with fellow archivists and restorers (particularly in the context of the ›Digital Film Restoration Within Archives‹ symposium), such treatment requires extreme care, an extended period of intensive testing,

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[1] From an email correspondence with James Benning in 2007. See also: Pichler, Barbara (2007). »American Dreams, American Nightmares«. In: Pichler, Barbara & Claudia Slanar (eds.) (2007) *James Benning* (= FilmmuseumSynema-Publikationen 6). Vienna: Synema, 75-87.

[2] See also the contribution by Matteo Lepore and Raoul Schmidt in this volume.

[3] See also the contributions by Thomas C. Christensen and Martin Koerber in this volume.

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LES ÉQUILIBRISTES GODAYOU (1911)

Front / back cover photograph: before / after digital restoration
(Courtesy of the Austrian Film Museum, Vienna)

An early production by eminent French film pioneers, the Pathé brothers. Taking center stage are two members of a Japanese circus family, which made its name as part of the celebrated Wirth's and Fitzgerald Brothers' Circuses in the 1890s. Digitally restored by the Austrian Film Museum in 2010 from a vintage stencil coloured 35mm nitrate positive print.