Moving Images and the Real:
The Responsibilities of Technology in Expressing
Filmic Reality

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ABSTRACT

Technologies of moving images have been representing reality since the late 1800s. Despite cinema and media histories documenting the relationships between moving images and reality, the vital philosophical enquiry into the mediation of this relationship by distinctive technologies of moving images is yet to be fully explored. This thesis considers successive transitions between technologies of moving images. It focuses on the relationships between technologies of moving images, these transitional phases and the reality such images represent. Crucial to this inquiry is the material relationship of moving images to physical reality. Rather than conforming to a dichotomy between analog and digital technologies, the thesis argues that only relationships between mechanical moving images and reality are indexical, as C S Peirce defines the term. Drawing on Peirce’s notion of indexicality and its application to nineteenth century photography, I argue how shifts in technology modulate the way that moving images represent reality and determine how they can be traced back to that referent. Central to the methodology of this argument is the application of empirical data to moving images that defines their material forms. The thesis demonstrates how the inclusion of engineering data into the discussion of the materiality of moving images demands new understandings of film, video and digital media with regard to their indexicality.

In arguing from a predominantly theoretical viewpoint, current moving image theories do not sufficiently acknowledge the granularity of technology when describing indexical relationships between reality and moving images. I argue for the transposition of an indexical severance, commonly located at the nexus between analog and digital moving images, to be relocated to the site of transformation from mechanical to electronic moving images. This argument is premised on a fundamental attribute of both Peircian indexicality and analog
media—that of continuity in opposition to discretisation. This thesis argues for a nuanced materialist model of successive technologies that distinguishes between the operations of mechanical, analog electronic and digital media. I argue that a division between electronic analog and digital technologies is one best viewed as historical when articulating indexical relationships between moving images and reality. The thesis concludes that mechanical moving images are the only form of automated moving images capable of sustaining indexical relationships with reality and this classification is wholly dependent upon specific imaging technologies.
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DECLARATION BY CANDIDATE

This examinable outcome contains no material which has been accepted for the awarding to me of any other degree or diploma, except where due reference is made in the text of the examinable outcome. To the best of my knowledge this text contains no material previously published or written by another person except where due reference is made in the text of the examinable outcome.

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INTRODUCTION

Introduction

Interviewed in 1981, John Cage says that ‘if technology advances to the point where we forget the difference between television images and real scenes, then we can no longer talk about television’ (p. 215). In 2010, Panasonic launched a North American advertising campaign for 3-D Viera HD televisions that claimed ‘A 3D picture so lifelike, can we still call it a TV?’ (McBride, 2010). Between Cage’s prescient insight and Panasonic’s marketing copy almost thirty years later, a question blending ontology, phenomenology and technology is prompted—what is it that we see when we look at moving images?

Technologies of the automated moving image have been representing reality since the late 1800s. Although cinema and media histories document the relationships between moving images and reality, the vital philosophical enquiry into the mediation of this relationship by distinctive technologies of moving images is yet to be fully explored. This thesis considers successive transitions between technologies of moving images. It focuses on the relationship between moving images, these transitional phases and the action such images represent. Crucial to this inquiry is the material relationship of moving images to physical reality. The notion of the moving image as a representation of reality can be regarded as a mimetic relationship between a sign and its referent. This thesis argues how differing forms of technology mediate this mimesis.

I, like many others, argue that only some relationships between moving images and reality are indexical, as the nineteenth century American philosopher Charles Sanders Peirce defined the term. Unlike other writers however, I propose a transposition of the commonly held indexical severance that occurs as part of the process of digitisation, allowing all earlier moving images an
indexical relationship with reality. This phenomenon has most been often described as a ‘break’ as will be detailed below and in Chapter One, but I argue that ‘severance’ is a more narrowly defined word that better articulates the agency and intent that technologies bring to bear on this action. I locate this severance within the transformative process of analog electronic moving images, represented by analog video and television.

Peirce’s notion of the index is part of a taxonomy that describes relations between signs and their real world referents. To serve as an index, a sign must have a direct relation to its object and Peirce (1992) cites several examples of indices, among them the photograph. Within contemporary media theory, there are significant arguments that describe an indexical break in the shift from analog to digital imaging; that is, a rift of the indexical relation between sign and object (Mulvey, 2003 & 2006; Rodowick, 2004; Manovich, 1999 & 2001; Balides, 2000 & 2003; and Nicholls, 1991, 1994, & 1999). However, a convincing counter-case can be made that indexical relationships between reality and analog electronic moving images are also not sustainable. Rather, the importance of the technological shift between mechanical and electronic moving images is key to understanding alternative possibilities. This thesis argues that the history and lineage of moving images’ indexical relationship with reality can be sequentially coupled to an evolution of imaging technologies beyond the prevalent analog/digital divide. In doing so, I argue for a more granular approach to successive technologies of the moving image.

At its core however, this thesis is concerned with the broader question of how to better articulate the relationship between moving images and reality and to investigate why indexical properties of this relationship are so often assumed. To acknowledge that there is a distinction is primary, but the question of shaping that distinction, of clearly understanding how photographic technologies transform reality, is at the heart of this thesis. Stanley Cavell (1979) arguing for ‘difference’ in the photographic image writes:
One might wonder that similar questions do not arise about recordings of sound. I mean, on the whole we would be hard put to find it false or paradoxical to say, listening to a record, "That's an English horn"; there is no trace of temptation to add (as it were, to oneself), "But I know it's really only a recording." Why? A child might be very puzzled by the remark, said in the presence of a phonograph, "That's an English horn," if something else had already been pointed out to him as an English horn. Similarly, he might be very puzzled by the remark, said of a photograph, "That's your grandmother." Very early, children are no longer puzzled by such remarks, luckily. But that doesn't mean we know why they were puzzled, or why they no longer are. And I am suggesting that we don't know either of these things about ourselves… Yet this seems, ontologically, to be what is happening when we look at a photograph: we see things that are not present. Someone will object: "That is playing with words. We're not seeing something not present; we are looking at something perfectly present, namely, a photograph." But that is affirming something I have not denied. On the contrary, I am precisely describing, or wishing to describe, what it means to say that there is this photograph here. It may be felt that I make too great a mystery of these objects. My feeling is rather that we have forgotten how mysterious these things are, and in general how different different things are from one another, as though we had forgotten how to value them. This is in fact something movies teach us. (pp. 18-9)

**Approach and Context**

The broad arguments of the thesis follow predominantly archaeological rather than genealogical approaches even within the historical tracings of Chapters Two, Three and Four. This is in part because successive technologies of the moving image do not replace previous technologies or alternatively subsume
them as effects within the new as Elsaesser (2006) proposes. I argue that newer technologies ‘must by necessity grapple with the residue of’ previous technologies as proposed by Altman (1984, p. 124) but not in the form of quotation as he argues, but instead, as alternate methods of representation and ultimately, presentation. The discovery of technologies that created television in the late 1920s and the deployment of these technologies worldwide in the 1950s did not extinguish the production or distribution of the previous film based moving images. Filmic, as opposed to videotape or digital representations of reality are still prevalent in the production and display of contemporary moving images sixty years later, amidst substantial technological development for electronic moving images. Similarly the introduction of digital moving image technologies for television in the 1990s did not replace analog television for almost twenty years.

It can be already discerned then that my description of this research as taking an archaeological approach embeds more that a passing reference to nineteenth century historical particularism. This thesis speaks not only to the recovery and analysis of culture primarily through artefacts as is common in archaeology but also to the plurality of practice in the production of moving images and the distinct and at times concurrent technologies that render moving images. This focus on discrete technologies without a desire to assimilate but instead promoting a structure of coupling, can be regarded as a rejection of more recent archaeological schools that privilege continuity and in the case of processual and post-processual archaeology, cultural evolutionism.

Earlier technologies of film are distinct from and not superseded by video technologies. Film’s technique of intermittently recording a full frame of movement to a momentarily static film-strip is fundamentally different from video’s parsing of the frame to its electronic component parts including luminance, chrominance and spatial location and recording these on continuously moving tape, hard drive or solid state media. The resolution, contrast ratio and colour gamuts of film are different than those for video.
These are distinctions of technique and technologies, not easily ranked in terms of verisimilitude and certainly not successive replacements or even imbrications of earlier technologies within more recent developments.

This same vector can be extrapolated forward in addition to tracing previous technologies. In rejecting both mimetic and technological quotation, digital images are open to new forms of display that do not necessarily represent. As emblems of Peircian Icons, they can in an unfettered fashion, present without recourse to previous mimetic recognition or technologies.

This thesis’s archaeological site-based approach to the history of moving image technologies also ascribes to Kracauer’s (1960) linking of his approach to cinema with a recommended approach to treating history. He defends the exploration of smaller found stories over larger theatrical treatments for both historians and filmmakers in order to better understand larger themes of culture and society. In radiating outwards from specific technological moments this thesis encompasses parallel developments, discovers links and cycles, revolutions and sequences that form traceable lines through history and simultaneously preserves the autonomy of distinct technologies. These traces can be observed then as cinematic fault lines demonstrating potential for upheaval and reinvention of the material terrain of moving images.

In this, I agree with Altman’s (1984) position that there is ‘no simple straight line from the Ark of the Covenant passing through Assisi, Quattrocento perspective painting, Renaissance and neoclassical theatre, photography, cinema, and TV. Instead there is a complex web of constantly changing relationships among representational technologies’ (p. 124). I do not subscribe however, to Altman’s McLuhan-like argument that the historical challenge is in ‘identifying the return of one repressed representational system in another’ (ibid). I argue that distinct representational technologies do operate in succession but that these distinctive technologies at times determine their form and processes of representation independently of earlier iterations. The
materiality of technologies instrumental in creating and presenting moving images is a clear example of this.

To be clear; the eschewing of overtly filmic content and presenting ‘film as film’ often referred to as Structuralist or Materialist film is only peripheral to this thesis. Film theorists in this sub-field including Peter Gidal (1976 & 1989), Stephen Heath (1981), Malcolm Le Grice (2002) and A. L. Rees (1999) represent majority positions regarding the role of moving image content in materialist approaches. Gidal emblematically argues that ‘the Structural/Materialist film must minimise the content in its overpowering, imagistically seductive sense, in an attempt to get through this miasmic area of “experience” and proceed with film as film’ (1976, p. 2). The materialist focus in this thesis however, moves beyond the presentation of self-reflexive moving image content and considers moving images to be—in no small part—outcomes of specific technologies. In this, the thesis considers primarily the inscription of the work and the technology that inscribes.

Importantly then, and more broadly, this project treats history as a largely theoretical object; as a ‘political understanding’, after film theorists Metz (1982), Comolli (1996) and Heath (1981), rather than as what might be regarded as ‘historical’ (Heath, pp. 225; 228). Metz argues that:

*The technical* does not designate a kind of enclosed area sheltered from history. It is true that the technical, by the very fact that it works, proves the scientific (and not ideological) truth of the principles that are its foundation. But the *how* of its functioning (the ways in which the machine is regulated) which is distinct from its *why*, is nowise under the control of science and brings into play options which can only be of a socio-cultural order. (trans. Heath, 1981, p. 225)

As Heath (1981) notes further, the history of technology is especially problematic given its scientific basis and apparent objectivity. It is all too easy
to isolate technology from its societal and ideological elements in order to
foreground technology, or as he argues, ideology:

Cinema does not exist in the technological and then become this or that
practice in the social; its history is a history of the technological and
societal together, a history in which the determinations are not simple
but multiple, interacting, in which the ideological is there from the start
– without the latter emphasis reducing the technological to the
ideological or making it uniquely the term of an ideological
determination. (p. 227)

Many early incarnations of technological determinism consider technology to
be autonomous and able to leverage an effect on society as an independent
force (Smith, 1994). This thesis acknowledges after Metz (1982), Heath
(1981), Neale (1985), and Balides (2000 & 2003) that technologies—and
particularly communications technologies—are part of wider cultural and
social processes that have a bearing on which technologies are developed and
also how they are used. Moving image technologies have cultural meanings and
are developed within societies, not applied to them from an external position.
These technologies add to pre-existing social patterns and allow for active and
passive interactions.

Practice and theories of the moving image have interrogated reality in many
different ways throughout its brief history. Initial commentary on the late
nineteenth century actualities of the Lumières’ was countered by the
manipulated reality of Méliès’ moving image work. In the early twentieth
century, theory of the moving image largely moved onto Formalist traditions as
exemplified by Arnheim and Balázs, French surrealism of the 1920s, a focus on
montage by Eisenstein, Pudovkin and Alexandrov, and Italian neorealism. This
was followed by Bazin’s celebrated ontology of the photographic image in the
1940s. In turn Merleau-Ponty’s existential phenomenology, Kracauer’s social
mimesis, various forms of Structuralism of the late 1960s and 70s drew directly
and indirectly on the semiotics of Peirce, György Lukács and Swiss linguist Ferdinand de Saussure to articulate the relationship between reality and the moving image. Psychoanalytic approaches of the 1970s examined the psychic dimension of the impression of reality that moving images offer. Succeeding this, the poststructuralism of Foucault, Lacan, Kristeva, and Derrida’s notion of \textit{trace} replacing sign, argued for the instability of signs, unfixable signifiers, and a displacement from reality. The mid 1980s and 90s introduced cognitive theory to ideas of the moving image. Cognitive theorists for the most part eschewed semiotics and psychoanalysis to link accepted science, incorporating informatics, perception, and reasoning with filmic conventions to explore the realities offered by moving images and the relationship between them. Subsequent to this period, theorising the relationship between moving image and reality revolved around affect, embodiment, haptics and immersion, usually from phenomenological stances. The philosophy of film which had emerged out of the gap created by film theory’s cultural turn in the late 1970s has also in contemporary dialogue become increasingly concerned with notions of reality and the inherent or ontological properties of the moving image. This short but varied history and the role of theory and technology in creating and responding to creating new realities for the moving image is examined in detail throughout Chapters Two, Three, and Four in turn.

There are different notions of reality and many of these are measured perceptually. There are also different classes of moving image realities. In a Bazinian (2004) sense, these are a blend of represented and representation. Questions of aesthetics, cognition, and perception must be tackled in any investigation of the real, or of what the experience of reality consists, even if ontological. Similarly, different kinds of filmic reality must be considered. Filmic reality can be experienced as external representations using familiarity and recognition, which I refer to as ‘referenced photo-realism’ or as an insular essentialism, which I refer to as ‘fantastical photo-realism’. This thesis takes on the challenge proposed by Bazin (2004) that
if the paradox of the cinema is rooted in the dialectic of concrete and abstract, if cinema is committed to communicate only by way of what is real, it becomes all the more important to discern those elements in filming which confirm our sense of natural reality and those which destroy that feeling. On the other hand, it certainly argues a lack of perception to derive one’s sense of reality from these accumulations of factual detail. (p. 110)

For Bazin the relationship between the moving image and reality is one in which the cinematic apparatus inscribes the space of objects and their environment. This can be regarded as an argument concerning the required blend of ontology and phenomenology; an argument concerned with the essence of represented reality and the creation of the filmic representations of reality.

**Definitions and Scope of the Thesis**

Regardless, a requirement to define ‘reality’ in this thesis remains. Descriptions of differing realities in this thesis are after the philosopher Etienne Souriau’s (1953) writings that introduced Aristotle’s term *diegesis* to film studies. Souriau’s pre-structuralist approach to aesthetics attempts to offer a scientific method for understanding and systematising film and art. The work has no published English translation but demonstrably influences contemporary arguments regarding diegisis in the moving image including those in Neumeyer (2009), Stilwell (2007) and Metz (1982). Souriau’s taxonomy of reality as mediated by the moving image has also been usefully summarised in English by theorists including Edward Lowry (1985, pp. 84-7), Frank Kessler (1998, pp. 63-78; 2009, p. 192), and Warren Buckland (2000, pp. 46-51). Diegetic taxonomies are often contrasted with mimetic frameworks including that proposed by Peirce (1867), but Souriau’s seven levels of filmic reality are appropriate to distinguish between the kinds of reality being described in this
materially framed thesis. Buckland describes Souriau’s levels of reality as follows:

1. Afilmic reality (the reality that exists independently of filmic reality)
2. Profilmic reality (the reality photographed by the camera)
3. Filmographic reality (the film as physical object, structured by techniques such as editing)
4. Screenic (or filmophanic) reality (the film as projected on a screen)
5. Diegetic reality (the fictional story world created by the film)
6. Spectatorial reality (the spectator’s perception and comprehension of a film)
7. Creational reality (the filmmaker’s intentions) (p. 47)

These terms—particularly Afilmic- and Profilmic- reality—are used in this thesis after Souriau (1953).

Lowry (1985) notes that Souriau’s first two levels of reality are external to ‘the film itself’ (p. 85). This then is an analysis of the ‘filmic universe’ and is concerned with the spaces and contexts of the moving image, not only the image itself. Also, Lowry translates Souriau’s definition of profilmic reality as: ‘all that I see on the screen (even an animated cartoon) has been created by the photograph of a real, physical object’ (ibid). This is noteworthy for three reasons. First, that it is a materialistic concern, not a distinction between the recording of the afilmic world and the creation of a fantastical image for the screen as Souriau’s animated cartoon example demonstrates. Secondly, that this level blends the reception of the image with its creation. Souriau fuses the action of photography with the resultant screening of that image. This is problematic for Souriau’s structure in that this definition conflates the profilmic with the filmophanic. Thirdly, Souriau’s profilmic reality naturally,
given its time of publication, does not consider non-optical photography in which there is no profilmic referent or the manipulation of afilmic or profilmic reality. This has a bearing on all three points made above regarding profilmic reality. These limitations do not diminish the usefulness of Souriau’s levels but instead highlight the transformative power of technological intervention on the moving image and serve as a reminder to be vigilant when discussing different levels of reality as mediated by the moving image, in turn mediated by distinct technologies.

It is not only on a material level that Souriau’s realities are relevant. Diegetic-, unlike profilmic- reality, allows for both referenced and fantastical images, profilmic- and non-profilmic images. Diegetic reality is concerned with ‘everything which concerns the film to the extent that it represents something… that type of reality supposed by the signification of the film’ (Lowry, 1985, p. 85). The distinction is then, between materiality and signification and within Souriau’s seven levels, both are accounted for. More recent theoretical models that supersede Souriau’s levels replace indexicality with a reality effect—replace materiality with language. The overarching result is semiotic arguments in which resemblance is coded and learned and considers material relationships with reality as being merely one of many discourses. Notions of Peircian indexicality persist, however, and the tension between these views is evident.

The problematic nature of digital imaging and indexicality then is an especially fertile site for debate. In a Peircian model, reality can only be apprehended through signs but the inclusion of the *interpretant* in Peirce’s taxonomy allows for the perception of signs without referents. This is similar to the Saussurian view that language does not directly refer to its object in a Peircian sense. The link between Peirce and Saussure here is that for both theorists, convention can allow the sign to make reference to reality but this is a mediated rather than literal relationship. Verisimilitude of representations then become vital when considering the relationship between moving images and reality. Discussion in subsequent chapters takes up these points, specifically arguing for the ways in
which digital moving images, and most importantly, instances of rarely considered electronic analog moving images, blend previously exclusively immaterial representations with novel material forms.

The material and ontological emphasis of this thesis considers the philosophy of realism in film to be largely concerned with the traditional realism of the moving image and I acknowledge this to be largely outside the scope of this study. Realism in film has an expansive remit. Historically, I consider it to encompass French Poetic Realism of the 1930s; Italian neo-realism at the close of and post World War II; American Film Noir that challenged the particular realism of Hollywood Classic cinema before and in the following decade; the French New Wave and Cinéma Vérité of the late 1950s and early 60s; internationally distributed Iranian art house cinema of the 1990s exemplified by the films by Abbas Kiarostami, predominantly Danish Dogme 95 films from 1995 onwards. Realism in Film is also exemplified here by mockumentary films including A Hard Day’s Night (1964), This is Spinal Tap (1983), C’est Arrivé Près de Chez Vous (Man Bites Dog, 1992), Best in Show (2000), Dark Side of the Moon (2002), Brüno (2009) and also Kalat’s (2009) predominantly television-based ‘Fictuality’ and ‘Dramality’ in addition to pseudo-documentary or ‘found-footage’ films including The Blair Witch Project (1999), the Paranormal Activity franchise (2007; 2010; 2011; 2012), Romero’s Diary of the Dead (2007), Lake Mungo (2008), The Last Exorcism (2010), Trolljegeren (Troll Hunter, 2010), Apollo 18 (2011), and Chronicle (2012).

Similarly the engaging work of Conard (2009 & 2006), Coplan (2009), Mulhall (2008), Sanders (2008), Wartenburg (2007), Gilmore (2005), Falzon (2002), Žižek (2000), and others in examining the articulation of philosophical ideas of reality through the moving image are also largely outside the scope of this thesis. I refer to these endeavours in the thesis as ‘philosophy as film’ or ‘film as philosophy’. A small number of theorists in film philosophy including Allen (2007), Curren (2005), Carroll (1996 & 1995), Wartenberg (1995), and Smith (1997) theorise the medium of film from a philosophical foundation. I
refer to this as ‘philosophy of film’ and argue that for this thesis it is the most constructive approach to describe the mimetic relationship between moving images and reality. Despite general technologies of moving images being included in this approach to the philosophy of film, specific material forms and importantly, successive forms of the moving image, have largely not been considered in those arguments.

**Distinguishing Filmic Reality from other Realities**

Societies are becoming increasingly technologically mediated and moving image technologies are both pervasive and rapidly changing: ‘the rising waters of imagery have already reached our chins. A century from now, if things continue on this present course, people may take this immersion as a given…That future promises to be inextricably bound up with the lens-based media: still photography, film, and video’ (Coleman, 1998, pp. 63; 64). It is crucial to understand the relationship between moving images and reality in order to continue distinguishing between these modes of experience. As Pierson (1999), commenting on the ‘dream of simulation’ notes:

> One of the most powerful discourses on computer-generated imaging technologies centres on the possibility that this technology might one day produce images that are so realistic it is impossible to distinguish them from objects in the real world. (p. 167)

This thesis develops a vocabulary and offers methods for understanding and discussing such images. It is already possible to create moving image realities that are beginning to approach phenomena perceptually indistinguishable from reality. Examples of this in application are industrial digital Virtual Reality (VR) environments that move beyond current 3-D visualisation. These include ‘Reality Deck’ facilities such as the immersive flight simulators at the visualising environment planned at Stony Brook University in North America that will display 1.25 billion pixels of information to spectators, ‘approaching
the visual acuity of the human eye’, and the so called 4-D cinema seat motion-
control systems lead by *D-BOX Motion Code* (Jablonski, 2010).

4-D cinema is a marketing term adopted by sectors of the cinema industry to
badge cinema screenings that present 3-D imagery synchronised to real world
and real-time physical effects including rain, wind, vibration, smell, and strobe
lighting effects in order to construct an increasingly life-like moving image
experience.¹ A contemporary example of this phenomenon that dates back to
the Hales Tours of the early twentieth century is the 2010 season of 4-D
screenings of James Cameron’s *Avatar* (2009) in South Korea.² This use of M-
FX—a contraction of Motion Effects—has created a new creative and technical
production role dubbed ‘motion editing’ for the production and presentation
of more lifelike moving images.

Considering the addition of sensory information beyond the traditional sight
and sound of moving images contained by the viewing frame, and this coupled
with technological advances in 3-D, CGI, and Super Hi Vision high resolution
digital moving image recording and projection, it is slowly becoming only a
knowledge of these vistas as synthetic that allows viewers to differentiate them
from real world experiences.³ As Bill Mitchell (1992) notes: ‘to the extent that
computed perspectives can be shaded in photorealistic fashion, so that
computed perspectives and photographs become graphically
indistinguishable… the borders between the actual world and these fictional

¹ 4-D has also been used as a marketing term for less immersive cinema experiences. A recent
example of this is Robert Rodriguez’s *Spy Kids: All the Time in the World in 4D* (2011)
presented in ‘Aroma-Scope’ in selected theatres. This marginally enhanced experience featured
a scratch and sniff card with a number series corresponding to numbers flashed on screen as
time cues to release the (dubious) scents.

² For the historical contexts of Motion Effects see Chapter Two. For further information on
these specific screenings and *D-BOX Technologies*, the leading supplier of M-FX technology in
North America, see Sunlee (2010).

³ Super Hi Vision or Ultra High Definition (UHD) is a high definition video format being
developed by Japan’s national public broadcaster 日本放送協会 (NHK) and ratified by the
International Telecommunications Union (ITU). The format displays images at a spatial
resolution of 7680 x 4320 pixels, approximately sixteen times the resolution of current High
Definition Television (HDTV).
worlds will be increasingly difficult to identify and maintain’ (p. 134). Distinctions between the organic and the synthetic are becoming increasingly difficult to determine in an industrial screening context with comparative public and domestic consumer experiences to follow.

The principal argument put forward in this thesis—that analog electronic images do not have indexical relationships with reality in a way that has previously been widely accepted—has the potential to recast the relationship between reality and moving images from the creation of television technology in the 1920s until the shift to digital moving images in the 1980s. This sounds a tocsin for the veracity of recorded history and by association, the subsequent documentation of digital moving images and their relationships to reality.

The thesis is largely concerned with moving images within cinema although other forms of moving image can also be considered to be within the scope of my broader argument. The thesis only briefly examines moving images as part of the World Wide Web and other digital mediums such as interactive Flash animation and video games, choosing to focus on linear film, video and animation in a cinematic and traditional television context. Despite the synchronous relationship of audio to the moving image, the focus of the thesis is on visual moving images and although the importance of audio accompanying moving images is acknowledged, the central focus here is visual.

The use of the term ‘moving image’ follows Lev Manovich’s (2001) description of cinema:

Cinema was understood from its birth as the art of motion, the art that finally succeeded in creating a convincing illusion of dynamic reality. If we approach cinema in this way (rather than as the art of audio-visual narrative, or the art of the projected image, or the art of collective spectatorship, etc.), we can see how it superseded earlier techniques for creating and displaying moving images. (p. 296)
This definition demonstrates a primary concern with the mimetic properties of the moving image and a concern with medium rather than content. There are several reasons for using the term ‘moving image’ alongside ‘cinema’, ‘film’, and other comparable terms. Cinema and film do not encompass the capacities of the moving image in its relationship to reality; moving image is a term similar to the common word ‘movie’ that historically acknowledges the now quaint terms ‘moving pictures’ or ‘motion pictures’; and moving image describes an inherent and differentiating function of media rather than referring to the nonetheless important physical foundations of cinema, film, and video. Throughout the thesis, I use various qualifiers to distinguish between different physical forms of the moving image. These include film, videotape, Digital Versatile Disc (DVD), Computer Generated Imagery (CGI), mechanical, electro-mechanical, electronic, analog and digital, but where these terms are not employed, the thesis argues for all moving images. Unmonitored single-channel video surveillance footage of a deserted car park is as valid here as the masterly film work of Ingmar Bergman. In this matter the thesis is primarily concerned with the ontology of the moving image, not the aesthetic reception of these images.

This approach is in part a response to a habitually indiscriminating view of rapidly changing moving imaging technologies. As Ron Burnett (2004) argues: ‘most societies use a variety of materials to give life to images. And the beauty, as well as the contradiction of this process, is that spectators become less and less aware of the influence of these materials upon the experience of viewing’ (p. 6). As a materialist endeavour, this thesis is concerned with the underlying mimetic relationship of material forms of the moving image to reality, not realism in film or video, and not the visual or aural aesthetics and styles of moving image realism.

The use of moving image separates such images from other visual representations such as paintings and sculptures. The use of image allows the inclusion of non-pictorial moving images such as those produced by Marcel
Duchamp, Stan Brakhage and Len Lye. Acknowledging numerous arguments, often from the formative years of cinema and notably those of Bazin (2004, pp. 76-124), distinguishing cinema from live theatrical performances (and kinetic sculpture for instance), there is an implicit understanding that first, moving images here are two-dimensional. Even stereoscopic films are materially two-dimensional projections that are apprehended as three-dimensional images. Secondly, the moving image is not ‘inscribed in a true space [but] a photographed one’ (Metz, 1986, p. 248). Metz describes theatrical performances as taking place on the ‘same stage or “scene” as the public’ in contrast to ‘the “other scene”…[where] every film is a fiction film…everything is recorded…and this is still true if what is recorded is not a “story” and does not aim for the fictional illusion proper’ (p. 249). Thirdly, I also subscribe to Carroll’s (1996) argument that moving images are generated from templates rather than interpretations as occurs in the theatre, in that there is automation in their presentation rather than a subjective realisation of the work. This does not mean that there is no ‘presence’ in the moving image. On the contrary, as Bazin (2004) describes after Peirce; ‘it does so in the same way as a mirror—one must agree that the mirror relays the presence of the person reflected in it—but it is a mirror with a delayed reflection, the tin foil of which retains the image (p. 97).

The Moving Image and Empirical Research

Broadly there are four contemporary strands of empirical research for moving images. The first is concerned with aesthetics or style and typically deconstructs moving images work based on recording shot length, editing decisions and framing. The numerical results are tabulated, diagrammatically presented as evidence regarding production techniques and their intended effects on the viewer. Salt (2006 & 2003), Bordwell (2006), O’Brien (2004), and Thompson (2006) have extensively worked in this area to make claims regarding the relationships between the Mean Average Shot Length (MASL) in historical
film production and wider cultural phenomena. The second strand is the role of psychology in perceiving automated moving images. The empirical methodology applied to this area often involves eye tracking and computer vision. The third strand is research for technical innovation in which new production techniques are developed and implemented for moving images. This strand is only marginally concerned with the theory of moving images. The fourth strand is not concerned with theory at all. This strand is research within the field of engineering that defines technical standards for recording, distributing and displaying moving images. The Society of Motion Picture and Television Engineers (SMPTE) is the international industry standards body that technically defines what moving images are in this context. SMPTE standards describe the materiality of attributes such as resolution, colour, luminosity and frame rates for moving image applications and in synthesis, define the materiality of images themselves. This engineering data is rarely employed in theorising the moving image and has not previously been acknowledged in theorising the relationship between moving images and reality.

Methodology

This thesis employs several research methods. It traces and interrogates a history of the moving image; distilling the important role that technology plays in recording and rendering moving images. After outlining Peirce’s semiotic taxonomy with a particular focus on the index and further, Peirce’s application of the index to the photograph, it systematically applies Peirce’s notion of the index to all automated moving images in order to test the validity of an extension from photography to moving images—mechanical, electronic, analog and digital. The thesis also applies SMPTE standards data to interrogate

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4 For a comprehensive introduction to these relatively new methods see Smith, Levin & Cutting (2012); Smith (2012); David Bordwell’s (2011c) blog entry ‘The Eye’s Mind’; and the guest post on this same blog by Tim Smith (2011) entitled ‘Watching You Watch There Will Be Blood (2007)’. 
existing arguments regarding an indexical relationship between moving images, reality and specific technologies. Classification with this data divides moving images into specific formats to consider how distinct technologies facilitate the production and viewing of moving images in addition to transforming their relationships with reality. Additionally, the thesis examines specific moving image works produced during periods of technical transformation as defined by SMPTE standards to articulate their differing indexical relationships with reality.

These filmic works are illustrative of particular moments in technological transitions. In dissecting the ontological aspects of moving image works considered to be technically transformative in mainstream histories, the thesis provides additional insights into the indexical relationship between moving images and reality. The works illustrating the mechanical to electronic shift for moving images contextualise this within the wider technological development of that time. The development of radio and the network infrastructure delays attributed to the Great Depression and the Second World War (Armes, 1988) are noted in this discussion. An examination of the marginalised technology of mechanical television as a proto-broadcasting format is discussed with an emphasis on it operating on the cusp of a transition between the rendering of mechanical and electronic moving images.

The filmic works examined as part of the analog to digital transformation illustrate ideas of synthesis in the moving image and how this impacts on moving images’ relationship with reality. These works are considered in two categories, ‘referenced’ and ‘fantastical’. Referenced photorealism strives for synthetic image content that is familiar and perceived as representing a real-world referent. In fantastical photorealism, the synthetic content has no direct real-world referent. A selection of predominantly analog feature films produced by the American film studio system in the early and mid 1980s are examined to discern differences between these and their digital counterparts of the same era.
As part of a historicising of trends in the theoretical writing on the relationship between technology and the moving image, published written works that might be conventionally determined to be secondary texts are considered here to be primary sources. These written texts are one form of empirical documentation that contributes to a field of data. These texts attempt to come to terms with and interrogate the role of moving image technologies alongside their development. The particular vocabulary and phrasing of these written artefacts is crucial to understanding their specific role in the rhetoric of mimetic relationships between moving images and reality. One of the outcomes of this approach in the thesis is that selected texts from the field are, at times, quoted at greater length than if they represented secondary texts.

Structure of the Thesis

The thesis is comprised of four chapters, with the latter three scrutinising the claims of Chapter One using historiographical scaffolding. Spielmann (1999a) argues that ‘much of the debate about “new” technologies focuses predominantly on aspects of discontinuity … and on concerns about continuity. Amazingly, there seems to be little interest in a comparative analysis of analog and digital features in moving and non-moving images that also considers an historical analysis’ (p. 132). This thesis makes substantiated claims regarding the indexicality status of distinct technologies of the moving image in the first chapter and then chronicles a finely granular succession of moving image technologies that demonstrate how this central argument is reflected through the history of the automated moving image in three subsequent chapters. This account in which analog electronic moving images are considered discontinuous, requires a transposition of a Peircian indexical severance through a consideration of distinctions between the mechanical and electronic in addition to an often cited dichotomy between analog and digital.
Chapter One details Peirce’s index and its application to mechanical, analog electronic and digital moving images. This chapter examines Peirce’s notion of the index and his application of it to nineteenth century photography as well as others’ subsequent use of the index for mechanical, electronic and digital moving images. It deconstructs deficiencies in the conventional arguments regarding indexical relationships between moving images and reality particularly those dealing with analog electronic images. Material properties of analog and digital moving images are discussed, as are the effects of transformation, quantisation, and sampling on such images. SMPTE standards representing the requirements for material forms of moving images for capturing, broadcasting, and exhibition are presented. Their relevance to the representation of reality by moving images is discussed for successive iterations of moving image technologies. The chapter concludes by charting technologies of the moving image and their links to the historiographical material discussed in Chapters Two, Three, and Four.

Chapter Two, ‘Reality, Mechanical Moving Images and their Antecedents’, examines methods by which the relationship between moving images and reality is articulated in text and artefact form from the emergence of photography through to film of the mid 1920s. This chapter foreshadows digital moving images as synthetic technologies that offer new modes of seeing in a similar way that analogue electronic technologies did in the first broadcast era following WWII.

The subsequent chapter, ‘Reality Effect? Reality or Verisimilitude in Mechanical and Electronic Moving Images of the Mid-Twentieth Century’ continues to follow technical developments alongside the theoretical arguments examining the relationship between film, television, video, and reality. It includes the introduction of video technology in the late 1920s that was ultimately realised as networked television in the 1950s. It also examines claims of moving image verisimilitude from twentieth century theorists alongside film, television and video production of that time.
Chapter Four, ‘Reality, Simulation and Presentationism: the Transubstantiation of Digital Moving Images’ charts the analog to digital transformations of the electronic moving image from the 1980s including extensive hybrid digital film practices and the theoretical debates surrounding contemporary moving image media. A shift from mimesis to simulation is observed and further, from representation to presentation. I argue in this chapter for a plurality of practices and a new approach to theorising digital technologies of the moving image and their relationships to pro- and a-filmic realities.

The thesis concludes by realigning the relationship connecting moving images and reality based upon and distinguishing between the technologies employed to render them. It considers the division of analog and digital technologies as one that is best viewed as historical when articulating indexical relationships between moving images and reality. The thesis reiterates a more nuanced materialist model of successive technologies that distinguish between mechanical, electro-mechanical, analog electronic and digital. Mechanical moving images are considered to be the only form of moving images sustaining indexical relationships, and I argue that this classification is wholly dependent upon specific imaging technologies.

Reality as represented by moving images and mediated by technology, is combined with a cultural context in which we understand them to be representations of another place and time, real or imagined, material and immaterial. Dependent on the technology employed, moving images—particularly digital moving images—are in their creation and their content, variously depicted as either exhibiting referenced photo-realism—leveraging our experience of reality and recognition—or fantastical photo-realism; again drawing on recognition but also extending recognition beyond representation through technology resulting in a new category of presentationism. This new category eschews both the representation and simulation modes of mimesis by
demonstrating an ability to exceed our experience of reality and the aesthetic of the hyperreal often attributed to digital cinema.

Peirce’s Index and Technologies of Moving Images

In contrast to my central argument and as noted above, published literature supports a general consensus that there is a Peircian indexical break with reality when an image is rendered digitally rather than analogically (Issacs, 2008; Grau, 2007; Peucker, 2007; Bolter, 2007 & 2005; Mulvey, 2006; Mitchell, 2005; Burnett, 2004; Cubitt, 2004; Manovich, 2001; Lunenfeld, 1999). Le Grice (2001), Hamlyn (2006) and Stewart (1999) regard digital images as severing this indexical relationship for various reasons. Manovich (1999 & 2001) writes of the material origin of digital images and how they ignore lineage, in that a photograph, a computer generated image, and digital 2D hand drawn animations are digitally indistinguishable from each other. Mulvey (2003 & 2006) argues that the viewer’s ability to break the flow of motion in digital moving images by pausing a DVD-Video for example is a rationale for this severance. Even Rodowick (2007), who attempts to present a balanced view, characterises the shift from analog to digital ‘as a one-way street in which the causal link to physical reality becomes weakened or attenuated’, eventually conceding a ‘discontinuity’ (pp. 118; 120). In this thesis I clarify how arguments proposing an indexical break for solely digital moving images, despite their claims to materiality, are heavily weighted toward theoretical considerations and that they omit inherent technological properties of moving images, that is, their material form.

In making a case for indexical relationships between reality and moving images that is dependant on specific technologies, this thesis also offers an alternative alignment to broadly accepted structures forming histories of the moving image. This new history pays particular attention to the indexical transformation through technologies of moving images in relation to pro- and
a-filmic reality. Much has been made of the indexical relationship between the moving image and reality having been altered alongside changes to image making technologies. But extant histories of the moving image do not sufficiently acknowledge the subtlety of pivotal technological changes when considering indexical transformations of the moving image.

Existing cinema histories are often preoccupied with ‘two recurring paradigms for the telling of the story: place and time’ (Harbord, 2007, p. 15). These histories generally consider broadly five eras of the moving image (Nowell-Smith, 1996; Salt, 1992). These can be described as Pre-cinema, which is characterised by magic and illusion, and emerges from the history of the theatre and/or scientific exploration; The Birth of Cinema and Early Cinema, most often described as a cinema of spectacle and technological advancement; Sound Cinema celebrating the introduction of sound; followed by Modern Cinema which can at times include other audio-visual media such as television and occasionally video. The last of the five eras is the relatively recent Digital Cinema, beginning at the end of the twentieth century and is considered in these standard histories primarily as technological. There is also a cyclical rhetoric to some of these histories. Manovich (2001 & 2001a), for example, describes digital cinema as a return to the manually crafted pre-cinematic moving image production of the nineteenth century.

This thesis reconfigures these standardised cinema histories by outlining a new schema to better articulate the indexical relationship between moving images and reality. This new schema comprises three eras of moving images. These are the eras of Mechanical Moving Images, Analog Electronic Moving Images and Digital Moving Images. In addition to reducing the number of eras, each of the titles describes a distinctive technology for creating and displaying moving images rather than previous descriptions of content or chronology.

The ragged shift from mechanical moving images to electronic moving images commencing in the mid-1920s is viewed as pivotal in this thesis. Mechanical television as both a precursor to and interloper into the much-lauded transition
to electronic moving images heralded the technology that would later become modern television and video. There are similarities here to a soupçon approach in introducing digital computers to cinematic imaging in the 1980s and how their sporadic use foreshadowed the computer-based digital moving imaging revolution of the late 1980s and early 1990s. This is the other pivotal shift interrogated by this thesis. Highlighting these transitory yet significant developments, the thesis offers new ways to consider the transition from mechanical to electronic moving images and from analog to digital moving images.

**Conclusion**

Drawing on SMPTE engineering specifications to argue for the true material basis of distinctive technologies of the moving image, this thesis argues that an indexical break between moving images and reality does not first occur as part of the transformation from analog to digital moving images in the 1980s, but rather from mechanical to analog electronic images dating back to the 1920s. These analog electronic moving images, represented predominantly by television and analog video, present discretised images sampled from continuous reality in a remarkably similar fashion to their digital counterparts.
CHAPTER ONE

Out of Sequence: Transposing Peirce’s Indexical Severance

Introduction

The status of mimetic relationships between moving images and reality are often premised on a divide between analog and digital technologies as framed in the Introduction. The discretisation of continuous reality to binary numerical values is perceived as transubstantiation, irrevocably mutating the ‘real’ world into a less verisimilitudinous representation of the reality it depicts (Mulvey, 2004 & 2006; Stewart, 2007; Elsaesser, 2009). I argue that claims of a metamorphosis through digitisation overlook the role, processes, and contribution of analog electronic moving images to this transfiguration.

Enduring articulations made about the relationship between automated moving images and reality are recurrently anchored in notions of indexicality, the term referring to a single class of sign defined by nineteenth century American semiotician Charles Sanders Peirce (Bettetini, 1973, p. 184). Rudolph Arnheim (1957) succinctly summarises this relationship as ‘the object does not only resemble reality but is a product of it—mechanical reproduction’ (p.27).

Peirce’s theory of the index is one of mediation and more specifically, identification through relational signs. Within a metonymic framework it attempts to describe the relationship between signs and their referents—‘objects’ in Peircian terms. This approach intersects with many persistent arguments regarding the moving image including the distinction between the photographic moving image and other visual representation, the moving image as art, and arguments positioning the moving image within a formalist, or

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3 The choice to nominate this as ‘transubstantiation’ is discussed in the opening of Chapter Four.
alternatively, realist framework. In more recent theory these frameworks often present indexicality in opposition to a semiotic reality-effect particularly within classic realism (Stam, 2000, pp. 143-4). It also intersects with the wider concerns of pictorial representation by theorists and philosophers including Nelson Goodman (1968), Rick Altman (1984), Flint Schier (1986) and Kendall Walton (1984 & 1997).

A Peircian sign represents an object as an Icon, an Index or a Symbol. These classes are part of a larger intricate taxonomy of classification of signs that Peirce offers and the trichotomy of Icon, Index and Symbol is one of the earliest and least cumbersome of Peirce’s classifications. Peirce revised and added to his typology of signs over numerous published and unpublished papers spanning more than forty years resulting in a plethora of sign classifications. (Weiss & Burks, 1945; Burks 1949; Goudge, 1965; Hoopes, 1991; Atkin, 1995; Short, 2007, p. 207). Burks (1949) describes studying Peirce’s theory of signs as

difficult not only because of the unusually fragmentary character of his writings on this subject but also because of the presence of certain inconsistencies and confusions. In many instances these discrepancies are only apparent, resulting from the fact that Peirce tried to work out his views in different ways, and with a varying terminology, at different times. In other instances the inconsistencies and confusions are real, resulting from his tendency to lump things together and overlook important differences in his eagerness to discover the basis for a comprehensive philosophic system. (p. 675)

Weiss & Burks (1945) describe the full extent of Peirce’s classifications as: ’(a) Peirce’s single trichotomy of ”categories,” (b) his triply trichotomous, and (c) decimally trichotomous ”division” of signs as well as (d) his ten-fold and (e) sixty-six-fold ”classification” of signs’ (p. 383). The relationship between these classifications is as follows: ’Peirce’s three trichotomies of signs are part of his final ten trichotomies. The ten classes he derives from his three trichotomies
are part of the sixty-six classes he derives from his ten trichotomies. His final classifications of ten trichotomies and sixty-six classes of signs thus contain his other classifications as subordinate parts' (ibid, p. 385). Short (2007) notes though, that ‘the promise of a system, rigorous and comprehensive, remains a promise only’ (p. 235)

This discussion concerns only the earliest single trichotomy of categories reasoning that this is the set of classifications that in various forms are most often referred to by film and media theorists discussed in this thesis. Burks was part of the first generation of twentieth century philosophers to interpret Peirce’s work and much of his criticism of Peirce’s arguments naturally do not take into account Peirce’s writing published after this time that addresses some of these criticisms (Atkin, 2005). There is much debate concerning the robustness, exceptions, classifications and logic of Peirce’s taxonomies and shifting terminology and much of this detail is extraneous to this thesis (Atkins, 1995; Short, 2007). An example from Deledalle (2000) demonstrates thus:

Is the representamen of 1867 (which is an intermediary Third) the same as the representamen of the semeiotic theory [sic. This is Peirce’s preferred spelling as noted by Hoopes (1991) p. 5] which is a first? From 1895 on, the representamen is a First and trichotomizable into a representamen which is a possible, a representamen which is an existent, and a representamen which is a law or rather a rule. If the representamen is a First, can it still be understood in terms of “representation” as in the paper of 1867? (p. 57)

This thesis and particularly this chapter are concerned with the notion of a Peircian Index as one part of a larger taxonomy and the legacy of that relationship as it has been applied to the photographic image. I am not undertaking an audit or exploration of Peircian semiotics excepting for this sign that has become a trope of representation for photographic imagery in its own right. Tom Gunning (2007) frames this as a reductive approach, arguing that:
Within theories of cinema, photography, and new media, the index has been largely abstracted from this system, given a rather simple definition as the existential trace or impression left by an object, and used to describe (and solve) a number of problems dealing with the way what we might call the light-based image media refer to the world. (p. 30)

Gunning (2007) goes on to argue that ‘what we might call a diminished concept of the index may have reached the limits of its usefulness in the theory of photography, film, and new media’ (p. 31). I agree that the use of a reductive or abstracted notion of the index is problematic. But focusing moving image representation through the lens of successive technologies in combination with accurately portraying Peirce’s index as it occurs in this thesis offers a more precise reading of the relationship between moving images and reality than has been previously offered. Additionally, through these benchmarks I challenge the canonical view that a division between analog and digital technologies forges a necessary Peircian indexical uncoupling.

**A Peircian Triad**

Peirce’s triadic structure of Icon, index and Symbol are classes that describe how a sign stands in for its referent. Icons represent the object through a quality of the object such as colour. They exhibit a likeness in the way a landscape painting represents that terrain; Indexes represent the object through an existential and at times, causal relationship. An analog photograph is the crucial example from Peirce here—it indicates. Notably, it is also iconic in that it is a likeness and further, is symbolic in that there is a visual language that must be understood to apprehend the photograph as a representation of reality in terms of flatness, scale, colour, and temporal shift. The photograph additionally employs symbols to represent the object (and at times the sign) through accepted use, a rule or usual designation—signs will be interpreted as
such and are general indicators for which meaning is understood through usage, as with books or words.

Peirce offers additional correlate triadic structures that populate his taxonomies; for example, Peirce offers three sub-categories of icon, these being image, metaphor and diagram and three kinds of indices: tracks, symptoms, and designations. These structures also extend to notions underpinning Peirce’s sign system. There are three semiotic relational bases: A sign, an object, and an interpretant. In Peirce’s relational semiotic system, significance consists of a sign that signifies its referent—the sign-object relation. This act then produces a subsequent sign to signify that object—the sign-interpretant relation. A sign then ’is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object’ (Peirce (1932) vol. II, para. 228).

Underpinning these classes there are three phenomenological categories; Firstness—something in itself; Secondness—a sign in relation to something else; and Thirdness—a reference to an interpretant, being a sign that is at once a sign of the object and also an interpretation of the sign. These categories are associated with each class of sign, Icon, Index and Symbol in turn. For Peirce a triadic structure is always present and required: ‘semiosis is always a triadic process by which a first determines a third to refer to a second to which itself refers’ (Deledalle (2000), p. 18).

There are several attributes to an indexical sign including the index forming an inseparable pair with its object necessitating the object’s existence; the object

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6 There are also cross-triadic categorisations including; Qualisigns, Sirsigns and Legisigns that define classes through their relation to their immediate object and Rhemes, Dicisigns and Arguments that define based on the proximity to the interpretant, but these are outside the scope of this discussion.
being an individual thing; the index intrinsically showing its object but not describing it; and the relationship being non-rational (Goudge, 1965; Atkin, 2005). These are all important conditions but the most important attribute of an index to this discussion is that an index has a direct physical relationship with its object. This means that for one of the numerous examples Peirce offers—the photograph—the relationship between image and reality is one for which the index is pure or genuine. When considering predominantly linguistic expressions functioning as indices, Peirce outlines a further distinction between ‘genuine’ or ‘pure’ and ‘degenerate’ forms of indexical signs. The common interpretation of this classification is that Indices as Seconds can be genuine—having an existential relation, or degenerate—having only a referential relation to its object (Atkin, 2005, pp. 19-20).

Although I am not explicitly considering degenerate indices in this thesis, this distinction is useful as it describes the indices under consideration as genuine or pure indices in a Peircian vocabulary that extends these terms outside of linguistics. This distinction is relevant to the issue of a requirement of causality for indexical relations. Atkins (2005) for example, differentiates between pure and degenerate indexes when arguing for a non-requirement of causality between Indices and their Objects.

Without direct reference to Goudge (1965, p. 55) or Burks’ (1949, pp. 679-70) notable threads of philosophical debate around Peirce’s index and the conflation of causality and semiotic relations as demonstrated by Peirce’s examples of the weathervane and the North Celestial Pole Star, T L Short (2007) for the most part resolves this point. He first quotes the distinction between a Peircian Icon not requiring a causal connection but denoting its object by ‘virtue of characters of its own which it possesses, just the same, whether any such Object exists of not’ (Peirce quoted in Short, 2007, p. 215). Short then goes on to identify Peirce’s definition of indices shifting across multiple papers, noting that Pierce in 1903 characterises an index as ‘a sign which refers to the Object that it denotes by virtue of being really affected by
that Object.’ Yet at a similar time, Peirce also defined the index as ‘a sign…
which refer to its object not so much because of any similarity… nor [by
association]… as because it is in dynamical (including spatial) connection both
with the individual object, on the one hand, and with the senses or the
memory of the person for whom it serves as a sign, on the other’ (p. 219).
Short concludes that a spatial connection must be between two actualities,
existing or occurring, but does not require one to be the cause of the other: ‘the
dynamic relation of index to object depends on the existence of the latter’
(ibid). Even if the causal condition is debatable and as can be seen above,
delineating the role that causality plays [in Peirce’s index] is not an easy task
(Atkin, 2005, p. 22), the photograph does not require it and so although
important to a Peircean taxonomy, this point may be largely put aside in the
context of this thesis. What remains however, is the insular quality of Peircean
Icons, not merely rebuffing causal relationships with their object but not
necessitating their existence. Peircian iconic relationships will be further
discussed in relation to synthetic digital moving images in Chapter Four.

The Indexicality of Photographs and then Moving Images

The photograph, given by Peirce as an example of a Second and having a
corresponding indexical relationship with the reality it depicts, can then be
observed to also have qualities of Firstness and Thirdness—iconicity and
symbolism. These are not as important as the qualities of Secondness however.
The general iconic resemblance that the photograph has to the scene depicted
and the shared symbolic understanding of the visual language enabling the
photograph to be read as a representation of the scene depicted are
subsumed—in terms of the relational status between the indexical sign and
Object—by the causal relationship that exists between them. An indexical
relationship is the defining characteristic of this sign. In a Peircian taxonomy, a
photograph as index may have an icon incorporated within it and similarly, a
symbol may have an icon or index incorporated within it. Further, the object
must be a *particular* thing in a Peircian taxonomy and a photograph as a first or an icon, exhibits a likeness that cannot be said to be only a likeness of that particular object. Peirce holds that only indexical relationships can be formed with particular objects (Short, 2007, p. 215). The iconicity possible within photographs however, is central to the relationship that digital—rather than analog—images have with their Peircian objects.

From Peirce’s descriptions and interpretations of Peirce’s writings it can be argued in a non-contentious fashion that film-based photographs—both still and moving, have an indexical relationship with the pro- or a-filmic reality they depict. This is primarily— but not a necessary attribute of indexicality—because of the causal nature of photographic representation. The light falling on the filmic substrate that records the images is shared with the light illuminating the depicted scene. There is a direct and physical relationship between the image recorded and the reality it represents. The light that inscribes the latent filmic image and so allows the viewer to see a resultant image is the same light that allowed the Peircian Object to be discerned.

Three valorised twentieth century film theorists make links between still photography and the moving image as having the same photochemical base and recording images in much the same fashion. André Bazin (1960) famously argued for the mechanical origins of photography as offering an objective view of the depicted scene and his contribution to representations of the real in cinema continues to influence theoretical discussion of cinematic realism (Grist 2009; Cardullo (2007); Dilorio, (2007); Lowenstein, (2007); Matthews, (1999); Andrew, (1997; 1978); Rosen, (1987)). Bazin’s work will be discussed in Chapter Three but his argument, similar to Panofsky’s (1997), which considers the proximity of still photography and the moving image against other forms of representations, is useful here in establishing an ontological link between photography and the moving image:
Painting was forced, as it turned out, to offer us illusion and this illusion was reckoned sufficient unto art. Photography and the cinema on the other hand are discoveries that satisfy, once and for all and in its very essence, our obsession with realism... for photography does not create eternity, as art does, it embalms time, rescuing it simply from its proper corruption. Viewed in this perspective, the cinema is objectivity in time. The film is no longer content to preserve the object, enshrouded as it were in an instant, as the bodies of insects are preserved intact, out of the distant past, in amber. The film delivers baroque art from its convulsive catalepsy. Now, for the first time, the image of things is likewise the image of their duration, change mummified as it were. Those categories of resemblance which determine the species photographic image likewise, then, determine the character of its aesthetic as distinct from that of painting. (pp. 7-8)

As will be discussed in Chapter Three, Siegfried Kracauer, reviving a predominantly early twentieth concern with the specificity of film, writes of the filmic image as being an extension of photography, this building on his earlier writings on photography. Kracauer’s (1997) *Theory of Film: the Redemption of Physical Reality*’s ‘concern is the normal black-and-white film as it grows out of photography... it rests on the assumption that that film is essentially an extension of photography and therefore shares with this medium a marked affinity for the visible world around us. Films come into their own when they record and reveal physical reality’ (Hansen, 1997, pp. xlvii; xlix).

Kracauer writes of the indexicality of the moving image as not only an inscription of reality, as is often cited, but also as a medium that estranges the world it represents. It is the uncanny and the strangely familiar that film promotes through its photographic foundation. This trait has particular resonance with contemporary fantastical representations created through digital technologies presenting hyper-real and impossible photorealistic images.
The third key theorist to link the medium of photography with the moving image is the philosopher Stanley Cavell (1979). He argues that photography and the moving image share optics as an essential common element:

What Panofsky and Bazin have in mind is that the basis of the medium of movies is photographic, and that a photograph is of reality or nature. If to this we add that the medium is one in which the photographic image is projected and gathered on a screen, our question becomes: What happens to reality when it is projected and screened? That it is reality that we have to deal with, or some mode of depicting it, finds surprising confirmation in the way movies are remembered, and misremembered.’ (p. 16)

It is clear that intuitive and compelling materially based arguments can be made for photographic moving images as sharing the central properties of still photography and functionally extending these to include motion to create film, video and less convincingly, digitally based moving images.

Additionally, there are numerous other theorists that link still photography with motion images, some via Peircian taxonomies, and others that use Peirce to speculate on variations of standard photography. Roland Barthes (1985) has explored the theorisation of the still image in order to understand the moving image: ‘the “movement” which is taken for the essence of film is not animation, flux, mobility, “life”… but merely the armature of a permutational unfolding, whereupon a theory of the still becomes necessary… Moreover the still is not a sample… but a quotation’ (pp. 60-1).

One of the more interesting takes on Peircian indices for photographs given the current state of digital stereoscopic cinema is Laura Bird Schiavo’s (2003) citing of Peirce to describe a relationship that nineteenth century photographic stereoscopic still images have to reality:

The stereograph thus signifies in a manner beyond that of the indexical sign, becoming instead the actual visual equivalent of the object or
objects signified. The stereograph seen through the stereoscope was alleged to be the very same as the scene viewed in person. (p. 128)

As Schiavo footnotes, this idea of exceeding the index is similar to Susan Sontag’s description in her essay “The Image-World” (1995, which does not cite Peirce), but seemingly here, if one image is enough to satisfy the conditions for indexicality in Peirce’s taxonomy then two simultaneous images are able to conjure reality somehow with greater proximity. The introduction of cinema to this model presenting reality at 24 still images a second then makes for a more immersive experience. Add to this stereoscopic cinema, doubled frame rates, increasingly vivid colour, and pristine digital projection and ever more gradually, distinguishing between cinema and reality becomes problematic—at least in theory.

However, still and moving image photographic representation diverges with regard to iterative technologies that record pro- and a-filmic reality. Whereas the technology creating still photographs based on analog television that subsequently created analog video in the mid 60s moved from filmic-based mechanical representation directly to digitally mediated representation commercially in 1981, motion based photographic images were employing analog electronic technologies in addition to film based motion images until the commercial introduction of digital moving image production in 1986. These advancements will be discussed in detail in Chapter Three but it is important to note the divergent vectors between still and moving images here.

Digital moving images and their relationships with reality will be discussed at length in Chapter Four and it is clear that for both still and moving images there is an indexical severance through discretisation when pro- or a-filmic reality is recorded or manipulated digitally. In this thesis the predominantly engineering term ‘discretisation’ is regarded as literally the process of rendering images materially discrete. It is considered in opposition to these images’ reference of continuous pro-filmic reality (Poynton, 2003). In digitally recorded images, the photoreceptors in digital cameras are the first step in a
sequence that converts light into the binary ones and zeros often cited as evidence of an indexical break with reality. As part of this process, sampling occurs and the continuous reality that is recorded is transformed into a data-set that is an incomplete or non-continuous recording of the pro- or a-filmic event. Similarly, analog images that are digitally manipulated also undergo an indexical break for these same reasons, even if subsequently returned to an analog state as with the Digital Intermediate (DI) process that commences and finishes with a film print but undergoes digital manipulation in-between. DI will be discussed in Chapter Four as part of a discussion on combinative moving images.

**Peirce’s Legacy and the Moving Image**

Peirce’s legacy ensures that there are numerous references to an indexical cessation when images are recorded or rendered digitally and these are most often described in terms of an analog/digital dichotomy. There is a scatter of descriptions regarding the transformation that digital technologies have wrought on indexicality but the sentiment is clear. At one end of this continuum, early commentary by Hayward & Wollen (1993) are predominantly hesitant and non-committal in their observation: ‘the digitisation of the photographic has renewed debates about the (un)reliability of the indexical relationships between the represented and its representation. Digitisation has made the malleability of sounds and images seem like something new and has rekindled anxieties about the ability to communicate truthfully; in an era when communications technologies proliferate, the irony is painful’ (p. 7). More recently, Garrett Stewart (2007) at the other end of this spectrum, offers what is perhaps the most intense description of an indexical severance in carving an analog/digital divide, appearing to include analog electronic moving images—not just film—as electro-mechanical technology, against the ‘electronics’ of the digital. He writes:
In postfilmic cinema, no image precedes the one we see—or follows from it in sequence. All is determined by internal flux (frame singular). Between whisked-away imprint and the whiplash action of convertible pixels, then, lies the difference between electrical and electronic cinema: segmental transit versus fragmental transformation. Photograms graph motion, inscribe it by succession itself. By contrast, the computed picture, timed by binary (com)mutations, is more like a weightless easel for pixel tessellations, bit by microbit. (p. 6)

Laura Mulvey is one of several writers who at times explicitly refers to Peirce but also writes of Peircian indexicality without naming Peirce in deference to the standing and widespread awareness of Peirce’s index. Mulvey (2006) refers to indexicality in the past tense; as an implicit given; and of digitality as negating that same relation:

The digital, as an abstract information system, made a break with analogue imagery, finally sweeping away the relation with reality, which had, by and large, dominated the photographic tradition… although the photograph may have other properties, the physical link between and object caught by a lens and the image left by rays of light on film is the material basis for its privileged relation to reality (p. 18).

In an earlier text, Mulvey (2004) is even more forthright:

New technology provides a channel into the cinema’s past. However, as a non-indexical medium, it provides a further, crucially important inflection that affects the history of film and photography. (p. 154)

Likewise, Thomas Elsaesser (2009) in his introduction to an essay on the relationship between the cinema and the museum views the indexical severance ushered in by digitality to be non-contestable and even prosaic: ‘now digitisation has broken the indexicality of the photographic image, undermining its ‘documentary’ value by replacing the optico-chemical link to physical reality with numerical code’ (p. 1).
Another approach—rapidly becoming untenable—is to limit an argument by excluding digital technologies altogether as Bill Nichols (1991) does in the first chapter of *Representing Reality: Issues and Concepts in Documentary*. Nichols agrees with the majority opinion on an indexical break for moving images through digital technologies but excludes it from his remit. ‘All photographic and motion picture images made according to the prevailing conventions that allow light reflected from physical objects to be registered on photosensitive film or video tape will exhibit a distinctive bond between image and object. (Digital sampling techniques destroy this claim; this study is limited to nondigitized imagery)’ (p. 5).

Senior theorists like Mulvey (2004 & 2006), Elsaesser (1993; 2002; 2006; 2009), and Nichols (1991 & 2001) are afforded the brevity of explicit or implicit passing remarks regarding Peircian indexicality by virtue of the more comprehensive work completed by contemporaries including Mary Ann Doane (2002; 2007; 2009), David Rodowick (2007), Tom Gunning (2004 & 2009) and these in turn, through the earlier work of Gianfranco Bettetini (1971; 1973, particularly pp. 180-192) and Peter Wollen (1969, pp. 116-55) which will be discussed in relation to the theorising of André Bazin and Christian Metz in Chapter Three.

Notably, Gunning (2004) argues a minority opinion in claiming that ‘storage in terms of numerical data does not eliminate indexicality (which is why digital images can serves [sic] as passport photographs and the other sorts of legal evidence or documents, which ordinary photographs supply)’ (p. 40). I argue simply that Gunning is here concerned with the *application* of digital images rather than their material forms and the burden of proof is connected to the culture and perceptual realism of photographic images rather than their material forms. Additionally, as a precursor to my argument presented in Chapter Two, Gunning’s argument reiterates a recurring theme of apprehension standing in for ontology. Gunning is arguing that the accuracy of
photographic representation is dependent not only on indexicality but also on recognition.

However, the majority of these contemporary arguments are sound, relying on the materiality of digital images and their mode of production. But many of these explicit allusions sidestep or do not acknowledge the intricacies of intention in Peirce’s writings or the nuances of electronic but nonetheless analog images. Gaut (2009) for example, citing Prince (1996), writes that ‘the traditional film image is, in Peirce’s terms, an index (has a causal relation to its referent), whereas many digital images are merely icons (resembling their subjects but lacking a causal relation to them)’ (p. 81). Of the innumerable possible summaries of a Peircian index, Gaut chooses to briefly elaborate on the aspect of causality, which as discussed above through Short’s (2007) interpretation, is both historically contentious and ultimately well supported as unnecessary for establishing indexicality. Although a photograph may have a causal relation to the reality it depicts, this is not a condition of indexicality.

In fact, Prince (1996) does not mention causality with regard to Peirce, despite Gaut’s citation. Prince quotes Peirce on photographs—recycling a quotation made famous by Wollen (1969, p. 124) in Signs and Meaning in the Cinema and also specifically quoted by Doane (2002, pp. 93-4), Nichols (1991, p. 149) and others—writing that ‘they are exactly like the objects they represent . . . they . . . correspond point by point to nature. In that respect then, they belong to the second class of signs, those by physical connection’ (p. 28).

Prince (1996) does follow his brief summary of Peirce’s index with a similarly succinct summation of Barthes’ view of the relationship between the photograph and its referent that includes causality, noting that ‘for Barthes, photographs are causally connected to their referents’ (ibid). Interestingly, Prince does not note the importance of temporality in his account of Barthes’ position on representation. In a similar way that indices may or may not have causal relations with their referents, Barthes’ focus on the temporal shift in which the photograph exhibits the essential trait of ‘having-been-there’ is not
necessary to establish indexicality as Peirce’s examples of the weathervane and sundial as indexical demonstrate.

This view of indexical severance is echoed by Mark Hansen’s (2004) argument for the dissolution of the image through ‘digital transfiguration’, after Manovich’s (2001, pp. 98-101) positioning of radar as the first of the new real-time screens:

Following its digitization, the image can no longer be understood as a fixed and objective viewpoint on “reality”—whether it be theorized as frame, window, or mirror [after Vivian Sobchack’s (1993) classifications]—since it is now defined precisely through its almost complete flexibility and addressability, its numerical basis, and its constitutive “virtuality”. (Hansen, 2004, p. 8)

Angela Ndalianis (2004) also cites Prince (1996) in describing the challenges that digital media presents to indexicality, more obliquely offering a causal focus to her summation: ‘realism in the cinema has been tied to “concepts of indexicality,” with film viewed in photographic terms ([Prince] 1996, 28). Computer-generated images force a re-evaluation of this tradition in that they have no profilmic referent or source of origin in the real world’ (p. 169). And again, Jenna Ng (2007) writing on virtual cinematography cites Prince (2006) in describing a distinction between analog and digital moving images. She argues that ‘the advent of digital applications in filmmaking today, particularly in the use of computer-generated imagery, potentially threatens to unravel the ontology of the moving image: unlike the case for its filmic counterpart, the creation of CGI on a computer, entailing its independence of an indexical engagement with the object, dispossesses the digital image of any connection to the reality of its referent’ (p. 173).

Importantly, Ng and Ndalianis’ arguments are—in an unannounced form—reductive. Unlike Prince’s (1996) text, they consider not all digital moving images but only those that are computer generated rather than those
representing an a- or pro-filmic scene through digital technologies that include optical lenses. Bill Nichols (who noted that digital images would not be discussed) makes this distinction clear and considers these two classes of digital images distinctly (1991, p. 268). This again raises the issue of simulation—to be discussed in Chapter Four.

Novelty and Theorising the True Nature of Imaging Technologies

Peircian indexicality is then widely regarded as contemporaneous with analog moving images and equally inadmissible when considering the relationship digital moving images have with their Peircian objects. I argue that this position is, in part defensible but considers the technology of moving images with a decidedly cursory approach. Complicit within a gap in knowledge regarding the ontological status of particularly analog electronic images are misunderstandings about imaging technologies. As framed in the Introduction, it is important to consider historical and cultural contexts when examining new technologies of the moving image. As Yvonne Spielmann (2010) argues this is because the novelty does not arrive out of the blue. But it is building [sic] up from a variety of interrelated, parallel and also unconnected technical developments that become the building blocks for the arrival of a ‘new’ medium that progresses dynamically and not statically. Thereby, newness and novelty become shifting categories by themselves, and can serve to conceptualize recent and contemporary media phenomena in relation to previous media forms. (p. 7)

But the veracity of this information is paramount when making assessments of any technology. There are many moving image theorists and philosophers including Bill Mitchell, Sean Cubitt, Berys Gaut, Friedrich Kittler, Matthew Kirschenbaum, David Rodowick, and arguably Lev Manovich, who have commanding expertise related to the methodological application of technologies. But there are also numerous writers and practitioners who
demonstrate a distinct lack in understanding the technologies they write about. Published texts by these latter writers further obscure knowledge of imaging technologies and perpetuate falsehoods about the role and status of imaging technologies. There exist many examples of this issue and I will briefly examine only four: two from peer reviewed journals; one from a single-author book; and one from an edited anthology. Each of these examples deal with content specifically focused on the role of moving image technologies and arguments that rely on the material properties of images as crucial to the positions taken by these writers.

In a themed issue of *Wide Angle* on *Digitality and the Memory of Cinema*, Michele Pierson (1999a), an oft-cited writer in the area of science fiction cinema and VFX, writes about the future of CGI in cinema. Pierson’s important contribution to the debate regarding the materiality of CGI images in digital cinema will be examined in detail in Chapter Four but here I wish to pause and examine a specific claim regarding ‘digital artifacts’. Pierson writes:

> The decision to describe certain types of computer-generated images as “digital artifacts” is not one that has been made without reservations. The potential for confusion over this term arises from the fact that within the special effects industry itself, a “digital artefact” refers to an extraneous digital object that has been marked for removal in the post-production process (eg. The removal of wires used for stunt work). It has nevertheless been retained here because it draws attention to the display of the CGI effect as an aesthetic object. (p. 46)

Pierson (1999a) attempts to make an important distinction in support of a central argument treating the CGI image as an aesthetic object but her misunderstanding of the central term creates far more than a grammatical or isolated slip. It makes for an adverse impact on her overarching argument. Digital artefacts in the VFX industry context refer explicitly to artefacts introduced *after* the image passes through the camera lens. They are created by digital processes involving lossy compression, data corruption via hardware or
software failure, or an inherent loss of veracity as part of an image file format. Common examples of digital artefacting are pixelisation, macroblocking, or aliasing via JPEG (Joint Photographic Experts Group) compression. This definition is the antithesis of the profilmic stunt wires that Pierson cites as an example of a digital artefact in her argument. The digital artefact has no real world referent—digital processes applied to images are responsible for its creation (Fossati, p. 287). It is also not an intended part of the rendered CGI image. It is a digital anomaly that although could be regarded as an ‘aesthetic object’, is certainly not in the sense Pierson argues for. This counters Pierson’s argument about the validity of the CG image and the role she ascribes to CGI. The ‘potential for confusion’ is one created by Pierson rather than clarified.

In 2002, the venerable journal Screen published a paper by Julia Moszkowisz entitled “To Infinity and Beyond: Assessing the Technological Imperative in Computer Animation”. Moszkowisz makes an excellent point regarding the indexicality of computer mediated films, reminding the reader that there is an auditory indexical relationship between CGI work and reality when CGI characters are ‘voiced’ by actors. Moszkowisz argues that ‘the products of digitality are not totally synthetic, but have the marks of human presence, and traces of artistic creativity, inscribed all over them’ (p. 312). This is part of Moszkowisz’s greater argument that animation in all forms can be seen to preserve some semblance of an indexical relationship with reality and is more a set of techniques than a genre. Moszkowisz makes links between indexical relationships for older analog forms of animation and the residue of these methods in newer digital processes:

\[
\text{This [the tracing of “real” movement] is now achieved using stop-motion animation, a device that allows animators to capture the central points of human movement and figuration (as marked out on a real person or}
\]

7 'Lossy' compression refers to digital compression in which non-redundant data is removed in order to reduce the size of a digital file. It is the antonym of ‘lossless’ compression and is often represented in examples by variations of the lossy JPEG image file format. (Brinkmann, 1999, pp. 28-31; O’Quinn & LeClair, 1996, pp. 164-7; Harley, 1993, p. 22).
ceramic model), and to translate the information into digital data…. In this respect *Final Fantasy* [2001] is no exception, despite the fact that it stands at the apex of the digital enterprise. For stop-motion techniques are undeniably at its heart, capturing the movement and gestures of real actors and converting their human expression into digital data. (p. 312)

Moszkowisz (2002) is clearly describing digital motion-capture and performance-capture technology in these passages, not stop-motion animation. Motion-capture provides an environment that allows digital data-sets to be generated by sensing and tracing spatial movement in real-time. This data is then parsed and applied to digital 3D models as an animation technique. Moszkowisz’s account could be just a misnomer and not impact on an argument linking the two techniques excepting that the techniques of stop-motion and motion-capture function in diametrically opposed ways.

At the core of stop-motion animation is a production sequence of: prepare a profilmic event state; capture that state by recording a single or small number of still image frames; change the profilmic state; capture again, and so on. Stop-motion capture by name and nature is stop-start and the movement being recorded is anything but—it is necessarily static and is recorded as still images. The motion component of stop-motion animation is the end result of a recorded sequence of images but movement (excepting its interval) is not performed or recorded through these still frames. Motion-capture conversely, is a data gathering technique that records continuous movement. Although motion capture uses sampling techniques to incrementally capture multiple spatial locations in quick succession, unlike stop-motion animation, it records in real-time.

A digital technique that would be more supportive of Moszkowisz’s (2002) argument is rotoscoping. This technique is the frame-by-frame manipulation of digital motion frames to create a seamless motion sequence. The wire removal that Pierson (1999a) cites is most often achieved through the time consuming process of ‘roto’. Rotoscoping treats the motion image through
individual frames, does not occur in real time and results in a seamless motion image. Unfamiliarity with moving image technologies leads Moszkowisz to create an impoverished argument that is undone before gaining traction.

Rotoscoping is also central to Ron Burnett’s discussion of Richard Linklater’s film *Waking Life* (2001). Burnett (2004) claims that video does not contain frames:

> By way of contrast, it is quite a shift for a film to be shot in digital video and then transformed into animation. Yet, that is exactly what Richard Linklater has done with his recent film *Waking Life*. In this instance and as a contrast to *Final Fantasy* [2001], live video footage was “rotoscoped” or animated, frame by frame. This is not an unusual technique in the cinema, but it is rare for video, in part, because there are no frames in video. Rather, images flow by with little to indicate what separates them. (p. 219, my emphasis)

Burnett understandably argues that video is distinct from film but the basis for this appears to be a common misconception that the continuously moving record-head of the video camera does not record discrete frames. Given this, Burnett also conflates the material state of the recording with the viewing experience. Putting aside the possibility of progressive frame recording in which a full frame of real-time video is recorded every 1/25th or 1/29.97th of a second and so instead allowing for interlaced video recording in which each frame of video is comprised of two fields, each frame is discrete in recording and only in playback is blended with field information from adjacent frames—and only if the video display supports interlaced playback. The post-production process of rotoscoping—including the interpolated rotoscoping technique using Bob Sabiston’s *Rotoshop* software undertaken for *Waking Life* (2001)—requires discrete video frames to manipulate and the film was mastered and theatrically screened from 35mm film prints projected at 24 progressive frames per second. It cannot be successfully argued, then, that video has no frames citing that one part of the production process utilised
interlaced footage that was conformed as discrete frames for rotoscoping and was projected as standard progressive film. The recording mechanism of video is notably different from film’s stop-start recording of still frames but despite continuously image scanning, its equivalent to filmic ‘exposure’ is the regular and discrete recording and storing of addressable two-part image frames. This is evidenced by the shared convention of a timing system—time code, between film and video.

It is possible that Burnett is instead referring to the experience of viewing interlaced video in contrast to progressive filmic images in this passage but this is problematic in that Burnett is writing specifically of the materiality of film versus video. Additionally, *Waking Life* (2001) was not distributed theatrically on video and every film released on Standard Definition DVD regardless of its originating format or technology is encoded and can be screened as interlaced video with an appropriate video display, not just *Waking Life*. This feature of interlaced video display is intrinsic within the DVD-Video specification and the hardware of Cathode Ray Tube (CRT) video displays which are discussed below.

It is not only theorists that misapprehend moving image technologies. The renowned cinematography and filmmaker Babette Mangolte who has been making experimental film since the mid 1970s and has exhibited moving image work at Berlin’s 2007 Berlinale, at the Tate Britain in 2001, and the Whitney Museum in 1999, contributes a chapter to the written anthology honouring Annette Michelson. Mangolte’s (2003) chapter entitled “Afterward: A Matter of Time. Analog Versus Digital, the Perennial Question of Shifting Technology and Its Implications for an Experimental Filmmaker’s Odyssey” traces the transition from analog to digital filmmaking processes from a practitioner’s point of view and mourns the loss of film as a production and screening medium. The central problem with Mangolte’s justification for preferring analog moving images over digital ones is that it rests on her argument detailing how temporal digital images are created:
In the world of digital, time is encoded in a bit-map, and there can be no entropy. In the compression algorithm of a digital image, only what changes in the shot is renewed. That which is the same in the shot stays the same in the digital image, in contrast to the constantly changing emulsion grain from one frame to the next in the film image. The inscription of the decaying body in [Michael Snow’s] *Wavelength* [1967] is therefore not possible in digital, even in HD DIGI [as used by Lucas for the *Star Wars* prequel *Episode III: Revenge of the Sith* (2005)]. (p. 264)

Mangolte (2003) misrepresents digital image compression here and it undoes an argument about the superiority of the veracity of filmic images over their digital counterparts. Digital compression has two broad forms—spatial and temporal. Within these forms, compression of moving image data can be inter-frame, intra-frame or both. Only consumer implementations of digital compression use inter-frame compression as this kind of file reduction breaks the integrity of the single frame making it unsuitable for frame accurate editing usually required in an industrial context but sufficient for domestic playback from camera or other media to a video display. If a frame of digital video relies on other frames in order to be rendered and one of these frames is trimmed from the sequence, it can no longer be displayed intact. When editing with consumer level compressed files, only key-frames that are regularly encoded as intra-frame compressed frames can be addressed as edit points. Industrial digital compression algorithms when applied—if any compression is applied—most often results in lossy intra-frame compression, more efficiently storing pixels of the same or very similar hue and saturation values as references to other pixels in the same frame.⁸ Even consumer video compression only compresses the chrominance portion of the image and leaves the luminance

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⁸ In addition to lossless compression algorithms, there are also professional digital moving image transfer formats that do not apply any compression to images. These include HD-SDI, dual link HD-SDI and 3G-SDI and are limited only by the in- or off-camera limitations for recording bandwidth.
component untouched, as viewers more readily perceive this loss of image veracity.

Despite Mangolte’s (2003) description of the ‘constantly changing’ nature of successive frames of film differentiating analog from digital, this argument equally applies to all industrial digital moving images that are captured, stored and screened digitally. It is true that domestic screening formats including DVD-Video, digital television broadcasting and on-line movie download all employ inter-frame compression but it is only in these domestic contexts that this occurs not in the universal way that Mangolte is arguing for.

It can then be seen that the ‘newness’ of technologically mediated moving images—particularly digital ones—present challenges for theorists and for practitioners reflecting on their craft. It is crucial in moving forward that accurate understandings of media technologies are communicated and discussed. David Rodowick (2007) makes two salient observations. The first is that apprehension is insufficient: ‘still, the conceptual criteria of perceptual realism, which are restricted to qualities of spatial semblance, are of limited use in helping to understand how photographic and filmic images are distinct, nor do they point the way to uncovering or creating new powers of digital imaging’ (p. 110). The second is that these extant histories and those being written must reflect the true nature of these technologies. Rodowick argues that

a more complex and nuanced historical context is needed for us to begin to comprehend how a photographic ontology, in Cavell’s sense of the term, is being displaced by a digital ontology. For it is not yet given that we have the tools for understanding what a computational “medium” might be or what would make it new, modern, or actual in relation to the photographic and the cinematographic. (p. 96)
The Index and Quantisation

From the representative theoretical arguments framed above, it can be seen that mechanical moving images represented by film clearly have an indexical relationship with reality. Applying the same Peircian criteria, it can also be seen that digital moving images clearly do not have an indexical relationship with reality. Rodowick (2007) leaves no room for capitulation in his summation declaring that ‘because of the discontinuity of inputs and outputs, the force of indexicality in digital-capture devices stops when light falls on sampling devices, whether they be the charge-coupled receptors of digital cameras or the samplers of digital sound recordings. From this moment forward, light and sound become symbols, and therefore manipulable as such’ (p. 120). This leaves analog electronic moving images represented by pre-digital video and television and having no direct still-image correlate, as a special case.

It can also be seen from the references above, that distinctions regarding indexicality are made based on an analog/digital division, not a mechanical/electronic distinction. Gaut (2010) argues typically for this distribution:

But I will say little about it [analogue video] here, since its salient new features relative to traditional film are its capacities for live broadcast, for enhanced image manipulation and or a degree of interactivity. Digital cinema also possesses the first of these features, while taking the latter two to wholly new heights. So for the purposes of exploring differences between cinematic media, digital cinema is a more striking and useful contrast with traditional film than is analogue electronic cinema. My main point of comparison with traditional photographic cinema, then, will be digital cinema. (p. 10).

Mulvey (2006) also glosses over analog electronic moving images, writing that: ‘however significant the development of video had been for film, the fact that all forms of information and communication can now be translated into binary
coding with a single system signals more precisely the end of an era’ (p. 18). I argue that in order to be ‘more precise’ a less cursory examination of the relationship between analog video and film is required with respect to technologies of representation and in particular the differences and similarities between successive moving image technologies.

As outlined in the Introduction, I propose three categories of moving images that correlate with distinct moving image technologies, offering new illuminations regarding the role these technologies play in indexical relationships between moving images and reality. These categories are; mechanical moving images embodied by various film gauges from 1895 onwards; analog electronic moving images realised through analog television and video; and digital moving images represented by a range of digital technologies including digital video and film in combination with optical technologies.

This is a deliberate departure from established historical divisions based on content. As framed in the Introduction, these categories are often described as being pre-cinema, followed by the birth of- and early- cinema, in turn followed by sound cinema and then modern cinema of the twentieth century with video and television in parallel development and subsequently digital cinema. Not unlike a Peircian trichotomy with acknowledged interdependence and simultaneity, each of the following three chapters addresses mechanical, analog electronic and digital categories of images—where possible in-turn—articulating their distinct relationships with reality and each other based on technologically mediated materiality.

As framed above, Peirce’s index conventionally occupies a severing role in understanding the shift from analog to digital moving images at the end of the twentieth century. The transformation of reality into the ones and zeros of binary data to digitally represent the world on screen has been widely accepted as the location of a break in the causal relationship between moving images and the actuality that they reference. This thesis refers to that effect as quantisation in that it converts continuously variable reality into a finite number of discrete
elements. In engineering terms the reduction of a continuous time signal to a
discrete set of integer values generates what are known as quantisation errors. It
is these errors, generated by the lack of a continuous signal, that, alongside the
material transformation via quantisation, substantially contribute to an
accepted break in the indexical link between the digital moving image and
reality. There is a finite proportion of error though and this is measurable
because there are a finite number of signal samples. The maximum
quantisation error for an analog to digital conversion is typically less than the
error for an equivalent analog signal (Santina & Stubberud, 2007, p. 48). It is
then crucial when considering an indexical break between the moving image
and reality to examine not only the transformation processes leading to changes
in the inherent qualities of the image, but also the resultant signal and its
veracity to the original.

As evidenced in this chapter, substantial written theoretical discussion
regarding differences between analog and digital moving images exists. A
number of these arguments focus on the technological distinctions between the
two (Armes 1995; Hayward & Wollen 1993). Others focus on aesthetic
distinctions (Elsaesser, 2006; Manovich, 2001; Allen, 1995; Walton, 1997).
Some of this writing, which is most relevant here, engages with the relationship
of reality to moving images, building on existing theories of the image and
particularly examining photography as the dominant form of mechanical image
What is common is that the majority of these arguments use the term
'sampling' when describing the effect digitisation has on reality.

A voltage with a corresponding amplitude value that varies over time represents
analog and digital electronic moving images. This amplitude can be perceived
as the subjective brightness—based on the measurable luminance—of the
recorded scene. This voltage is sourced from the camera sensor that generates a
specific voltage when exposed to light. Sampling for moving images is the
measurement of this voltage at discrete intervals, generating discrete values and
then reconstituting these signals as an arguably continuous time signal. This marking of regular intervals in order to arrive at a discrete time signal is commonly employed as part of image digitisation.

There are broadly four steps in the digitising process. The first is digitisation which entails: ‘sampling the grey values at a discrete set of points, which can be represented as a matrix… we sample the image at certain points of a discrete grid… generally we do not collect the illumination intensity exactly at these points, but in a certain area around them.’ (Jähne, 2005, pp. 243; 245). Importantly it is an area around the point not just the discrete point that is sampled at this stage. The next step in the sequence is sampling. Here, ‘sampling means that all the information is lost except at the grid points’ (ibid, p. 246). Repeated sampling can increase the veracity of the resultant value—assuming there is signal noise that will enable the generation of different results in subsequent samples. The third step is reconstruction from these samples and this ‘reconstruction is performed by a suitable interpolation of the sample points’ (ibid, p. 249). This process of reconstruction is then, the inverse of sampling.

Most importantly, the results of these operations are still continuous grey values. The values are still part of an analog signal. They are not yet quantised. One way to describe the difference between a sampled signal and a quantised signal is that the former has a discrete range but can still contain continuous values within that range whereas the latter always has discrete values within that range. This global process of discretisation is known, confusingly, as ‘sampling’ while the sequence of its constituent parts can be referred to both as ‘sampling’ and ‘quantisation’.9

9 The term ‘sampling’ employed here and in cited texts within this thesis is also distinct from the optical engineering terms ‘measurement sampling’, ‘analysis sampling’, and ‘display sampling’ (Brady, 2009, pp. 253-5). Here, ‘sampling refers to both the process of drawing discrete measurements from a signal and the representation of a signal using discrete numbers’ (ibid, p. 255).
The final step in digitising analog moving images is quantisation. This part of the process ‘map[s] them [continuous grey value pixels] onto to a limited number of discrete grey values… Quantization always introduces errors, as the true value \( g \) is replaced by one of the quantization levels \( g_q \)’ (ibid, p. 253). The general aim of quantisation is that no grey value steps (between luminance levels) should be discernable by a human visual system in the same way that individual pixels are not visible in digital images despite those images not being continuous.

So the term *sampling*, often referred to as breaking an indexical link between moving images and reality, is in fact more correctly referred to as quantisation with the sampling stage of the process preserving a continuous signal that, as will be discussed below, is the benchmark for an indexical link with its referent. This use also stems from the global process being colloquially referred to as ‘sampling’. This nomenclature of the process of *sampling* containing a constituent part also referred to as sampling recalls Peirce’s nomenclature within his triadic structure of semiosis. As outlined above, a Peircian semiosis consists of a sign, an object, and most importantly, an interpretant. Peirce correspondingly uses multiple terms to stand in for *sign* to qualify this point and offer more accurate alternate renderings of the term, naming ‘representamen’, ‘representation’, and ‘ground’ as alternates for ‘sign’.

Considering the inherent material forms of the moving image from an engineering perspective, the use of the term ‘sampling’ to describe the transition from analog to digital moving images is only arguably correct but more importantly to this thesis, is not only an issue of language. Simply replacing instances of ‘sampling’ with ‘quantisation’ does not solve this problem. Longstanding and widely accepted arguments regarding the process of transformation from analog to digital moving images cannot be resolved by referring to quantisation rather than sampling because of the fundamental technological differences between these processes and the materiality of the moving images they are applied to. Similarly, qualifying the use of sampling as
referring to both sampling and quantisation does not account for the analog output of the constituent sampling phase of the global sampling process. Broad references to ‘sampling’ that ignore the analog output of the constituent sampling process have become fundamental assumptions in theorising the effect that digital technologies have on the moving image and the subsequent relationship such images have with reality.

Added to this is the issue of sampling made explicit above and the indexical status it then confers on analog images and their indexical relationship with the reality they record. As Bernd Jähne (2005) notes: ‘sampling may already occur in the sensor that converts the collected photons into an electrical signal. In a conventional tube camera, the image is already sampled in lines, as an electron beam scans the imaging tube line by line’ (p. 243). Bill Mitchell’s (1992) view on this in a footnote to his description of digital images introduces explicitly his position on distinguishing between the analog and digital and is an informed detailed cogent representation that is in agreement with, but articulates beyond much other commentary on this point:

> It is important to distinguish carefully between analog and digital electronic images. Video images are analog, not digital. Although video images are subdivided into a finite number of horizontal scan lines, the variations in intensity along scan lines are represented by a continuously varying signal. (p. 228, emphasis mine)

My issue with Mitchell’s argument is that, as has been demonstrated above and will be further discussed below, the ‘continuously varying signal’ is a sampled one. It must be discerned as to whether the indexical link between an analog image that is sampled but not quantised, and reality, is severed. The distinction between sampling and quantisation is again brought to the fore.

The vexing problem of the indexicality of specifically analog electronic images continues to present an aporetic state when attempting to elicit what distinguishes electronic analog and digital images. As Mitchell (1992) argues,
representations of analog moving images are subject to reduction and approximation in similar ways to digital images:

It is an illusion to think that we can reproduce the world in its true colors. If a visual recording medium had unlimited spatial and color range and resolution and strictly linear response, we might indeed use it to produce true-color images—ones that were point-for-point matches to the colors of a real scene. But all real recording media, including photographic film, are limited in their ranges and resolutions; have characteristic microstructures of brush strokes, tesserae, grains, and the like onto which intensity or color values must be mapped. (p. 114)

Mitchell’s (1992) words strongly recall Barthes’ (1985) pre- *Camera Lucida* description of the photograph quoted below as a continuous sign without a reference. Barthes, like Mitchell, clarifies that the photograph is reductive but adds to this that a photograph is categorically denotative rather than connotative (before arguing against this view using examples of press and advertising images in *Rhetoric of the Image*). He also introduces the notion of a lack of constituent elements, arguing that photography is a continuous message without codes:

From the object to its image, there is of course a reduction: in proportion, in perspective, in color. But this reduction is at no point a transformation (in the mathematical sense of the term); to shift from reality to its photograph, it is not at all necessary to break down this reality into units and to constitute these units into signs substantially different from he object they represent; between this object and its image, it is not at all

10 Barthes, (1982) subsequently argues in *Camera Lucida* that ‘this argument is futile: nothing can prevent the photograph from being analogical; but at the same time, Photography’s noeme has nothing to do with analogy (a feature it shares with all kinds of representation). The realists, of whom I am one and of whom I was already one when I asserted that the Photograph was an image without code—even if, obviously, certain codes do inflect our reading of it—the realists do not take the photograph for a “copy” of reality, but for an emanation of past reality: a magic, not an art. To ask whether a photograph is analogical or coded is not a good means of analysis.’ (p. 88)
necessary to arrange a relay, i.e., a code: of course the image is not the reality, but at least it is its perfect analogon, and it is just this analogical perfection which to common sense, defines the photograph. Here appears the particular status of the photographic image: it is a message without a code; a proposition from which we must immediately extract an important corollary: the photographic message is a continuous message (p. 5)

Barthes is also primarily concerned in his earlier writing with the semiological aspects of the photograph and so focuses on the use of photography as communication rather than the ontology of the photograph. Barthes’ view here corresponds to photographs being Peircian icons rather than indices, a term more often reserved for digital images in contemporary views.

**Representation, the Sign and its Object within Analog Video**

The engineering proofs of Mitchell’s (1992) and Barthes’ (1985) arguments are found in the specifications for analog video signals as prescribed by the SMPTE standards. There are a finite number of vertical lines for image recording and display as noted by Jähne (2005), John Watkinson (2008), Dominic Case (2001), and Charles Poynton (2003) alongside Mitchell (1992) and Barthes (1985). Added to this are a specified scanning rate, alternately scanning odd and even lines of the raster image and a limited colour palette. Variations in material and the applications of these materials here create facsimiles of reality but at the crux of this issue is the conferring of a status regarding the indexical relationship between these differing images and the reality they represent.

Materially, electronic moving images are constituted by two essential components: luminance and chrominance and it is useful here to confirm the qualities of these components. It is also edifying to consider the fixed bandwidth determined for both analog and digital video images. This is a
restriction that renders images spatially and temporally finite through sampling the data used to represent moving images. Standards organisation SMPTE (2004), describes video as follows:

The composite color video signal shall contain an electrical representation of the brightness and color of a scene being analyzed (the active picture area) along defined paths (scan lines). The signal shall also include synchronizing and color reference signals that allow the geometric and colorimetric aspects of the original scene to be correctly reconstituted at the display. (p. 2)

Analog NTSC video for example, is described as being limited to 525 lines, 59.94 fields per second achieved by a 2:1 interlace with an aspect ratio of 4:3 (SMPTE, 1998; 2004; 2006). This is most clearly described in the SMPTE (1998) standard for *Three Channel RGB Analog Video Interface*:

The video signal shall correspond to scanning of the image at uniform velocities from left to right and from top to bottom. This will provide 525 nominally horizontal lines where alternate lines are scanned on each vertical pass for 2:1 interlace. As a result of vertical blanking, there are 483 active picture lines which are divided into an active picture period and a horizontal blanking period. (p. 2)

The colour component of the video image is similarly constrained in that there is a limited colour palette and as per Mitchell’s (1992) description, is restricted to integer values in display by virtue of needing to be addressed on the fixed array of a raster display:

The RGB signals shall be suitable for a color display device having primary colors with the following chromaticities in the CIE S002 system of specifications:

\[
\begin{array}{cc}
\text{Red (R)} & 0.630 & 0.340 \\
\end{array}
\]
Green (G) 0.310 0.595
Blue (B) 0.155 0.070

NOTES

1 The display primaries with the chromaticities specified above are commonly referred to as the SMPTE C set.

2 This specification does not preclude the continued use of equipment built to the color parameters of the NTSC 1953 color television transmission standard for which the chromaticities in the CIE S002 system were specified at the values listed below. Signals produced using the original NTSC specifications will not display properly on modern display devices:

\[
x\quad y
\]
Red (R) 0.67 0.33
Green (G) 0.21 0.71
Blue (B) 0.14 0.08

(SMPTE, 1998, p. 2)

Analog video’s bandwidth parameters restrict the brightness and intensity of colour stored and displayed. As an imprecise guide, NTSC video conforming to SMPTE standards is equivalent to the range 16-235 on an 8-bit (2^8) RGB scale (0-255) as can be seen in Figure 1 below. This is the palette displayed by the majority of computer displays. This means that the blackest black and whitest white able to be seen on an analog television or video display is less than the luminance latitude visible on an RGB computer monitor for which
these same colours would appear as a dark or light grey respectively.\textsuperscript{11} SMPTE specifications state:

> When the composite NTSC signal is transmitted (or recorded on some types of video tape recorders), the overall bandwidth is normally limited to less than 5 MHz, typically 4.2 MHz as for broadcasting. In such cases, if it is desired to permit recovery at the receiver of the wideband I signal, as provided in the NTSC transmission specifications, it is necessary to decode and re-encode with the appropriate narrowband Q channel filter prior to transmission (or recording [sic]) …

> Composite video output signal amplitude without the two color-difference subcarrier signals shall be 140 IRE units peak-to-peak (see figure 4).

12.2 Reference level shall be blanking level of 0 IRE units.

12.3 White (luminance), black (setup), blanking, burst, and sync signal levels shall be as given in table 1.

12.4 Maximum composite video output signal amplitude with the two color components (chroma) shall be 171 IRE units peak-to-peak (see figure 4). (SMPTE, 2004, pp. 5; 8)

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\textsuperscript{11} Similarly, the constriction and so conversion limits from film to standard definition analog video are approximately 95 and 685 on a scale of 0-1023.
By way of comparison, digital video has remarkably similar restrictions, adding to the analog bandwidth restrictions a finite number of pixels per line and admittedly a not-insubstantial system of formal image sampling. These are detailed in SMPTE Standard 314-2005 (2005, pp. 26-44) and SMPTE 370M-2006 (2006a) and aim to optimise data storage requirements alongside the preservation of image quality. The digital specifications below are for one of many digital moving image formats but regardless, display a parallel set of restrictions to analog video that can be argued to be instances of image sampling in addition to the formal data sampling and compression of its digital counterpart:

5.1.1 Sampling structure

The sampling structure is identical to the sampling structure of 4:2:2 component television signals described in ITU-R BT.601. Sampling of luminance (Y) and two color-difference signals (CR, CB) in the 4:2:2 structure are described in table 20.
Table 20 – Construction of video signal sampling (4:2:2)

<table>
<thead>
<tr>
<th>Sampling frequency</th>
<th>525/60 system</th>
<th>625/50 system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>13.5 MHz</td>
<td></td>
</tr>
<tr>
<td>Cb, Cr</td>
<td>8.75 MHz</td>
<td></td>
</tr>
<tr>
<td>Total number of pixels per line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>858</td>
<td>864</td>
</tr>
<tr>
<td>Cb, Cr</td>
<td>429</td>
<td>432</td>
</tr>
<tr>
<td>Number of active pixels per line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>720</td>
<td></td>
</tr>
<tr>
<td>Cb, Cr</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Total number of lines per frame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field 1</td>
<td>480</td>
<td>576</td>
</tr>
<tr>
<td>Field 2</td>
<td>286 to 524</td>
<td>336 to 622</td>
</tr>
<tr>
<td>Quantization</td>
<td>Each sample is linearly quantized to 8 bits for Y, Cb, Cr</td>
<td></td>
</tr>
</tbody>
</table>

Line structure in one frame

For the 525/60 system, 240 lines for Y, CR, and CB signals from each field shall be transmitted. For the 625/50 system, 288 lines for Y, CR, and CB signals from each field shall be transmitted. The transmitted lines on a TV frame are defined in table 20.

Pixel structure in one frame

4:2:2 compression-

All sampled pixels, 720 luminance pixels per line and 360 color-difference pixels, are retained for processing as shown in figures 11 and 12. The sampling process starts simultaneously for both luminance and color-difference signals. Each pixel has a value from -127 to +126 which is obtained by the subtraction of 128 from the input video signal level.

4:1:1 compression-

All sampled luminance pixels, 720 pixels per line, are retained for processing. Of 360 color-difference pixels sampled per line, every other pixel is discarded, leaving 180 pixels for processing. The sampling process starts simultaneously for both luminance and color-difference signals. Figures 13 and 14 show the sampling process in detail. Each pixel has a value in range from -127 to +126 which is obtained by the
subtraction of 128 from the input video signal level. (SMPTE, 2005, p. 26)

Attending to the SMPTE prescriptions above it can be seen that Mitchell’s (1992) argument is problematic regarding the distinction between analog and digital images when relying only on the rationale of discretisation for distinction. Mitchell’s introductory description of digital images now reads uncannily like a description of analog video: ‘images are encoded… by uniformly subdividing the picture plane into a finite Cartesian grid of cells (known as pixels) and specifying the intensity of color of each cell by means of an integer number drawn from some limited range’ (p. 5).

Mitchell begins by referring to photographs but then includes video in an enveloping argument that allows him to position this examination within his global view of discretisation being a solely digital phenomenon:

There is an indefinite amount of information in a continuous-tone photograph, so enlargement usually reveals more detail but yields a fuzzier and grainier picture… A digital image, on the other hand, has precisely limited spatial and tonal resolution and contains a fixed amount of information. Once a digital image is enlarged to the point where its gridded microstructure becomes visible, further enlargement will reveal nothing new: the discrete pixels retain their crisp, square shapes and their original colors, and they simply become more prominent.

The continuous spatial and tonal variation of analog pictures is not exactly replicable, so such images cannot be transmitted or copied without degradation. Photographs of photographs, photocopies of photocopies, and copies of [analog] videotapes are always of lower quality than the originals, and copies that are several generations away from an original are typically very poor. But discrete states can be replicated precisely, so a digital image that is a thousand generations away from the original is indistinguishable in quality from any one of its
progenitors. A digital copy is not a debased descendant but is absolutely indistinguishable from the original. (p. 6)

It has become clear since the publication of Mitchell’s text that digital copies are not always indistinguishable from their predecessors because of the introduction of digital noise and at times, but not necessarily, the introduction of quantisation error as framed above and described by Kirschenbaum (2008, p. 12) in addition to being obliquely noted by theorists including Gaut (2009), Manovich (2001, p. 54), and others. Despite this, Mitchell’s core argument remains logical if not contentious.

Part of my argument noted above with regard to quantisation error is that it is both the image-making process and the outcome that must be considered when considering veracity. As Mitchell (1992) goes on to argue:

"Synthesized images can now be virtually point-for-point matches to photographs of actual scenes, and there is experimental evidence that, for certain sorts of scenes, observers cannot distinguish these images from photographs. They can successfully borrow the photograph’s mantle of veracity and pass as true records of actual scenes and events. (p. 161)"

Metz (1974) clearly articulates the importance of perceptual reality and its ability to be a constituent element of the material form of the image without including digital images:

"The strict distinction between object and copy, however, dissolves on the threshold of motion. Because motion is never material but is always visual, to reproduce its appearance is to duplicate its reality. In truth, one cannot even “reproduce” a movement; one can only re-produce it in a second production belonging to the same order of reality, for the spectator, as the first. It is not sufficient to say that film is more “living”, more “animated” than still photography, or even that filmed objects are more “materialized.” In the cinema the impression of reality is also the reality of impression, the real presence of motion. (p. 9)"
Manovich (2001) is even more celebratory regarding the perceptual veracity of digital images—albeit only for computer generated varieties:

The synthetic image is free of the limitations of both human and camera vision. It can have unlimited resolution and an unlimited level of detail. It is free of the depth-of-field effect, this inevitable consequence of the lens, so everything is in focus. It is also free of grain—the layer of noise created by film stock and by human perception. Its colors are more saturated, and its sharp lines follow the economy of geometry. From the point of view of human vision, it is hyperreal. And yet, it is completely realistic. (p. 202)

Adding to this thread is the acknowledged compression and sampling nature of analog photographic imaging as noted by Mitchell (1992):

The range of light intensities in a visual field will often be very much greater than the range of tones that can be captured and presented by a [analog] photograph. Pigments, inks, and dyes can yield a ratio of tonal values, from darkest to lightest, of about forty to one, but the ratio from deep shadow to sparkling highlight in a sunlit scene can be thousands to one. Thus the photograph must compress the intensity range of the scene, with inevitable distortions and loss of detail. (p. 90)

Despite all this information, however seductive it may appear in establishing indexical relationships between analog electronic images and reality, at its core the distinctive feature when comparing analog with digital images is a dichotomy between continuous and discrete. The process of digital imaging can record and display more veracity than its analog counterparts; it has greater spatial and temporal resolution; better colour fidelity; and greater exposure latitude, all resulting in superior perceptual realness. These however, are not the measures employed for indexical fidelity. The distinction between analog and digital moving images is emblematically argued by Gaut as being one in which ‘an analogue image is one that is completely specifiable only by
continuously varying values. Object-generated, handmade, photochemical images and predigital video images are all analogue. In contrast, a digital image is one composed of discrete values, typically integers’ (2009, p. 76; 2010, pp. 9; 14).

The indexical roadblock for digital images is exemplified by Mitchell’s argument of discretisation. It is a more nuanced version of more cursory ‘sampling’ arguments as proposed by numerous writers and theorists in earlier sections of this chapter. Rodowick (2007), another theorist who delves into multiple aspects of indexicality and whose argument is quoted in part above, reaches a similar conclusion, citing the same rationale:

Both kinds of photography [analog and digital] produce convincing representations as a result of their quality of counterfactual dependence, wherein any change in the referent is reflected as a corresponding change in the image, and in both cases this quality relies on the logic of indexicality. But they may also be qualitatively distinguished according to the types of causation involved in the acquisition of images and by ascertaining whether the causal relations between inputs and outputs are continuous or discontinuous. Here (analogue) transcription should be distinguished from (digital) conversion or calculation. (p. 116)

Mitchell’s representative position appears to be a variation of an autographic versus allographic argument after Goodman (1976) as mentioned in the introduction to this chapter. Here, the analog continuously varying image stands in for autograph, and the reproducible or procedural digital image, for allograph.12

Two Constituent Forms of Spatial Discontinuity in Analog Video

Arguments detailed in earlier sections of this chapter that place analog electronic moving images alongside mechanical filmic images and in opposition to digital images are ironically centred on that which was used to separate video images from the earlier technology of film images in the twentieth century. These in turn reflect earlier arguments that differentiate photography from painting and theatre. Mitchell (1992) summarises this strategy on the basis of materiality, arguing that ‘although a digital image may look just like a photograph when it is published in a newspaper, it actually differs as profoundly from a traditional photograph as does a photograph from a painting’ (p. 4).

Using similar vocabulary to Mitchell’s (1992) arguments segregating analog and digital images, analog video is often described as a continuous signal, but this is at the service of differentiating it from film’s stop-start motion (Williams, 1992; Cubitt, 1998; Spielmann, 2008; and Mulvey, 2006). Spielmann describes video generating a ‘flow type of image as an unbroken stream… constantly moving… express[ing] the flow of electrons’ (p. 47). This description and particularly its language, almost contrarily recasts the syntax used to describe film together with analog video as continuous, against the discretisation of digital signals. These arguments however, are intended to distinguish television and video from film—not from digital images. In this flow model, it is film that is discrete, video and television continuous, and digital images return that status to discrete. This focus on analog video inadvertently congregates material similarities between film and digital images in ways that are not often considered.

Analog video and television are perceived on the one hand, to render a continuous and faithful recording of reality. This is unlike their digital counterparts that grasp snatches of reality and then sample and compress them into packets of digital data, subsequently throwing out parts of the recorded scene in an often perceptually transparent but always materially destructive
manner. On the other hand, analog video is considered to record continuously against film’s stop-start recording method. This argument is premised on the ‘lack of fixity’ of the video signal (Spielmann, 2008, p. 49). Analog video employs field recording in which sequential frames are displayed in an imbricated fashion, mixing images from one frame to the next with odd/upper and even/lower lines/fields alternately presented on screen. This is distinguished from the filmic image which comprises a ‘fixed motion image of the film… tied, at shooting and projection, immovably to the template of a vertical ordering of the single image frames on the filmstrip. Video cancels such demands’ (ibid, p. 48).

Problematically, this view of analog video and television as continuous, only functions for the reconstituted form of these media. In both storage and in editing, video and television are frame-addressed as single images in the same way film and digital images are, but admittedly, are also reconstituted from the frame’s components—as are digital images. A further attribute that links analog video with digital images is that unlike those media, film’s constituent parts—excluding latency—remain the same in all states. They are photo-chemically integrated frames. Analog video, television, and digital images all share the attribute of smaller distinct constituent parts forming the screened image, with the deconstructed forms unlike the constituted image in materiality and appearance. This can be regarded as an electronic form of latency, a term more often associated with the mechanical photographic image. What is useful in this and other iterations of the continuous video model is that the distinctions being made by Spielmann (2008) are between mechanical and electronic technologies, not between analog and digital ones.

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13 The latency of film can be argued to affect only its occlusion or alternately it can be, I believe, more strongly argued that photochemical processing does alter the material form of the film stock, as does any film contact printing. This questions the veracity of the relationship between photographic negatives and prints for still imaging and contact printing for motion images. It positions the recording camera obscura and daguerreotype discussed in Chapter Two as more direct forms of representation than the increasingly allusory analog camera and imaging technologies that followed but is tangential to this discussion.
In arguing for a continuous temporal flow for video, an unacknowledged spatial discontinuity is realised through Spielmann’s (2008) argument. The construction of the imbricated video frame that reduces flicker and the bandwidth required to present the image is at once required for temporal continuity, but contemporaneously instigates a spatially discontinuous video image by breaking the frame into multiple discretely addressed fields. As Spielmann concludes but without conceding this point: ‘this makes it clear that the “video image” essentially represents an incomplete and discontinuous type of image’ (p. 49).

Spielmann also yokes analog video to digital images, defending difference but also describing a parallel coding:

> In the electronic [analog] process, information is not coded as in the digital; however, it becomes available in multiple forms via the transformative process comparable to numeric coding. The limitless possibility for optionality in the digital cannot be reached by way of the linear premise of the electronic. Linearity in the electronic media is defined by the continuous process of inscription of signals governing the medium’s realization. (p. 49)

Although both analog video and digital media are formed from segmented parts, the nonlinearity of the digital—its ‘optionality’—differentiates it from its analog counterpart and it is this rather than Mitchell’s (1992) or Spielmann’s (2008) continuity that provides a tangible material distinction. However, this is only one of many effects available to digital media. Crucially, it is as effortless for digital moving images to operate linearly as nonlinearly. Having already established that an indexical relationship between moving images and reality requires continuity over discretisation however, I return to Spielmann’s differentiation of analog video from film. As demonstrated above, the essential temporal continuity created and required by the raster scanning process inherently instigates a spatial discontinuity by demanding discrete interlaced fields within each video frame.
There is a further spatial discontinuity inherent within analog video displays and this second discretisation is more pronounced than that discussed above. It is the spatial discontinuity created through the filtering of the video image as it reaches the phosphor coating behind the glass front of the analog video display or television. To better understand this effect I propose an analogy with halftone images.

Analog halftones were first developed in the mid nineteenth century and can be readily seen in a variety of historical and contemporary non-photographic—non-continuous—printed images (fig. 2). These images can be regarded as instances of sampled photographs.\textsuperscript{14} Halftones are the product of converting continuous tone images ‘into pictures composed of fine dot patterns that vary in size or frequency to create the effect of intermediate grey tones’ for print reproduction (Mitchell, 1992, p. 74).

\textbf{Figure 2} Generic analog halftone screen—magnified

Halftones then are discontinuous in that the halftone screen filters the pictorial content, using only a subset of the image elements and discarding others.

\textsuperscript{14}There are also digital halftones that achieve similar halftone effects but do so through dithering algorithms. This technology is distinct from analog halftoning and is not considered here. For more on digital halftoning see O’Quinn & LeClair (1996, pp. 286-94)
Halftones are examples of discrete, rather than continuous, analog images.

Under a Peircian model, halftones do not have an indexical relationship with their referent objects because they are not photographic—not continuous, despite a cursory visual appearance of continuous tone and one of their primary uses being the reproduction of photographs. Mitchell, in the same paragraph as quoted immediately above, writes that, unlike halftones, ‘photographs and appropriately constructed video displays produce true continuous-tone images’ (ibid). I argue this is not true and that unlike photographs, analog video displays and televisions produce non-continuous or discrete images, despite these images being analog.

There is a strong similarity between the process of generating images through halftone printing and through analog video. A conventional analog video monitor is based on the hardware of a Cathode Ray Tube (CRT). These devices have a shadow mask or an aperture grill at the receiving end of the tube (fig. 3).\textsuperscript{15} A shadow mask is a sheet of perforated metal placed just behind the phosphor-coated glass at the front of the screen. It functions as a filter to refocus the light from three electron guns that are activating the individual phosphor dots on the screen, each aligned to particular colours by a triadic arrangement of light-sensitive dots. The differing angles of the guns, as they are most often physically separated at the back of the tube, mean those lights passes through the mask holes at slightly different angles and so only reach the appropriate colour-sensitive target. These dots then, arranged in a triangular form, each receive only light from one of three electron guns.\textsuperscript{16}

\footnote{\textsuperscript{15} This is not to be confused with the either a spatial aperture effect in which the electron beam—having a finite radius, exhibits a Gaussian distribution of energy across its diameter or a temporal aperture effect that can introduce a time-lag as the image is scanned right to left, top to bottom. See Watkinson (2008, pp. 77-9) for an introduction to these effects. The spatial aperture effect is related to the overall envelope of the image, effectively limiting the bandwidth of the image but not affecting continuous values within that envelope.}

\footnote{\textsuperscript{16} For an historical account of the introduction of shadow masks to television in the late 1940s and early 50s, see Abramson (2007, pp. 40-2).}
To achieve a similar effect, the aperture grill (or tension mask) system uses a fine mesh of vertical wires to separate the different colours into vertical strips rather than the triangular arrangement of the shadow mask solution. It is possible to visually distinguish the two forms of image screening without magnification as the aperture grill has two horizontal supporting wires, one third from the top and bottom of the screen that are visible on the front of the screen, particularly with brighter images. Aperture grill CRTs can produce brighter images because of a design that allows more light to pass through the mask but are also susceptible to light bleed between the slots, creating a softer image. Shadow mask screens offer more edge definition because of the smaller apertures concentrating light for additional sharpness but have to increase the electron beams’ strength to compensate for the light lost outside of the tiny apertures.

The visual and procedural similarities between the screening mesh for analog printed halftones and electronic analog screens requiring some kind of aperture grill or shadow mask is arresting. The photograph as source image for the printed halftone is analogous to the video signal as recorded to be displayed on the CRT. Both display technologies feature discrete picture elements—analog pixels, which reconstruct the original continuous tone image in a discrete fashion. Both techniques sample a continuous tone image and present a
Conclusion

It can be seen then, that the measure of indexicality is reliant on continuity and also that there are two discontinuities present in analog video; the first of these being the breaking of the continuous video frame into discrete spatial fields as part of the electronic process of generating analog video images; and the second, a halftone-like spatial sampling of the video image resulting in discrete analog pixels on-screen. In Peircian terms, either of these ruptures is sufficient to sever an indexical relationship with the image’s referent object. The indexical status of analog video is no different from that of digital video images because both fundamentally consist of discrete non-continuous picture elements—pixels. I argue that an indexical break between moving images and reality—as described by contemporary film theorists—does not first occur historically as part of the transformation from analog to digital moving images but from mechanical to analog electronic images.

In discerning indexical relationship between moving images and reality, the value of an enquiry framework that considers differing technologies rather than a less granulated analog/digital divide is now evident. The subsequent three chapters historiographically chart the newly minted mechanical, analog-electronic and digital eras of the moving image in turn, considering the moving image filtered through the lens of successive technologies and attenuating the prevalent analog/digital distinction in favour of a more nuanced approach.

The remainder of the thesis traces the relationship between moving images and reality by reviewing and interrogating the history and technologies used to produce and exhibit moving images. The material relationship of moving images to reality and how this relationship has been theorised underpins this dialogue. Discussion in subsequent chapters concerns the essential nature of moving images and their mimetic relationship with reality and also the
experience of reality through moving images as reflected in much of the historical theorising of cinema, film, video and digital media. This is an important distinction given that the possibilities for perception are not limited to verifiable reality, as I will demonstrate.

The thesis can be said then, to distinguish between the reality of film and realism in film as described in the Introduction. The mimetic reality of film is the overarching focus of the thesis but realism in film and the phenomenological aspects of film are also important to any understanding of reality as proffered by the moving image.

Accordingly, the relationship between moving images and reality is regarded as central to the disciplines of cinema studies, film theory, media studies, and screen studies. Annette Kuhn (2009), writing about theorising the screen, argues that:

> What we are seeking to explain or understand, very broadly speaking, are the moving image screen or screens, what is displayed on these screens, and the nature of our encounter with them. In thinking about these things, we may focus variously on the screen itself, on our mental processes, on our bodies, or on the heterogeneous ‘surround’. This is a wide-ranging remit. Moreover, what we are seeking to understand or explain is not only diverse but also in a process of changing and becoming. (pp. 5-6)

This thesis acknowledges the breadth of enquiry suggested by Kuhn and consciously focuses on the relationship between moving images and reality as providing insight into the inherent nature of moving images. However, as Kuhn highlights—seemingly after Bakhtin—any aspect of film is always subject to change. The evolution of imaging technologies is a main instigator of this ‘becoming’ and the manipulation of reality in moving images is central to this thesis. The techniques involved can be traced back through moving image history to late nineteenth century trick-films, and further if we include
still images, to the practice of composite photography preceding moving images.

Chapter Two: *Reality, Mechanical Moving Images and their Antecedents*, chronicles the history of moving images through the first of three technology eras considered in this thesis. These are mechanical moving images that emerged jointly from the fields of science and the carnival sideshow and this context is examined alongside arguments regarding actuality and presentations of reality unique to the mechanical moving image.

As its title suggests, Chapter Three: *Reality Effect? Reality or Verisimilitude in Mechanical and Electronic Moving Images of the Mid-Twentieth Century*, considers the introduction of electronic moving images as the second era of moving images. An increasing level of visual detail is made possible through the mid-twentieth century via new film stocks and lighting technology combined with the introduction of sound, colour, stereoscopy and larger displays. These developments at the service of greater verisimilitude, exhibit a compelling illustration of Barthes’ Reality Effect, ‘positing the referent as real’ as he applied it to the ‘collusion of a referent and a signifier’ in realist literature (1985, p. 147). Chapter Three also documents the simultaneity of mechanical and electro-mechanical moving images, and tensions between uses of mechanical and electronic technologies against the electronic throughout the duration of the second era of moving images.

This thread leads to the fourth chapter: *Reality, Simulation and Presentationism: The Transubstantiation of Digital Moving Images*, which tackles the introduction of digital moving images and the eventual demise of mechanical imaging represented by the film medium, that had persisted since the birth of cinema. Peirce’s notion of the index is woven throughout these chapters, defining and problematising the connections between the moving image and reality, particularly where theorists and practitioners have directly or indirectly drawn on Peirce’s taxonomy.
CHAPTER TWO

Reality, Mechanical Moving Images and their Antecedents

Introduction

This chapter historiographically interrogates the mechanical moving imaging era defined in the Introduction. The moving images discussed in this chapter offer context and elucidation of the arguments regarding indexicality and more broadly the relationships between moving images and reality presented in Chapter One. My central argument laid out in there is that an indexical break between moving images and reality first occur historically as part of the transition from mechanical to analog electronic images rather than from analog to digital moving images. Chapter Two is nominated in the Introduction as a site within which a more finely nuanced version of the relationship between technology and indexicality can begin to be interrogated. The accuracy of defining the era considered in this chapter as Mechanical Moving Images and further, its role within a newly defined triad of successive technologies, is proven here.

My contextual argument that continuity is a required attribute for Peircian indexicality offered in the previous chapter is readily achieved in this era of mechanical moving images through mechanical and electro-mechanical technologies. This chapter is then, one that can additionally interrogate distinctions between the apprehension of moving images and their materiality particularly as it relates to the relationship between these images and their status of representation. Expediently, images and theorising of this era are for the most part, overtly concerned with what were then new methods for representing reality and the novelty of photorealism. This emphasis prompts discussion of the unique properties of technologies that enable representation of moving images.
An historical investigation into the relationship between moving images and reality can begin, as others have, with the semblances within Plato’s allegory of the cave and trace a circuitous path to twenty-first century digital cinema. For the inhabitants of Plato’s cave, the illusion of the shadows on the wall is all they know, and are considered real. Since they know nothing beyond these shadows, they have no sense that what they perceive to be reality is mere illusion. For Plato, images are no more than shadows on the cave wall. As discussed in the Introduction, this is part of a larger notion of mimesis in this thesis, helping to define representation, imitation, and reality.

Witnesses to successive technological innovations, especially of the magnitude of late nineteenth and early twentieth century moving images, do not have the benefit of hindsight, and so each new technical iteration appears proximate and at the zenith of experience. The technically specific verisimilitude presented by moving images at any given time in the development of the moving image is the extent of representational experience. Perceptual realism, as for Plato’s cave, is the accepted yardstick for realism in the era of mechanical moving images.

One of the effects of this is that much theorising and commentary on mechanical moving images that this chapter chronicles, deals with the apprehension of moving images. These then, take precedence over more material aspects of cinema. Rather than this detracting from their relevance to this thesis, this preoccupation prompts a critical consideration of perceptual realism alongside an ontological focus. One of the concerns of this thesis, as framed in the Introduction, is the distinction between filmic and other realities. Perceptual realism, measured through the terms referenced- and fantastical-realism in this thesis are then important terms in any moving image history and particularly for technologically mediated accounts. In the era of mechanical moving images the recognition of real world referents through film and the observance of the familiar through photographic representation are key to linking the phenomenology of apprehension with the ontology of the material.
The substance of this chapter chronicling the era of mechanical moving images considers this era to include all mechanical and electro-mechanical moving images up until the birth of technology that would later become television. The endeavours of this era demonstrate a striving for increased verisimilitude alongside the grasp of emerging transformations to reality that directly impact on apprehensions of the moving image. As argued in Chapter One however, technological advances in colour, sound, resolution, and immersive environments that serve to increase verisimilitude do not in themselves make any impact on indexicality. Perceptual realism may appear to be the gauge of success for verisimilitude but the benchmark for indexicality is material. The defining requirement is continuity over discretisation. As noted above, all mechanical and electro-mechanical moving images considered in this chapter can be seen then, to have indexical relationship with the reality they represent. However, early film practitioners and theorists grappling with the impact of mechanised moving images largely consider an authority of representation enveloped in the guise of perceptual photographic realism to be the potency of what was then a new technology. This view was generally not questioned and many references to indexicality are initially implicit within the survey of this era of mechanical moving images.

The Photograph and Reality

This chapter begins not with Plato’s mimesis, but rather, the birth of photography as the first technology that strove to record reality through mechanically reproduced images. Photography was born out of the technology of the daguerreotype, having only one technical difference to its successor; the daguerreotype used a positive only process (as opposed to photography’s negative), hence its lack of reproducibility. But it remains an important technical antecedent to representations of reality through photography and it will be seen throughout this thesis that technological context is important when considering lineage and advances in depicting reality through moving
images. Hollis Frampton (1973) reminds the reader that ‘a photographic print is not, after all, a unique object but only a member of a potentially infinite class of “related” interpretations of a negative (p. 53).’ The daguerreotype then offers a sharp contrast to the possibilities that immediately followed—the invention of mechanically reproducible continuous photographic images.

The earliest surviving photograph is widely agreed to be *La Cour du Domaine du Gras* (View from the Window at Le Gras) captured in 1826 by Nicéphore Niépce, in the village of Saint-Loup-de-Varennes near his home. (fig. 4)

![Figure 4](image_url)

*Figure 4  Niépce, N. (1826), La Cour du Domaine du Gras [Photograph]*

The image was made using a camera obscura and beyond being the earliest known reproducible photograph, is noteworthy within this thesis for three reasons. First, the reality the photograph depicts is far from the visual expectation that we have of contemporary photography. It does not display the verisimilitude that is expected of a photograph largely due to the technology available at the time yet we still *recognise*, when given the context of the image, that it is a photograph. It is from nature, yet is also heavily visually stylised. It is easy to imagine a non-photographically rendered image to have more real-
world veracity than this image when considering the faithfulness of its representation. Secondly, the image shows sunlight being cast on opposing walls due to the long exposure time. Hence the photographic image is not reality as we may visually experience this vista and the production and presentation of the image must be considered distinctly. Thirdly, the camera obscura is a seventeenth and eighteenth century technology widely used to make perspective drawings. Here the technology of the camera obscura is coupled with nineteenth century technology of chemically rendered printed images to create ‘photography’. This is not a successive iteration of technology; it is a combination of existing technologies and technique for a new outcome.

The success or otherwise of imitation cannot only be judged by the resultant image but must include the methods employed to achieve it. With the knowledge of what this object is, the ‘essentially objective character of photography’ is invoked (Bazin, 2004, p. 13). This is because between the originating object and its reproduction there intervenes only the instrumentality of a nonliving agent… a very faithful drawing may actually tell us more about the model but despite the promptings of our critical intelligence it will never have the irrational power of the photograph to bear away our faith… no matter how fuzzy, distorted, or discoloured, no matter how lacking in documentary value the image may be, it shares, by virtue of the very process of its becoming, the being of the model of which it is the reproduction; it is the model. (Ibid, pp. 13-4)

This then is an example of what is described in the Introduction as referenced photorealism. Bazin (2004) takes this notion further though, and in what is not clearly either an ontological or phenomenological argument, argues that ‘the photographic image is the object itself, the object freed from the

17 For a detailed examination of the technological and social impact of the camera obscura as a cultural object see Crary (1990, pp. 25-66).
conditions of time and space that govern it’ (p. 14). I will return to this claim in Chapter Four alongside discussion of arguments regarding the transparency of the photograph and the ability to perceive reality through moving images.

Simply, Niépce’s photograph reflects the possibilities for mechanically reproducing photorealistic images in 1826. What we visually accept as reality is dependant on the methods used to render the object, particularly in the case of mechanically or electronically produced images, but also on factors including context and culture in addition to the visual veracity of the image. This last point echoes arguments made by writers including Schiavo (2003), Bottomore (1999), Crary (1990), Gunning (1989), and Metz (1986).

Rosalind Krauss (1982) notes that there is a strong tendency to treat ‘Western survey photography as continuous with painterly depictions of nature’ (p. 318). She details arguments that present photography—in which I include the emblematic Niépce image—as an extension of the landscape ‘sensibilities’ that were prevalent in Western painting of this time. Edward Buscombe (1995) links nineteenth century landscape painting and the filming locations of ‘The Western’ genre film through early photography. He argues that the reality of the filmic Western’s landscape is based on the authenticity of early landscape photography undertaken by surveyors and geologists. This in turn mimics earlier European painting, ‘mixing the pastoral and the romantic in equal parts’ (p. 88). Often these photographs, like the paintings they imitated, included the spectator pictorially within the frame, ‘inscribing into the image the correct way of reading it’ (ibid, p. 90). Photographic reality is, then, already commoditised and prescribed by the mid 1800s. Buscombe also argues that only a small subset of this western mountainous landscape, these being the Rockies in Colorado, Utah, and Arizona, became permissible representations of the real West in films of the twentieth century. Already, ideas of recognition and pictorial context in concert with representation are unavoidable.
Photographic Motion and Moving Images

The shift toward photorealistic moving images through technology arrived early in photographic history. Stereoscopy, a nineteenth century technology, introduced a nascent sense of moving images through the use of multiple photographs to create a single image-work. By replacing earlier stereoscopic hand drawn images with photographic reproduction, the stereoscope problematised the relationship between images and reality. In a nineteenth century context this means it questions the trustworthiness of vision:

> By inducing the illusion of solidity with only binocular cues, and prompting the experience of solidity where no depth actually existed, the stereoscope called into doubt the alleged subordination of vision to touch, an assumption predicated on the belief in a self-present world ‘out there’. Creating a situation in which we ‘see’ that which is not really there, the stereoscope insinuated an arbitrary relationship between stimulus and sensation. This notion challenged centuries of thought that has assumed a direct correspondence between objects and their retinal projections. (Schiavo, 2003, p. 116)

Early stereoscopic devices include the Wheatstone Model (1830s), the Brewster Stereoscope (1840s), and the Holmes Viewer (1861), all offering an array of interchangeable three-dimensional reality via photographic images for wide consumption. Many minor changes in the positioning of image cards differentiate these devices before a more important distinction emerges: the introduction of Brewster’s lenticular stereoscope, replacing Wheatstone’s mirrors. There was on-going debate throughout the 1850s regarding the ownership of the rights to the invention of the stereoscope as a middle-class toy. Brewster’s device, in addition to using lenses, was a far more elegant solution to binocular viewing than Wheatstone’s, which had emerged from scientific enquiry rather than the intention to create a mass-produced populist plaything. Brewster’s device enclosed the viewing card, doing away with Wheatstone’s open viewing design that exposed the workings of the stereoscope. In the
context of a cinematic viewing experience this added an element of illusory magic to the representation of reality. It also recalls the presentation context of the nineteenth century phantasmagoria complete with hidden projector and screen.\textsuperscript{18}

Nevertheless, all stereoscopes offered a similar visual experience ‘as the viewer attempted to bring the scene together’ with a distinctive foreground and background reconvergence, often resulting in ‘an incoherence of vision’ (Cowie, 1999, p. 25), rather than a homogenous or unified space that might be considered ‘more real.’\textsuperscript{19} Discussing the real, stereoscopy, and its similarity to moving images, Krauss (1982) writes that:

\begin{quote}
The phenomenology of the stereoscope produces a situation that is not unlike that of looking at cinema. Both involve the isolation of the viewer with an image from which surrounding interference is masked out. In both, the image transports the viewer optically, while his body remains immobile. In both, the pleasure derives from the experience of the simulacrum: the appearance of reality from which any testing of the real-effect by actually, physically, moving through the scene is denied. And in both, the real effect of the simulacrum is heightened by a temporal dilation. (p. 314)
\end{quote}

Krauss’ attention to the experience of the real nonetheless illuminates elements of the essence of moving images and so offers comment on both the phenomenology and the ontology of cinema as she discusses the potency of the image and the distinctive property of temporality that moving images offer. Krauss’ 1982 argument echoes in part Erwin Panofsky’s (1997) mid 1930s

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\textsuperscript{18} See Gunning (2009, pp. 25-7) for an introduction to the nineteenth century phantasmagoria. See Moen (2009) and Marsh (2009) for a broader view of phantasmagoria within nineteenth century ‘spectacular transformations’ and ‘dissolving views’ respectively.
\end{flushleft}

\begin{flushleft}
\textsuperscript{19} For further critical exploration of the stereoscope and its place in imaging history, see Gill (1969); Jones (1976); Darrah (1977); Becker (1979); Earle (1979); Crary (1999); and Schiavo (2003).
\end{flushleft}
argument distinguishing the experience of cinema from that of the theatre. Both theorists also share the technique of describing the experience of moving images through the context of earlier technologies of visual spectacle:

Here too [in the cinema], the spectator occupies a fixed seat, but only physically, not as the subject of an aesthetic experience. Aesthetically he is in permanent motion as his eye identifies itself with the lens of the camera, which permanently shifts in distance and direction. And as movable as the spectator is, as movable is, for the same reason, the space presented to him. Not only bodies move in space, but space itself does, approaching, receding, turning, dissolving and recrystallising as it appears through the controlled locomotion and focusing of the camera and through the cutting and editing of the various hosts—not to mention such special effects as visions, transformations, disappearances, slow-motion and fast-motion shots, reversals, and trick films. (pp. 97-8)

For Panofsky, not only is there a distinction between the real of the theatre and the simulacrum of the cinema but also a distinction between the representation of reality through the camera’s unmediated recording, the filmic reality crafted in post-production through editing, and in-camera special effects manipulated by the film-maker in constructing a finished moving image work. I will discuss the manipulation of reality in early cinema particularly in regards to the work of Georges Méliès below, arguing after Gunning (1997, 1989, & 1986) that what was immensely attractive about the reality offered by early moving images was not the moving photographic content displayed, but the technology that moved photorealistic pictures.

Krauss’ focus on the phenomenological attributes of the stereoscope means that her argument doesn’t acknowledge one of the strongest links between stereoscopy and moving images; that the stereoscope requires multiple images to create the illusion of depth and the associated cinema-like experience of the resultant unified image. The stereoscope, although designed and only providing for still image viewing, requires two differing images of the same
scene to create a three-dimensional view. This pair of images is separated across space rather than the time-sequence of motion pictures with the recording plates usually being exposed simultaneously and most often positioned six degrees (or interocularly 63.5 millimetres) apart, in order to maximise the illusion of depth. Photographic stereoscopic images of the nineteenth century are forerunners to the animation of still images for moving image outcomes, and also to stereoscopic moving images right up until the 1920s including the Televiewer process, Plasticon anaglyph projections and Natural Vision.

Stereoscopic still images, in a conspicuously parallel action to moving images, offer multiple images of the same scene, and like stereoscopic moving images remain for the most part firmly located in an optical and mechanical framework even for later digital incarnations of these techniques.

Stereoscopes were the first imaging instruments to introduce binocularity, a departure from the single or idealised eye that had been previously assumed in theories of vision since the Renaissance as noted above. This is especially noteworthy when considering the relationship between images and reality. Jib Fowles (1994), writing on the history of the stereoscope, offers a broad contextual note regarding visual communication that helps locate stereoscopy within the field of vision since the Age of the Enlightenment:

Stereographs were the first photographic mass medium, as woodcuts and engravings had enjoyed an extended history, one that predates the introduction of the printing press, while lithographic reproductions were plentiful since early in the 19th century. In any case, it cannot be disputed that stereography was a true mass medium, delivering duplicated imagery to multitudes of citizens. (p. 89)

The stereoscope, as a then fundamentally new vision device and form of mass media communication, is only one of many optical devices for social rather than solitary use. Pre-cinematic parlour toys such as the Phenakistoscope and Zoetrope—that use persistence of vision to create motion from sequences of static drawn (non-photographic) images—are a rehearsal for later, mechanically
produced photographic images. These objects create motion from multiple still images using non-mechanical means, foreshadowing the mechanised moving image. In a similar way, seventeenth and eighteenth century ‘drawn’ images are forerunners to non-photographic animation of the nineteenth century that in turn pre-dated mechanical photographically based animation. These images represent pro- and a-filmic reality beyond Peirce’s example of the singular photograph as indexical. However, the fusion of two photographs as a single image in no way detracts from an indexical relationship with reality. The optical intervention blends multiple instances of reality in creating a representation with three-dimensional depth. The crux of indexical proof lies in a distinction between the material form of the two photographs, each with their referent object, and the perceptual realism of stereoscopy.

Another nineteenth century precursor to cinema, exhibiting an entirely different scale from parlour toys of the time, was the panorama, particularly the ‘moving panorama’. Notably, these were also known as ‘moving pictures’ and displayed enormous continuously moving scenes to static viewers (Miller, 1996). Angela Miller writes that ‘the moving panorama required two large cylinders positioned at either end of a stage, across which the canvas, generally eight to twelve feet high (though much higher in later years) and often hundreds of feet in length, was rolled before the audience’ (p. 39). Miller, whose focus is on the origins of cinematic re-enactment, argues that the panorama was ‘a form of reputedly stunning illusionism that approximated both cinema’s visual field and time/space continuum; and in its last years, as an entertainment that anticipated the drama, movement, and epic spectacle of early film’ (p. 38).

Although having originated at the end of the sixteenth century, panoramas enjoyed a revival as part of nineteenth century social experience. These displays were immersive and generally historic in content. They were usually event reconstructions and so can be seen as part of visual documentary practice, differing from the moving images of cinema that were to come, primarily in
that despite being a time-based experience, they presented an image of reality that was a single moment in time, not unlike *The Matrix’s* (1999) bullet-time photography. An important exception to this with regard to the cinematic, were the ‘composite’ views offered by the 360° panoramas that can be seen to even more keenly anticipate cinema. These presented combined multiple discrete events within a greater narrative such as a war-field scene or a celebrated exploration epic. Additionally, further instances of multiple views within a single moving image frame are discussed below.

Three unique qualities of panoramas in terms of their ‘verisimilitude’ and as ‘precursors to film’ are described by Alison Griffiths (2003) thus:

First, the mode of spectatorship invited by their scale… second, their status as technologies of virtual transport and invocation of presence as a constituent feature of the panoramic experience; and third, in the case of moving panoramas, their exhibition content— a fixed, as opposed to an ambulatory, mode of spectatorship, in which audiences sat in a darkened auditorium for the duration of a performance, complete with musical accompaniment and explanatory lecture. (p. 3)

As I have noted with regard to the lineage of animation and drawn versus photographed images, Jonathan Crary (1992), describing visual culture in the nineteenth century, writes that many optical devices ‘preceded the invention of photography and in no way required photographic procedures or even the development of mass production techniques’ (p.17). This is central to Crary’s well-versed argument regarding the shift of a scientific and philosophical enquiry of vision from ‘geometrical optics’ in the seventeenth and eighteenth centuries to the ‘physiological optics’ of the nineteenth century. His argument ignores, however, the important nexus between photography and stereography in terms of its dominance in nineteenth century image viewing. The shift from Wheatstone’s intentionally simple line diagrams demonstrating stereopsis, to Brewster’s photographic lenticular stereoscopic experienced by the middle class
in the second half of the century, owes much to the veracity of views afforded by the independently originated photograph and its mimetic properties.

The function of photography and stereography becomes conflated when the applications of these technologies are ignored, as Crary does in his physiological vision argument. It is less important, however, than the conflation of stereoscopy and the eye in depicting reality. As Schiavo (2003) notes, marketing the nineteenth century stereoscope relied heavily on strengthening the similarities between reality shown by the stereoscope and natural vision, with ‘the eye as the ideal optical instrument and the standard by which all other technologies of vision were judged’ (p. 126).

Crary’s focus on separating photography from nineteenth century vision is, as it was for Krauss, predominantly phenomenological; it nonetheless offers important readings regarding the ontology of the moving image in the course of unpacking relationships between reality, nineteenth century photography and its antecedents. Crary (1992) notes that many of these pre-cinematic optical devices were created as part of scientific studies that measured retinal afterimages. The focus of these studies was on the reception of the image and illusions of motion, but they also resulted in objects that have unique moving image properties and relationships to reality.

Rendering specifically motion over time as static photographs between 1873 and the mid-1890s presents a closely related but strangely reverse interest. Practitioners included Georges Demeny, Ottomar Anschütz, Thomas Eakins, Harold Eugene Edgerton, and most notably Edweard Muybridge and Étienne-Jules Marey. In recording motion with multiple stills cameras, initially for the purposes of analysing motion, these photographers exposed images as units of time, as photographic frames that would later constitute mechanised moving images.

For these static images dubbed ‘chronophotography’, motion is parsed to become a cinematic sequence of still images. Marey and Muybridge used
opposing methods to achieve this. Muybridge offered a sequence of discrete stills (fig. 5) in contrast to the approach of Marey (and Eakins) who generated time-based sequences within a single photographic image. (fig. 6)

Figure 5  Muybridge, E. (1878), *The Horse in Motion* [Photograph]

Figure 6  Marey, É. (c. 1882), *A Photograph of a Flying Pelican* [Photograph]

Curiously and despite the technological developments underway at the time, neither practitioner worked to re-animate these images from reality as part of their investigations. As Bazin (2004) notes, ‘he [Marey] was only interested in
analysing movement and not in reconstructing it’ (p. 17). Muybridge did later exhibit moving image stills in the form of the zoopraxiscope, but this was a distinctly new venture that curiously did not use the stop-motion photography of his earlier work; it instead employed drawings photographically printed onto the zoopraxiscope’s revolving discs (Musser, 1995, p. 5). Importantly, these representations of motion substantially contribute to a demarcation between still and motion photography. As Frampton (1973) argues for Marey’s photography of this time: ‘the photograph could no longer contain the contradictory pressures to affirm time and to deny it. It split sharply into an illusionistic cinema of incessant motion and a static photographic art that remained frozen for decades’ (p. 50). These differing trajectories of still and motion photography can be additionally seen in the introduction of digital still photography that circumvents the analog electronic path that motion photography pursued throughout the second half of the twentieth century, moving from wet-chemistry directly for the most part, to digital processes without recourse to analog electronic technologies.

This oscillation between the use of new and old technologies for stereoscopes, pre-cinema parlour toys, and chronophotography reflects the rapid changes to vision of this era. Much of early chronophotography work was scientific or educational rather than artistic, as can be seen in Figures 7 and 8 where the sequences of images respectively show pronunciation of a phrase for deaf mute students and the contortions of a psychiatric patient recorded to assist with diagnosis.
Early scientific photography, although not detailed extensively here, is relevant as an additional proving ground for the moving image with respect to its indexicality. Alongside the emergence from the better-documented sideshow and entertainment contexts, scientific cinema rose out of nineteenth century experimentation. Virgilio Tosi (2005) documents in exhaustive detail the origins and pre-history of scientific cinematography charting the engineers, inventors and scientists beyond Muybridge, Marey, Edison, and Anschütz to demonstrate the depth and breadth of scientific impetus involved in realising automated moving images throughout the nineteenth century. Tosi argues that:

When entertainment cinema arrived, its development was that of peddlers, wooden stalls at markets and suburban festivals. Nothing serious, then: a funfair curiosity. It was not for this that scientists and
technicians, academy members, all driven by research interests, had worked so hard... It seems that, at the beginning, there was a sort of inability to communicate between scientific cinema and entertainment cinema. Each was on its own riverbank, so to speak, without the two ever meeting. (pp. 161-2)

Although many cinematographic technologies had their genesis in scientific exploration it was as mass-market entertainment depicting filmic reality that they were brought to prominence. As William Irvis (1953) observes of the relationship between reality and the photographic image through the technological and cultural transformations of the nineteenth century: 'the 19th century began by believing that what was reasonable was true, and it would end up believing that what it saw a photograph of was true' (p. 102).

It is clear that varied configurations of nineteenth century technology utilising photography, including those that employed multiple images and had a temporal dimension, support an indexical relationship with reality and were perceived as such through the apprehension of photorealism. The benchmark of a resultant continuous—rather than discretised—image is sufficient to categorise these phenomena as indexical. Alongside arguments presented in Chapter One linking photography to moving images, the applications of photography to filmic technology in addition to its material foundation also make this transition as will be seen below.

The Founding of Cinema

The 'birth' of cinema in 1895 heralded a completely new regard for the relationship between reality and the moving image. Several key advances in photographic technology preceded this, particularly the work of George Eastman in developing celluloid strip-film, Edison's Kinetoscope, and the film projectors of Polish inventor Ottomar Anschütz. In what is contestably the first instance of cinema exhibition, Louis and Auguste Lumière showed moving
images in March 1895 using the Cinématographe, a multi-functional device that recorded a sequence of still images, chemically processed them and projected the resultant moving image. Both Sean Cubitt (2004, p. 32) and Gunning (1989) link the art of still photography with the earliest moving images, with Gunning noting that 'it is too infrequently pointed out that in the earliest Lumière exhibitions the films were initially presented as frozen unmoving images, projections of still photographs. Then, flaunting a mastery of visual showmanship, the projector began cranking and the image moved' (p. 34). A public screening of ten short films, each less than a minute in duration and photographed that year, followed the inaugural viewing in December of 1895. These included the famed Sortie des Usines Lumière à Lyon (Workers Leaving the Lumière Factory). Stephen Bottomore (1999) remarks of these early films that 'what often impressed audiences most … was the uncanny realism of certain films and their ability to reproduce complex, natural movement: in portraying the undulations of smoke and water, for example or the movements of crowds of people' (p. 179).

Early practitioners and exhibitors of moving images like Robert Paul, who built the first motion picture studio in Great Britain, were well aware of the importance of perceptual reality in making moving images. Here Paul (1936) recalls production from 1896 and 1897:

Further, I equipped my friend, Short, with a camera with which he took some interesting films in Portugal, Spain, and Egypt. Of these one of the most popular was taken from the interior of a cave near Lisbon, and showed enormous breakers which appeared to be about to overwhelm the spectators… Sometimes a picture combined scenes in natural surroundings with others upon the stage. For example, two divers were filmed, descending and ascending, close to Nelson’s flagship, H.M.S. Victory. Between these views was inserted a set on the stage, with a back-cloth representing a wreck on which the divers worked, sending up treasure. We placed a large narrow tank containing live fishes between
the stage and the camera. Strange as it may now seem, the result appeared sufficiently natural to cause the Prince of Wales and Lord Rothschild, after seeing it upon the Alhambra [Theatre] screen, to ask me how it had been possible to photograph under water. (pp. 501; 505-6)

A widely known early work of the Lumière’s that illuminates a multi-layered discussion with regard to the relationship between early moving images and reality is *L’Arrivée d’un Train en Gare de la Ciotat* (1896), known in English as *Arrival of a Train at a Station*.

![Image of a train at a station](image)

**Figure 9** From Lumière, A. & Lumière, L. (1895), *L’Arrivée d’un Train en Gare de la Ciotat* [Motion Picture; DVD frame grab]

This film supposedly had viewers running from the Grand Café in terror at the sight of a huge train bearing down on them, a reaction that was later dubbed the ‘train effect’ by Yuri Tsivian (1994, see fig. 9). This reaction has been largely discredited (Cubitt [2004]; Loiperdinger [2004]; Bottomore [1999]; Tsivian [1994]; Gunning [1989 & 1986]; Metz [1986 & 1982]; and Arnheim [1957]). Reasons include the relative sophistication of the Parisian audience, a
prior knowledge of what they were about to see, and the effect as a promotional tool. The anecdote is known as the ‘founding myth of cinema’ and ‘cinema’s myth of origin’ in mainstream cinema history (Christie, 1994, p. 15).

Arnheim (1933) quoted in Bottomore (1999), writes of early audiences’ understanding of the separation of screen and auditorium, of moving image and reality as one where the screen train ‘eventually overflows the margins of the screen’. Bottomore goes on to describe this as a ‘dangerously fissiparous image at risk of escaping the frame’ (pp. 193-4). It wasn’t long before cinema practitioners took up this myth in a self-reflexive mode. Robert Paul’s 1901 film *The Countryman and the Cinematograph* was one of several films that played with the notion of the train effect, depicting a country bumpkin being fooled by the sophistication of new moving image technology (Bottomore, 1999, p. 178; Gurevitch, 2010). This myth functioned not only as a promotional tale but also as a foregrounding of a story that continues through to the twenty-first century—the ever increasing verisimilitude of the moving image and its contextualisation within spectacle. There are far lesser known screenings of a re-shot stereoscopic version of *L’Arrivée d’un Train en Gare de la Ciotat* (1895), produced by Louis Lumière in 1935. This 3-D film presents a far more challenging example of moving image reality even to a then not so naive viewer and demonstrates a continuing enterprise aimed at increasing realism through moving image technology.20

This 3-D screening was part of a long-standing investigation by Lumière and others on the relationship between stereopsis and photography beginning with Charles Wheatstone’s 1838 essay on binocular vision; ‘the mind perceives an object of three-dimensions by means of the two dissimilar pictures projected by it on the two retinae’ (p. 384). This screening and its history reveal that Louis

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20 Ray Zone (2007) details a compelling historical thread tracing the Lumière’s 3-D cinema patent lodging in 1900 through to private stereoscopic screenings in 1935-6.
Lumière’s relationship with cinema included a sustained interest in depth and its contribution to reality in moving images, in addition to his celebrated interest in image movement. Further, in a 1936 paper, Lumière writes of previous stereoscopic experiments including one ‘which I reported in a paper to the Académie des Sciences in 1918, and which was the result of a chance observation’ (p. 317). Following the delivery of this paper, Lumière (1936) evidences the importance of depth in his response to a discussion point from Mr. Kellogg and states, ‘If the stereoscopic or binocular effect is good, the mind automatically places more confidence in it than in the perspective. When the two effects work together, one has the impression that everything is normal’ (p. 320). The notion of recognition here is important. Lumière’s concern is with the verisimilitude of the image. A ‘normal’ view—indistinguishable from reality—that mimics human vision as if it were the recorded scene, is the goal.

It is also symptomatic of the commercial drive toward realism that the Technical Progress Committee of SMPTE (1936) wrote with regard to the application of stereoscopic technologies in their report to the Society in the same year:

The [Eastman Kodak Company’s] Pola-Screen opens up possibilities also [that is, in addition to controlling polarized light entering the camera lens] in the field of stereoscopy, applying it in a manner somewhat similar to viewing a blue and red positive through corresponding blue and red glasses, but without the color interference. A description of the possibilities of the filters has been published by Tuttle and McFarlane, and DeVinna has written an account of practical experience with these filters in cinematography. (p. 12)

Returning briefly to the beginning of this chronology ‘in the cave’, Lumière’s acknowledgement of depth via stereoscopy as an aid to increase the illusion of reality for moving images anticipates Baudry’s (1986) canonical Freudian reading of Plato’s cave forty years later. Additionally, Baudry references in this
work Bazin’s 1940s ‘myth of total cinema’, as will be discussed in Chapter Three. Baudry (1986) considers reality and depth in the ‘cinematographic apparatus’, which he questions as a

two-dimensional space suited to the representation of depth produced by the images of objects? Admittedly, they are flat shadows, but their movements, crossings over, superimpositions, and displacements allow us to perhaps assume that they are moving along different planes. (p. 303)

It can be seen then, that two connected threads related to my argument of Chapter One regarding successive technologies and materiality emerge in nineteenth century renderings of reality through the technologies of still and motion photography. The first is that there is continuity between the developments of earlier mechanical non-photographic moving images and photographically rendered moving images. This point is illustrated above by the cinematic nature of moving panoramas, the Phenakistoscope, Zoetrope and Zoopraxiscope, and also their links to traditional landscape painting. The second thread is the evidence of rehearsal for moving photographic images—predominantly through multiple photographic images—in the technologies and techniques of chronophotography and nineteenth century stereoscopy. What links these two threads is an overwhelming preoccupation with the apprehension rather than the materiality of these images when considering their verisimilitude. It is not surprising that the emergence of the moving image is considered to be foremost a phenomena of the nineteenth century sideshow rather than scientific enquiry despite the evidence to support both arenas. Veracity for mechanical moving images is predicated on subjective reckonings of photorealism in the nineteenth century. It is apprehension that overshadows materiality with the indexicality of mechanical moving images being assumed.
**Imago: Moving Images Emerge**

The duration, physical scale and volume of early moving images changes dramatically in the first few years of cinema’s history, altering their relationships with pro- and a-filmic reality through explorations of technology. The first films were less than one minute in duration and were projected in relatively small auditoriums. As Paul (1936) notes, ‘the possibility of presenting upon the screen long films giving complete stories had yet to be exploited and its realization formed a new phase in the development of the art’ (p. 504). Paul also notes the vast interest in moving images of that time and of their commercialisation. He writes of 566 patent applications for ‘animated picture devices’ taken out in Europe during 1896-1900 as compared to only 63 for the previous five years. This was an era where communication technologies of many kinds, including the railway, gramophone and telegraph flourished.

From an Australian perspective, the diversity and advancement of the developing moving image is astounding. A mere five weeks after the first screenings in London of Edison’s Kinetoscope, audiences were watching prints of these same moving images along the east coast of Australia. It is estimated that twenty-five thousand people in Australia saw these films in the first month (Moran & Veith, 2005). As early as 1896, a Lumière agent, Marius Sestier, travelled to Australia and shot around Sydney Harbour with his Australian partner Walter Barnett. They also filmed the Melbourne Cup horse race that year. In 1898, Albert Court Haddon documented Torres Strait Islanders on film. In 1899, the Queensland Government commissioned 30 one-minute documentaries to encourage British immigration. The Melbourne-based Limelight Department of the Salvation Army, one of the world’s first film studios, completed *Our Social Triumphs* in 1898 and was commissioned to
document the *Inauguration of the Australian Commonwealth* in 1901. All this occurred within the first five years of mechanised moving image technology.21

The move from spectacle cinema to documentary production also occurred very quickly, adding another dimension to depictions of reality that moving images offered. Edwin S. Porter released the documentary *Life of an American Fireman* (1902) and the fictional narrative *The Great Train Robbery* in 1903. Both films had relatively longer running times than earlier film works, used multiple locations and featured a greater number of shots and more fully developed notions of character and story. Porter’s fireman documentary used recorded footage that was unstaged, first referred to as ‘actuality’ footage by the Lumières in that it was the depiction of real events, people and objects and combined it with a new narrative to achieve increased dramatic effect.

*Life of an American Fireman* (1902) is perhaps best known for a sequence toward the end of the film where the action is covered by an interior shot in its entirety followed by the same action filmed as an exterior shot. This is often cited as a relatively primitive editing technique but linked as a prelude to *The Great Train Robbery* (1903) that featured the technique of true crosscutting between different vistas within the same scene. *The Great Train Robbery* with its novel-like and more complete storytelling is widely acknowledged as the first epic Western although at the time was considered a chase film, it being the first of a new filmic genre. It features camera movement, location shooting, parallel editing and less stage-based camera placements than previous film works. As noted, crosscutting is employed extensively, showing two separate sets of action happening continuously at identical times but in different places. The film also displays cinema’s first pan shots in scenes eight and nine, and the use of a visual ellipsis to compress time in scene eleven, where instead of following the telegraph operator to the dance, the film cuts directly to the dance as the telegraph operator enters. These early production and post-

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21 For a comprehensive discussion of the formative years 1894-6 for early film in an Australian context, see Long & Laughren’s (1993, Issues 91-6) serialised articles in *Cinema Papers*.  

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production techniques begin to describe how moving images constructed and presented reality on screen. The epic western, combined with elements of the chase film, became a staple in the second wave of early cinema. These moving image productions investigated a myriad of relationships between moving images and pictorial reality, leaving audiences clamouring for more.

As filmic output became more focused on presenting drama as expressions of new filmic realities, actuality presented by this moving image technology was preserved through newsreels and ‘interest’ films. The sustained production of both afilmic and the more popular profilmic reality demonstrates an abiding interest in the technology of moving images, not just the stories it offered. In Britain, descriptively titled actuality films including *The Funeral of Queen Victoria* (1901), *Launch of H.M.S. Dreadnought by King Edward VII* (1906), *Pathé’s Animated Gazette: London. Suffragette Riots at Westminster* (1910), and the scientific interest film *Urban Science: The Electrolysis of Metals* (1913) are emblematic examples of this drive.

Newsreels retained their popularity and in style did not change substantially over the next thirty years as can be seen in *The Assassination of King Alexander of Yugo-Slavia* (1934). But acknowledging the rapid technological advances for moving images, this important 1934 newsreel was a film that audiences saw with synchronised sound and in close-up rather than locked off wide shots. Confirming the indexical status of film, audiences saw intimately the death of King Alexander and his chauffeur, as well as the chaotic aftermath as the crowd turned on the assassin.

Several clear genres emerge within early film that can be linked to alternate pictorial reality offered by earlier media. Landscapes—often from moving trains known as ‘panoramic films’, street scenes, and advertising films all occupied distinct spaces within the form. Exploiting similar strategies that the telescope and microscope had used to commodify sight prior to the moving image, these machines extended vision. Travel, represented by World’s Fairs, panoramas, and technology assisted lectures, ‘became the metaphor for a
continuing dedication to “progress” (Bukatman, 1998, p. 251). Perhaps the most direct descendants of earlier photographic and drawn images are the genres of Foreign Views and Hale’s Tours.

Foreign Views, owing much to the reality proffered by ubiquitous nineteenth century stereoscopic images noted above, express ‘an almost unquenchable desire to consume the world through images’ (Gunning 1989, p. 40). They also reflect the views offered by earlier technologies of the non-photographic panorama and related visual spectaculars. Miller (1996) argues that panorama views are a reality that is a substitute for travel and ones that offer viewers an extended vision beyond their physical worlds. This is in contrast to Buscombe’s (1995) argument that early landscape photography was both the cause and the effect of tourism to these sites and provided a neat packaged version of the real location to take away in souvenir form. It is possible that the transition from still to moving images was significant enough to quench some of the desire to regard these natural wonders first-hand and that moving images were able to offer filmic stand-ins that replaced actual visits to these sites. This speaks to the primary mediation that moving images offer as stand-ins for reality. The indexical relationship between these images and reality is considered ‘enough’ for many of those for whom far-flung tourism was unattainable. This thread is revisited in Chapter Three with regard to immersive cinema of the 1950s.

Beginning in 1905 and named after Charles C. Hale, Hale’s Tours offered direct links between moving images, tourism, natural landscapes and the railway. Hale’s Tours can be regarded as a forerunner to contemporary theme park Virtual Reality (VR) simulation rides in that they present an encapsulated immersive reality through moving images. Audiences to this early cinematic experience were ushered onto a train carriage that became the setting for scenes of natural wonders filmed around the world with the camera perspectives matched to those that the train occupants saw through the front of the

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22 Hale’s Tours were also known as ‘Hale’s Tours and Scenes of the World’ and ‘Hale’s Tours Cars of the World’ (Fielding, 1970, p. 35)
carriage—now the moving image frame. This was augmented by the train carriage side windows displaying moving painted scenery, hidden machines simulating the physical rocking and vibration movements of the train, and a range of sound effects including screeching wheels and steam whistling throughout the seven to ten minute screenings (Cavalcanti, 1942; Fielding, 1970).

John Calvin Brown (1909), proprietor of White City Amusement park in Manchester, spuiks his installation of Hale’s Tours in the printed program for the park thus:

To the working man or the one who is by any reason unable to indulge in the luxury of travel in foreign countries or visit the places and scenes with which history and story have made him “book-familiar,” the invention of the cinematograph and its subsequent development has been a blessing. Hale’s Marvellous Tours of the World are the last word in the practical use of the animated picture as an educative entertainment. The splendid combination of the moving pictures and the mechanical and mental simulation of the swiftly flying express train from which the apparently moving landscapes and interesting places are seen, gives all the sensations and pleasures of an actual visit to the places shown on the screen by the perfected art of the photographer and developer. Travel in Hale’s magnificent railway carriages is most comfortable and is more than an illusory trip, for we see the most natural pictures of all the most interesting places of resort to which the wealthy of all nations go in their hundreds and pay huge sums for the pleasure. We get it here for an infinite small sum of two or three coppers and the loss of only a few moments of time, and in perfect comfort. A visit and a trip with Hale every time there is a change of programme during the season will well repay the serious minded as well as the one who only looks for the momentary pleasure to be derived from the entertainment aside from its educative value. The travel scenes shown by Hale’s Tours are the best
and most expensive animated pictures to be seen anywhere, and should be visited by every patron of the WHITE CITY.

This advertising copy promising ‘more than an illusory trip’ for White City distinctly foreshadows the promotion of constructed reality by Rekall Incorporated in Paul Verhoeven’s film Total Recall (1990) and McClane of Rekal Incorporated’s sales pitch to Douglas Quail in Philip K Dick’s 1966 short story We Can Remember It for You Wholesale (1987) on which Verhoeven’s film and the subsequent story rewrite for the screen by Kurt Wimmer (Fleming, 2010) are based.23 Hales Tours also indirectly link the technological feat of the railroad to a lineage of mechanically produced images. Many of the landscape photographs and stereographs that were in wide circulation from 1870 onwards were commissioned by railroad companies who understandably had a strong interest in tourism, even if the unspoilt views that were depicted were to be irrevocably changed by the very tourism they inspired. The railways also used early landscape photography to assert their dominance over the landscape; to demonstrate how such a wild and immense environment could be tamed by the advent of technology as experienced from the safety of the transitory train. These ventures can be considered in much the same way that the physically remote experience of filmic reality offers these same comforts through the trope of indexicality.

In a contemporary context, marketing for Apple Computer’s first iPad tablet—heralding the arrival of the post-PC era of computing—appeals to the virtual tourist just as Hales Tours did in its presentation of distant exotic destinations as intimately immediate through images (see Fig. 10).

The iPad also demonstrates a heavy reliance on a physical world metaphor in seeking to make the screen experience one that is tangibly real. The iPad’s Graphical User Interface (GUI) has carefully crafted interactive virtual page turns for e-book reading and visually leaves stubs of virtual paper residue when notebook pages are ‘torn out’ and filed. The extreme of this creation of referenced photorealism is the rendering of virtually raised bumps on the F and J letter keys that are customarily intended for touch typists to orientate fingers on a standard keyboard. But on the iPad, these are rendered flush on a seamless glass surface. As another example of referenced photorealism the visual effect perfectly simulates the familiar but ignores the tactile intent of the design element. It is a screen rendition that promotes visual simulation as the most important element in achieving reality and further abstracts the metaphor of keystroke entry with it being literally on-screen.
Trick-Films: The First Iteration

Another specific exploration between form and reality with moving images mediated by technology at the opening of the twentieth century is the ‘trick-film’. These moving images expanded and in some cases preceded the techniques of other early genre films. Trick-films sought to exploit the technologies of the moving image, specifically demonstrating how reality could be manipulated and the ways in which audiences could be deceived and delight in believing the unbelievable. In-camera and film printing trick-techniques included exploiting scale for visual effect, the superimposing of negatives, masking of part of the frame for fantastical effects, flaring and over-exposure of the negative to create supernatural effects, reversing movement, repeating of frames to pause action, rotating the camera around the lens to enable spatial shifts and speeding up the camera’s frame rate when exposing the film to create slow motion effects. The manipulated reality depicted in trick-films presents the fictive possibilities of a medium rapidly becoming its own object. Trick-films are perhaps the first formal experiments that introduced the idea of a distinct moving images reality.

Gunning positions the genre of trick-films, and much of early cinema, as an experience in which spectators focused on the technologies that produced cinema as opposed to its content. One thread that runs though much of Gunning’s writing (Gunning 1982; 1983; 1984; 1989; 1989a; 1993; 1994; 1996; & 1997), ascribes to early cinema the oft quoted phrase: an ‘aesthetic of astonishment,’ in that ‘rather than mistaking the image for reality, the spectator is astonished by its transformation through the new illusion of projected motion. Far from credulity, it is the incredible nature of the illusion itself that renders the viewer speechless’ (Gunning 1989, p. 34).

Panofsky (1997) opens his 1936 essay *Style and Medium in the Motion Pictures* with the statement that “it was not an artistic urge that gave rise to the discovery and gradual perfection of a new technique; it was a technical invention that gave rise to the discovery and gradual perfection of a new art” (p.
For Panofsky, like Gunning, it was an interest in the technology of moving images, not content that drove the development and reception of early moving images.

George Méliès, the best known of early trick-film makers, took up filmmaking along with a host of other magicians in part as an extension of his illusionist practice. Early cinema was often screened as part of performances by magicians of this era in sideshows and theatrical contexts (Solomon, 2000; Paul, 1936, p. 503). Although Méliès is best known for his proto-science fiction work including *Le Voyage dans la Lune* (1902) and *Le Voyage à Travers l'Impossible* (1904), his earlier trick-film experiments can be seen to more overtly play with profilmic reality. Méliès (1988), speaking of what he first dubs ‘transformation views’ goes on to remark that:

> Since I myself created this special area, I think I may say that that term fantastic views would be far more accurate … it was I myself who successively discovered all the so-called ‘mysterious’ processes of the cinematograph … it is the trick, used in the most intelligent manner, that allows the supernatural, the imaginary, even the impossible to be rendered visually and produces truly artistic tableaux that provide a veritable pleasure for those who understand that all branches of art contribute to their realization. (pp. 38; 44; 45)

The notion of fantastical realism introduced in the previous chapter and Introduction has its moving image debut with trick-films. The work of Méliès and others in creating ‘the impossible … rendered visually’ generates a template for the fantastical photorealism that is one of the hallmarks of moving images, particularly the digitally generated synthetic imaginings that will be discussed in Chapter Four.

*L’Homme Orchestre* (1900) uses multiple exposures to allow Méliès to play seven different simultaneous roles in a film that is shorter than one and a half minutes and in an acknowledgement to the craft of sideshow illusion,
concludes with Méliès disappearing in a puff of smoke (fig. 11). A strong ancestral line extends from these trick-films to pre-cinematic chronophotography. The pictorial resemblance of L’Homme Orchestre to Marey’s earlier still photographs from motion is striking (see fig. 6, above).

Trick-film techniques can be seen as the foundation of moving image methods that we now know as digital compositing—the ‘manipulated combination of at least two source images to produce an integrated result’ (Brinkmann, 1999, p. 2). As claimed in this chapter’s opening, the manipulation of reality in moving images is central to this thesis and many of the techniques involved emerged from these early trick-films. If we also include still images, they can be traced further to the practices of composite photography of the nineteenth century.

One of the earliest extant examples of composite photography is an iconic portrait of Abraham Lincoln. Ironically, this photographic portrait is an uncredited composite of southern politician and slavery supporter John Calhoun and Lincoln (see Fig. 12).
The other relevant branch of nineteenth century composite photography is Spirit Photography, represented through two main strands. The first strand is photography in which deceased people appear alongside the sitter in predominantly studio portraits of the mid and late 1800s through the technique of double exposure. The second, later strand depicts ectoplasmic emanations or supernatural actions such as floating objects or disembodied limbs. Spirit Photography can be regarded as a direct predecessor to the widely publicised photographs of the Cottingley Fairies of Yorkshire between 1917 and 1920, and less directly to the manipulated aerial war photographs of World War I, the political photo-manipulations of communist sympathisers in the 1950s, through to contemporary tabloid digital photo-manipulation of popular cultural figures.

There are two interesting aspects to Spirit Photography within this thesis. First, as noted, Spirit Photography makes a compelling link between early trick-films

24 ‘Ectoplasm was a term given by French occultist Dr. Richet to a whitish, malleable substance that oozed from the orifices of mediums’ (Gunning 1995, p. 56).
and earlier photo-manipulations of reality. The previously mentioned pictorial link between Méliès’ trick-films and chronophotography coupling still and moving images is bettered by a description of Méliès’ practice pre- and post-moving images. His earlier career as a magician that is often included as merely a contextualising aside to introduce Méliès’ filmic work, presents a micro-view of the shifts in representing reality and imaging technologies between the late-nineteenth century and early twentieth century.

The early twentieth century filmmaker Méliès was a former illusionist who had turned his carnival manipulations of reality to Spirit Photography, and then to trick-films as new technologies of moving images emerged. Méliès’ magical shows included ‘spiritualist numbers, in which devices of lighting, careful control of points of view, and an elaborate optical shutter derived from photography recreated the effects of a materialization séance’ (Gunning, 1995, p. 62). Gunning (1989a) points out that exploiting film splicing as post-production technique in order to create impossible realities, that ‘Méliès (and other early filmmakers) were drawing undoubtedly on the tradition and methods of behind-the-scenes manipulation found in the late-nineteenth-century magic theatre’ (p.10). The important discovery that Méliès’ drew on post-production techniques in addition to in-camera manipulation by Méliès’ great-grandson Jacques Malthète (1984, p. 174) and disseminated to a wide readership by Gunning is in contemporary views, a commonplace fact. Martin Scorseses’ film Hugo (2011) for example, includes an unremarkable scene of Méliès cutting and splicing a film-strip to create ‘trucage’ without editorial or textual comment (Metz, 1977, p. 657; 659).25 In fact, with films including Escamotage d’une Dame chez Robert-Houdin (1896)—a jump-cut work that is a variation of Charles Bertram’s Vanishing Lady illusion recorded on film and whose title references the Théâtre Robert-Houdin—Méliès was drawing first-}

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25 The scene depicting the character Méliès cutting and splicing film in Scorsese’s Hugo (2011) occurs 99 minutes into the film.
hand on his experience as an illusionist. The magic is provided by the technology of cinema but still presents as a traditional illusion.

This is further evidenced by Méliès’ (non-surviving) film *L’Armoire des Frères Davenport* (*Cabinet Trick of the Davenport Brothers*, 1902) which purportedly dramatised the famous Davenport Brothers’ séance show involving a ‘Spirit Cabinet’ which featured levitating objects, phantom hands, and a host of other supernatural phenomena. The other Méliès film work that completes this passage from carnival manipulation to the fantastical reality of moving images is *Le Portrait Spirituel* (*The Spiritualist Photographer*, 1903). This film presents in serial form, complete with title cards bearing technique names, many of the filmic illusions developed in the context of nineteenth century photographic Spiritualism. It is as if Méliès wants the audience to marvel at the technical accomplishment of mechanical moving images rather than suspend belief and engage with the filmic reality. The curiosity of new technology ‘locates an aesthetic of the operational, a delight in observing process and examining for literal truth’ (Harris, cited in Solomon, 2000, p. 13). *Le Portrait Spirituel* serves as an announcement of the power of a new indexical technology, the prevalence of overt filmic technique as well as an acknowledgement of its indexical relationship with, and distinction from reality.

Méliès (1988) spoke of his work with trick-films thus:

> A profession in which everything, even the seemingly impossible, is realized, and the most fanciful dreams are given the semblance of reality.
> Finally needless to say, one must absolutely realize the impossible, since one photographs it and renders it visible. (p. 39)

The second aspect of Spirit Photography that is of specific interest here is that it is one of the first sets of practices to present a conflicted reading of the relationship between reality and photographic images. The spectral component of the photograph, while asserting the superior vision of photography—seeing what was previously unseen, also destabilises a Peircian indexical relationship
between the image and its origin. Spirit Photography depicts ethereal images, unanchored in reality despite being enclosed by the solid reality of the photograph. Irwins’ (1953) argument cited earlier in this chapter regarding the perceived truth of photographic imaging in the nineteenth century is strangely still sound when considering Spirit Photography. Crary’s (1990) central argument that photography standardised vision of the nineteenth century, on the other hand, is undone when Spirit Photography is allowed for. Photography offers undifferentiated multiples of encapsulated reality that endure long after the reality depicted ceases to exist, or in the instances of Spirit Photography, didn’t ever exist for the viewer. This is problematic when regarding indexical relationships between reality and moving images. Spirit Photography offers both referenced and fantastical photorealism within the same image and the preservation of indexicality through multiple exposure and contact printing of continuous tone images. Spirit Photography also prompts a parallel with the phenomena of synthetic digital photographic images that have tenuous links to reality, being generated without light or physical lenses, and referencing reality rather than representing it. These photographs however, as discretised images have no indexical relationship with reality despite their perceptual realism and are without a Peircian object to represent. These points will be taken up in detail in Chapter Four, which examines the application of Peirce’s index to digital technologies of moving images and the mode of presentationism.

**Parallel and Successive Technological Histories**

The generative links between technology-driven advances in image making and consumption counter the rhetoric of ‘parallel histories’ from a number of contemporary writers who compare early cinema with digital media and question the specific role of technology in the development of moving images. Punt (2000 & 1995), Heilbroner (1996), Marx (1996), Smith & Marx (1996), Nye (1992) and Carlson & Gorman (1990), argue that the implementation of
the technologies of moving images was more important to success and advancement than the technology itself. Michael Punt (2000) makes several representative claims about parallels between early cinema and time-based digital media in attempting to recast customary views of early cinema. He argues ‘some inventions become “technologies” and other do not– almost by accident’ and that the invention of the mechanised moving image ‘is better explained as the intersection of a complex set of discourses and as a number of discrete devices and technologies already more or less perfected for other purposes’ (p. 63). In this, he is referring to inventions such as the Kinetoscope and its link to Edison’s earlier invention of the phonograph.26

Punt (2000) is more successful in drawing parallel histories than the recasting of those histories. His claims regarding the symmetry between the military and scientific development of the Internet and the development of the Cinématographe are robust, even if at odds with his rejection of technological determinism. He confuses the technology object with the inventor’s intention for a particular device and the subsequent gap in its societal use. Punt distinguishes between the apparatus and the experience of the technology, but almost completely ignores the division between the production and consumption of moving images. He does eventually return to the apparatus, acknowledging that moving image technology ‘became the foundation of a mass cultural experience’ and discusses similarities between the transformations that the Cinématographe and the Internet underwent as part of their cultures of technology (p. 70). Punt, like Robert Paul (1936) more than sixty years earlier, cites a significant increase in the number of (in this case American) patent applications to support his claim.

Lev Manovich (2001) argues an alternate theory regarding parallel histories of pre-cinema and digital technologies. Unlike Punt, Manovich is well versed in the dichotomy between production and consumption of moving images. He

26 This issue is explored in greater detail in Carlson & Gorman (1990, pp. 387-430).
argues that there has been a cyclic return in the digital production of moving images to nineteenth century pre-cinema animation techniques ‘when images were hand-painted and hand-animated. At the turn of the twentieth century, cinema was to delegate these manual techniques to animation and define itself as a recording medium’ (p. 295).

Given the content of Manovich’s thesis he unsurprisingly doesn’t mention trick-films or other compositing techniques in early cinema as he constructs what is shown by this thesis to be a dubious argument in which any manipulation of reality in early moving images is ‘pushed to cinema’s periphery by its practitioners, historians, and critics’ (p. 299). He goes on to argue that in an imitation of nineteenth century animation, the emergence of digital production has brought these ‘marginalized techniques’ to the fore. Gunning’s aesthetic of astonishment provoked by early moving images and applied to manipulated reality in which spectators were aware of the illusionistic properties but were nonetheless still surprised ‘at the very fact of the trick’ or reacted with ‘I know very well… but all the same’ is at odds with Manovich’s reading of the experience of early moving images (Young, 2003, p. 235; Gunning, 1989, p. 32). Gunning’s view can also be applied to Tsivian’s train effect to undermine the structure of Manovich’s larger cyclical assembly of moving image production.

As part of a larger transposition of the indexical nature of moving images throughout cinematic history, Chapter Four of this thesis argues that parts of Manovich’s argument are sound, but the timelines are not evidenced well. It has been demonstrated in this thesis that there was much interest by practitioners and spectators in the particular kinds of reality that moving image technologies offered at the beginning of the twentieth century as cinema developed into its own art form. These include a sustained interest in the fantastical and the challenges to visual reality these technologies offered.

Manovich (2001) correctly argues that hand-rendered effects were of the pre-cinematic era and were again embraced by digital moving image technologies
as a ‘sub-genre of painting’ at the end of the twentieth century (p. 295).

However, he misses an intervening iteration. As detailed above, early twentieth
century cinema replaced these hand-made effects with optical proto-
mechanised effects as seen in trick-films. These automated methods are now
echoed in digital moving image production where digital workflows that
include ‘intelligent’ software can make decisions and independently render a
new reality.27

who describe digital cinema as a ‘remediation’ of previous image making, and
part of an on going cycle of refashioning moving images with the new
subsuming the old. Rather than stopping at Manovich’s single parallel cycle
that links production via the mechanical with the new digital, Elsaesser (2006)
proposes a recurring McLuhanesque cycle, with each consecutive technology
reducing the previous innovation to one of many ‘effects’ available in the
techniques of its successor. So what had hitherto been thought of as the
dominant mode or the default value of the cinematic system—for example,
live-action photography—now becomes a mere local instance of a practice or
performance that the new medium organizes at a ‘higher plane of generality.
Thus the digital image, understood as a graphic mode, includes the
photographic mode as only one among a range of modes or effects it is capable
of’ (p. 18).

technologies but distinguishes production from consumption. Although
subscribing to a single revolution for production of moving images, regarding

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27 Widely known ‘hero’ implementations of these techniques in feature films include the
computer generated behavioural action as part of the ‘burly brawl’ in Andy and Larry/Lana
Wachowskis’ The Matrix Reloaded (2003), and the vast battle scenes in Peter Jackson’s’ Lord of
the Rings Trilogy (2001-3) created with Weta’s Massive crowd simulation software. Using
Crowd AI, CG individuals in the crowd behave according to crowd psychology and group
dynamics. The action is based on pre-programmed goals, desires, or changes in environment
that could include negotiating changing (virtual) physical landscapes and using objects as tools.
the display of these images Manovich, (echoing the opening of an earlier
Cubitt [1999a] paper on special effects and early ‘trucages’), argues that:

Each new technological development (sound, panchromatic stock, color)
points out to viewers just how “unrealistic” the previous image was and
also reminds them that the present image, even though more realistic,
will also be superseded in the future—thus constantly sustaining the state
of disavowel. (p. 186)

Early film has been described by Armes (1988) as ‘little more than a curiosity’
(p. 30) and certainly not regarded as an art form in its own right. It offered ‘in
a quite undifferentiated fashion everyday scenes, conjuring tricks… and little
staged outdoor scenes’ (p. 31). The breadth of early moving image practice
offered here contradicts this view. What can be agreed is that mechanical
moving images jointly emerged from a technological drive through scientific
exploration and the theatrical context of the sideshow, and as will be shown,
that by 1920 as commercial radio broadcasts began, had aggressively
established its own entity (Neale, 1990, p. 60).

Gunning’s (1989) ‘cinema of attractions’, which envisioned early cinema as a
series of ‘visual shocks’ links it to pre-cinematic fairground and spectacle media,
and charts the end of the era of early cinema—here defined as moving images
predating the dominance of narrative film—as being between 1903 and 1904
(Gunning 1986, p. 33; 1989). In Kuhn’s (2009) words, moving images were
still ‘changing and becoming’ but now doing this employing their own
language. The specific technologies associated with the moving image were
instrumental in creating this language and providing means to more extensively
articulate the capabilities of the increasingly popular moving image. I describe
Gunning’s view of this move away from spectacle to narrative forms as a shift

28 For a detailed analysis of spectacle media in the context of technologies of the late nineteenth
century—particularly the electric light—see Marvin (1988, pp. 152-90).
from showing to telling as will be discussed below. Fell (1980) describes the state of narrative at this time thus:

By 1906, consolidation with respect to organized, pre-delineated narrative design begins to assume consistent visibility. Some techniques (like motivating a subjective view by a glance, then following it with a matted shot to simulate perspective through a viewing glass or telescope) translate comfortably from one story mode to another: Grandma’s Reading Glass (G. A. Smith 1898), to Tour du Monde d’un Policier (Pathe 1905) [Lépine, 1905]. Other devices such as shot-to-shot continuities facilitated through unmatched movement, seem to derive more directly out of a particular kind of narrative, like the chase. Pursued and pursuer contained in one shot give way to pursued/pursuer/pursued/ pursuer checkerboarding. (p. 30)

Much other documented history of cinema between 1905 and 1920, when Hollywood became illustrative of an industry proper, focuses on the attempted monopoly control over film distribution using patents that mimicked the economic control observed in the record industry. Interestingly, the technology and use of the gramophone barely changed from the beginning of the twentieth century through to the 1920s. The cinema conversely, displays rapid changes in technology and through an integration of production, distribution and theatrical exhibition of moving images, established a firm hold on storytelling and representing reality in the twentieth century.

The discussion of early moving image narratives, trick photography and trick films above, serves as a reminder of the strong iterative links between successive imaging technologies and also of the notion introduced in Chapter One of a focus on spectacle in presenting novel representations of reality. Despite this presentation of the filmic medium as central to moving images, the materiality of these images is subsumed within their application. Photorealism experienced through the apprehension of mechanical moving images is the benchmark of
their claims to reality with indexicality buried within this experience as an essential but largely implicit attribute. The materiality of then new mechanical moving images is integral to the spectacle and not yet considered as anything but an inscription of pro- and a-filmic reality. As argued in Chapter One, reality can be recognised through representation and an acceptance of these images as direct representations of the real is largely uncritical and assumed. This phenomenon occurs for mechanical moving images and also within a distinctly different dynamic for digital moving images as will be discussed in Chapter Four.

From Showing Reality to Telling Reality: A Shift from Spectacle to Narrative Cinema

From brief grabs of visual reality through actualities twenty years earlier, D.W. Griffith’s three-hour epic *The Birth of a Nation* (1915) heralded a new episode in the history of the moving image. This overtly racist retelling of the American Civil War employed several new technical, creative and narrative techniques that again revolutionised the relationship between moving images and reality.29 These techniques included the introduction of night photography, use of subtitles to comment on action and intention, elaborate costuming to establish historical accuracy, extensive cross-cutting to achieve suspense and engagement, hundreds of staged extras in-shot for battle scenes, and the use of colour tinting for emotional effect.

The release of *The Birth of a Nation* (1915) established a new chapter in representing reality with moving images. As an example of classical narrative film, it consciously hides the self-reflexive aspects of early cinema, distances

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29 Some of the credit for this revolution can be claimed by The Australian production of Charles Tait’s *The Story of the Kelly Gang* that preceded Griffith’s film by almost ten years. It first screened in Melbourne in 1906. At sixty minutes running time it is acknowledged to be the world’s first feature film but does not share the same esteem as *The Birth of a Nation* as only seventeen minutes of Tait’s film have survived, and it is possible that the film did not screen in North America.
itself from the carnival and for the most part eschews spectacle in favour of narrative. As discussed above, early cinema presented moving images as actuality followed by trick-films that simultaneously undermine and celebrate that authenticity. Narrative film then offers a new cinematic take on reality.

The evident technical achievements in Griffith's 1915 film offer a new universal pictorial grammar and filmic reality in terms of coverage, editing style, veracity, and sustained emotional engagement. Young (2003) likens this new editing style to a conversation, noting that ‘Griffith’s editing had been touted by reviewers of “The Birth of a Nation” … as proof that the cinema was becoming a unique form of art.’ (p. 254).

Having worked in theatre as a writer and actor for ten years Griffith began directing film work with the Biograph production company in 1908. Between 1908 and 1911 he directed an astonishing 325 films developing his unique camera, lighting and montage styles (Iris, 1940, pp. 13-4). During this period at Biograph, Griffith used a Mutagaph camera that did not support the double exposure function of competing cameras to produce trick-films. It has been speculated that this technical shortcoming may have contributed to Griffith’s approach to filmmaking, especially the use of transitions between scenes and vignetting, achieved in part by a combination of the shortcomings of the Mutagaph camera and the halation effect of unbacked film stock (Newhall, 1940, pp. 34-7). Griffith reportedly put most of the proceeds from Birth of a Nation into his next film Intolerance (1916). This was the largest scaled production to date that although not as well known or regarded as Birth of a Nation, in montage style and film form influenced Russian filmmakers of the mid-late 1920s and further extended Griffith’s filming and editing repertoire including brief, enormous close-ups, not only of faces but of hands and of objects; the “eye-opener” focus to introduce vast panoramas; the use of only part of the screen’s area for certain shots; camera angles and tracking shots such as are commonly supposed to have been introduced by German
producers years later; and rapid cross-cutting the like of which was not seen again until [Battleship] *Potemkin* [1925]. (Barry, 1940, p. 24)

**Documentary, Reality and Realism**

The other milestone feature film of this time is Robert Flaherty’s celebrated documentary *Nanook of the North* (1922). This is acknowledged to be the first released feature length documentary film, a term coined by John Grierson, originally in reference to Flaherty’s work. The original use of the term was restrictive, applied only to Grierson’s productions and those of his contemporaries as part of the early British Documentary Movement. This is similar to the ‘avant-garde film’ moniker that was originally attributed to a specific set of French films in the 1920s. Both terms have since become more generalised, dropping their proper noun status. Both movements also share the mantle of presenting an alternative to the dominant fictional narrative film of the 1920s.

Flaherty’s film depicts the lifestyle of a Canadian Eskimo family. It is the first non-fiction moving image work that moves beyond the snippets provided by earlier actuality films and also makes a radical departure from contemporaries such as Edward S. Curtis working in a similar area. Curtis had notably made *In the Land of the Head Hunters* (1914), a narrative based non-fiction film set among the Native American Kwakiutl people of the Pacific Northwest that in its intention clearly foreshadowed Flaherty’s depiction of the Inuit. Both these films can be seen to signify a new trajectory that opened up new modes of storytelling, but also preserved the established aesthetic of nineteenth century stereoscopic foreign views and early twentieth century moving images of exotic locales discussed above.

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30 In terms of understanding how documentary as reality is defined across cultures, it is relevant to note that in Japan, the term documentary film was taken up as ドキュメンタリー, or ‘*kiroku eiga*’ (record film) with the use of katakana characters denoting a ‘loan-word’—one transcribed from a foreign language, and contrastingly in German as ‘Kulturfilm’—culture film.
Flaherty has been widely criticised for selected production techniques including staging set pieces and prompting action for the camera; blurring pro- and a-filmic reality. Regardless, *Nanook of the North* (1922) is an important work when considering the historical relationship of moving images to reality in its purporting to present a strange and unusual reality and attempting to stand apart from the plethora of fictive and afilmic depictions that had come before. Even the effect on the documentary subjects who had not been previously exposed to moving image technologies like this is telling. Flaherty (1922) describes screening small portions of the unfinished film on location:

> The audience—they thronged the Post kitchen to the point of suffocation, completely forgot the picture—to them the walrus was real and living. The women and children in their high shrill voices joined with the men in shouting admonitions, warnings and advice to Nanook and his crew as the picture unfolded on the screen. The fame of that picture spread through all the country. And all through the year that I remained there every family who came wandering into the Post begged of me that they be shown the 'Iviuk Aggie' [walrus pictures]. (p. 687)

Considering documentary film as a genre of moving images is essential when considering reality. This is for two primary reasons. Much of documentary film history is concerned with realist representation and documentary—by its very nature—contains material echoes of the real. Documentary has always held a position on the 'scorned margins' of film studies and in the light of contemporary media studies has been described as ‘a recidivist area of aesthetic backwardness’ (Corner 1993, p. 414). As a realist genre, however, it offers the possibility of closing a gap between moving images and reality in that it does away with the very layer of artifice that fictive moving images rely on.

If we accept the broad definition offered by Casey et al (2002) for realism in moving images as ‘a system of conventions which represents the world to us through a series of devices’, cinematic realism in non-documentary film is
produced in order to make the unreal appear real. For documentary, realism then is at the service of spectacle rather than narrative, despite documentary’s intent to offer memorable content and disallow form. Documentary can be argued as a form that presents reality again rather than recreating it. Corner describes the ‘two foundations of documentary’s distinctively referential poetics [as] the indexicality of the image and the “evidentiary”, rather than narrative, principle of editing’ (p. 415). There is much crossover between fiction and documentary forms and contemporary television documentaries known as ‘reality television’ are the starkest examples of this.

A strong precedent for reality television employing a documentary style of fictive film exists within the neorealist films of post-war Italy. These films were scripted fictions but employed a documentary style of production and post-production. Bill Nichols (1991), arguing for how documentary differs from narrative fiction, acknowledges that neorealism

breaks with some of the conventions that seem to separate fiction from documentary most sharply: the compositional quality of the image; the remove of the world of the image from the domain of history; the reliance on continuity editing; the tendency to motivate, in the formal sense of providing a plausible justification for the presence of objects, characters, actions, and setting as much as possible… Although qualities such as these have been taken up by documentary, neorealism remains just on the other side of the boundary between fact and fiction, narrative and exposition, story and argument. (p. 170)

Nichols outlines three types of realism that can be applied to documentary and fictive moving images.31 They are empirical, psychological and historical. Empirical realism is ‘mere film’ and Nichols (1991) explicitly ‘consider[s] empirical realism to be the domain of the indexical quality of the photographic

31 These are in addition to Nichols’ widely cited four modes of documentary being expository, observational, interactive, and reflexive. For more on these modes see Nichols (1991 & 2001) and Renov (2001).
image’ and he discusses how the documentary form uses this to establish context (p. 171). For Nichols, psychological realism is a departure from empiricism at the service of universalising characters or situations. He describes it ‘as a transparency between representation and emotional engagement, between what we see and what there is’ (p. 173). Historical realism is ‘visual historiography’ (p. 177). Nichols acknowledges the distinction between representations of reality and about reality, and also that for this mode, documentary and fiction films differ in ‘aesthetic and form of subjectivity’ (p. 181).

In parts of Nichols’ later work (1994; 2001) he adds a further type of realism that he names the ‘performative mode’ in which realist representation is suspended. Here Nichols (1994) attempts to encompass new forms of highly stylised and subjective documentary in which ‘realist epistemology comes under question and under siege’ (p. 97). This addition could effortlessly address reality television and the authenticity it offers, but Nichols inexplicably only occasionally argues in reference to any forms of television documentary apart from news and reportage. Nichols would certainly have been aware of burgeoning reality television and its decades’ long history at the time of writing. Although the global phenomenon of reality television was not to arrive until 2001, MTV network’s The Real World had first screened in 1992, and it had strong antecedents in numerous Japanese degrading performative game shows of the 1980s, the twelve part American PBS series An American Family (1973), and arguably Andy Warhol and Paul Morrissey’s The Chelsea Girls (1966). This is a significant omission considering the kinds of documentary productions that audiences and filmmakers of this time were watching and making. Nichols’ argument rests on the central tenet that audiences will accept filmic reality in documentary if there is a shared agreement between maker and audience about intention. Techniques such as staging action, collage, use of music and narration, are permissible at the service of a shared purpose.
Notions of authenticity and verisimilitude, central to indexicality, can be argued to embody the currency of documentary quality. As part of his thesis that non-fiction film did not exist for early filmgoers, film historian Hiroshi Komatsu (1995) has written about the fabricated documentaries produced during the 1904-5 Russian-Japanese War. Komatsu (1995) argues that these films were made because of a shortage of actual war films and that audiences were acutely aware of ‘false’ and true images in this early era of cinema. He makes a case that it was not a divide between documentary and fiction films that audiences of this time cared about, rather it was the truthfulness of the image when compared to reality:

Authenticity on the level of film reception was not that important; all these works were part of a homogeneous filmic representation. When spectators got angry that the war images unfolding before their eyes were false, their anger was in no way based on a conceptual opposition of nonfiction to fiction, but was simply directed against the fact that the representation was inaccurate. The case of early Taisho film [1912-1926] audiences judging French-made ‘Japan dramas’ as lacking accuracy is similar… This perception of inaccuracy also resembles what American spectators of about the same period experienced upon viewing European-made Westerns (a feeling we Japanese could not normally share). There certainly existed a mode of judging truth and falsity that differed completely from the dichotomous discrimination between fiction and nonfiction. (p. 9)

Komatsu goes on to discuss Japanese cinema of that era and its ‘absolute representationalism that could not be regarded as either fiction or nonfiction’. This was achieved predominantly by Japanese cinema being used to illustrate only well-known stories, providing intricate live narration, the ‘patterned’ performances of actors, and the display of an ‘aversion to American cinematic illusionism’ (p. 11).
The relationship between moving images and reality through documentary can also be argued to transcend the barriers of genre and audience reception. Documentary can be seen to reflect the material properties of the medium regardless of the specific images viewed but still be dependant on their context. Elizabeth Cowie (1999), writing about the spectacle of documentary film, argues that:

Verisimilitude is … central for the documentary film—just as much as and perhaps more than for the fiction film. The world presented must be believable, it must be like what we expect the world to be in order for the film to sustain our belief in its claim to reality. (p. 30)

Cowie (1999) argues—similarly to my use of the term referenced photorealism—that this is an issue of identification, that reality is ‘coded’ and for an audience to recognise reality in documentary film it must be presented in a way that is familiar and in some ways 'the same as what we already knew' (p. 30). As noted above, the trope of recognition will be discussed at length in Chapter Four but its inclusion as a necessary component of filmic reality is prepared here by Cowie.

**Early Formalism and the Distinct Properties of Moving Images**

The fictive and documentary endeavours of early mechanical moving images jointly construct a theorised field in which technology is championed by some and neglected by others. Moving image practices of the time were in flux as the regular introduction of new techniques and technologies largely extended rather than replaced earlier accomplishments. This led to multiple strands of development and differing perceptions of relationships with reality for moving images. In essence though, all filmic experiences of early cinema were realised through mechanical moving images. One of the persistent concerns of moving images in the early twentieth century, as will be demonstrated below, was
distinguishing such images from other kinds of pictorial representation often at
the service of defending moving images as being artistic despite their
automated production.

Much film theory spanning the years 1912-1935 was determined to carve out
new territory for film. Accordingly, it argued how moving images are different
from other images, specifically theatre and other established art forms, as well
as from the Peircian objects that cinema recorded and represented in what was
by then considered a unique method. These years for theory are often
characterised as a period dominated by Formalist film theory in that they
focused almost exclusively on filmic techniques and expressiveness similar to
that era’s literary Formalism and its notion of defamiliarisation. For film
Formalists, the manipulation of the specific technical aspects of the filmic
medium (and this approach highlights the specific un-reality of moving
images) is the key to artistic expression. This focus on form opposed the earlier
realist traditions of Lumière and Flaherty for whom moving images strive to be
direct reproductions of reality. The Formalism of moving images is part of a
wider tradition of formalism in literature, painting and music, but importantly
when considering moving images and reality, differs from Formalism’s broader
position that the inherent properties of the work ascribe meaning, in that film
Formalism takes a distinctly constructivist approach.

In this first Formalist period, moving images are compared to many other art
forms, especially music, and those arguments are made within the context of
aesthetics. The overarching position is an attempt to define cinema as a
distinctive form, and a formalist approach is instrumental in establishing
moving images as art rather than the mechanical reproduction of reality. Abel
Gance, Rudolph Arnheim, Jean Epstein, Antonin Artaud, Hugo Munsterberg
and Louis Delluc are among the best known of these theorists. Their ideas
describe ways of manipulating the real through moving images and how
moving images offer new kinds of reality. In particular the French theorists of
this period continue the sentiment of the quote above from Méliès regarding
the profession of making trick-films and reality. They argue that photography and cinema’s key trait is an ability to allow audiences to see what might otherwise be unseen. This notion of rendering the invisible visible recurs as theories of moving images cycle through the following decades. It is explicitly picked up in 1960 by Kracauer, and then again in relation to digital images by Sobchack (1987) and Ranciere (2007). Comolli (1996), acknowledging a distinction between the representation of reality and human perception—between what is able to be represented and the experience of reality—describes it as ‘the human eye los[ing] its immemorial privilege; the mechanical eye of the photographic machine now sees in its place, and in certain aspects with more sureness (p. 109).

Munsterberg’s 1916 text *The Photoplay: A Psychological Study* (1970) is the first widely published film theory book. It is almost exclusively concerned with narrative cinema and shows a strong bias towards the apprehension of moving images rather than their production. *The Photoplay* describes the properties of moving images as mental processes, echoing an approach to psychology in which all physical processes have corresponding mental processes. For Munsterberg, moving images are of the mind, not of the world. It is apparent then why he does not allow a broader definition of filmic work that existed at that time as he excludes the forms of documentary and instructive films from his description. These works do not comply with his psychological parallelism framework and for Munsterberg (1970), the relationship between reality and moving images is one not merely mediated by the mind but ‘produced by the spectator’s mind and not excited from without’ (p. 31).

The second part of Munsterberg’s text moves from a psychological base to a philosophical one in arguing for moving images as art objects. The relationship between moving images and reality is again raised here. Munsterberg writes of a state of ‘rapt attention’ in which audiences are satisfied with the experience of a ‘good’ film as its own mental object, rather than experiencing it in relation to the reality it is drawn from. In these instances, the audience is involved in an
aesthetic experience, akin to looking at any other work of art, and for Munsterberg this is a Kantian appreciation of beauty—isolated and devoid of context. Reality’s relationship to moving images for Munsterberg conforms to Kant’s stance on experience. *The Photoplay* argues that reality, unlike moving images, is comprised of time, space and causality. In Munsterberg’s argument, the experience of moving images in the real world is replaced by mental images in the filmic experience. The sticking point and simultaneous release for Munsterberg’s cinema is that rather than being prompted by an external reality all three of these qualities can be manipulated in the construction of moving images, unlike the relationship argued for by Munsterberg.

Epstein (1988), writing in 1923, proposes the addition of time as the fourth dimension cinema provides and how through this, a distinctively filmic reality is created:

> Time hurries on or retreats, or stops and waits for you. A new reality is revealed, a reality for a special occasion, which is untrue to everyday reality just as everyday reality is untrue to the heightened awareness of poetry. The face of the world may seem changed since we … can see the clear thread of thoughts and dreams, what might or should have been, what was, what never was or could have been, feelings in their secret guise, the startling face of love and beauty, in a word, the soul. (p. 318)

Artaud (1988), one of Epstein’s contemporaries, extended his stage theory in *Theatre of Cruelty* to the cinema, guiding his own and other film-works as part of French Surrealist cinema of the 1920s. Artaud’s cruelty as applied to cinema was an attempt to do away with representation, here meaning realism. Notably, this is for the most part related to realism *in* film not the reality *of* film. Artaud (1988) formulates his theories around a central argument that film is divided into two types; narrative film, along with its structures of signs and text, all expressed through prescribed codes of meaning, and a new form of moving
image he refers to as ‘pure or absolute cinema’ that embraces reality as the ‘primary raw material of cinema’ (pp. 410; 412).

Artaud (1988) writes of narrative cinema’s indirect relationship with reality in describing moving images as ‘merely the reflection of a world that depends on another source for its raw material and its meaning’ (p. 410). This reflects Artaud’s concerns that narrative cinema is a ‘venial hybrid art’, a translation of ‘more or less suitable images of psychological situations’ that belongs on the stage or in a book but not on the screen (ibid).

In the mid 1920s, during the latter part of this formalist period, there was a shift from the French avant-garde, film impressionism and its aesthetic connections to German expressionism of that time, toward Moscow as the host of Russia’s State Film School. Vertov, Pudovkin and Eisenstein are the theorists and practitioners that are most often associated with this movement. The Moscow School framed questions regarding moving images and reality primarily through editing. Of these practitioner-theorists, Eisenstein is the most prolific and approaches questions of filmic reality through montage, drawing on many fields including art history, economics, anthropology and psychology. Hegel and Marx are both strong influences in his writing about the ideological expectations he held for moving images and in his arguments regarding aesthetics. For the Soviets of this time, the single shot had no impact and it was only through the structure of montage—of editing, that the power of filmic reality was realised. Reality was not the strength of cinema; instead it was technique that was applied to reality that provided the appeal and power of the moving image.

This notion of montage locates the Soviets’ approach to moving image theory as a predecessor to Structuralism in film theory that become prevalent in the 1960s and 70s. It is important to note in terms of influence that many Russian Formalist written works were not translated into English until the mid 1960s. One of the central concerns of the Soviet Theorists regarding montage is the question of defining a specific mode of address for moving images. This
enquiry engages with Peirce’s taxonomy discussed in Chapter One given the Soviets’ twin concerns of the manipulation of pro- and a-filmic reality and the articulation of a sign system to describe the relationship between filmic representation and reality.

Dziga Vertov articulates a clear relationship between moving images and reality in his many writings and film-works of this period. Vertov, as noted for Comolli (1996) above, argues for the inferiority of the human eye to the *kino-eye* and that the camera should be used to transcend the illusionistic cinema represented by scripted mainstream films to reveal fact. Through a realist philosophy that can be seen to have strongly influenced a broad range of filmmakers including Chris Marker, Jean-Luc Godard, Lars von Trier of the Dogme 95 Movement, and the Maysles brothers, Vertov collaborated with his future wife, Elizaveta Svilova, and his brother Mikhail Kaufman to produce a newsreel series entitled *Kino-Pravda* (film-truth) between 1922 and 1925. This project also incorporated the publishing of a series of manifestos denouncing staged cinema and championing a cinema of fact. The title of this series references the then communist daily newspaper Pravda and reflects Vertov’s focus on truth, reality and a notion of film as a form of writing. In 1925, aware of the impending technology of electronically transmitted images, Vertov (1984) writes of the ‘essence of Kino-Eye’ thus:

> The method of radio-broadcasting images, just recently invented, can bring us still closer to our cherished goal—to unite all the workers scattered all over the earth through a single consciousness, a single bond, a single collective will in the battle for communism… instead of surrogates for life (theatrical performance, film-drama etc), we bring to the workers’ consciousness facts (large and small), carefully selected, recorded, and organised from both the life of the workers themselves and from that of their class enemies. The establishing of a class bond that is visual (kino-eye) and auditory (radio-ear) between the proletarians of all
Vertov called his own films poetic documentaries and intended in this work to take moments of reality recorded by the camera and through editing present a further truth that could not be perceived from the unmediated footage. Vertov (1984) argues that ‘it is possible by means of the kino-eye to remove a man’s mask, to obtain a bit of kinopravda. And it was the revelation of just this truth, by all the means available to me, that I designated as my entire future path in cinema (p. 124).

Vertov’s feted documentary Chelovek s Kino-Apparatom (The Man with a Movie Camera, 1929) was part of a larger group of documentary films known as the City Symphonies. Patricia Aufderheide (2007) discusses these films within a documentary context nominating them as an ‘unusual, poetic choice, an exception to the rule of documentary conventions... [made by] artists—makers manipulating form rather than storytellers using the film medium—as they invent, reinvent, and challenge’ (pp. 15; 14). Contemporaneous and earlier City Symphonies include Paul Strand and Charles Sheeler’s Manhatta (1921), Alberto Cavalcanti’s Rien que les Hueres (Nothing But Time, 1926), Walther Ruttmann’s Berlin: Die Sinfonie der Grosstadt (Berlin: Symphony of a Great City, 1927), Joris Ivens’ Regen (Rain, 1929), Boris Kaufman’s and Jean Vigo’s (under instruction from Vertov) À Propos de Nice (On the Subject of Nice, 1930), and Henri Storck’s Images d’Ostende (1930). This documentary form has also influenced celebrated experimental filmmakers including Kenneth Anger, Jonas Mekas, Stan Brakhage, and Michael Snow in explorations of the form of moving images; striving for a purity of representation and simultaneously celebrating the self-reflexivity of the cinematic image.

Vertov maintained that the kino-eye was an objective view of reality but despite commencing the Kino-Pravda series with unstaged actualities and editing them for his desired effect, by the end of the project three years and
twenty-three episodes later, Vertov and his collaborators were employing split-screen, freeze frame, superimposition and stop motion techniques in addition to staging some moments of action for the camera. Vertov defended this widely criticised move stating that:

It took me a while to learn that my critics, brought up on literature, under the force of habit, could not do without a literary connection between the different items… *Kinopravda* made heroic attempts to shield the proletariat from the corrupting influence of artistic film-drama. (p. 44)

Conversely, Rudolf Arnheim writing in the early 1930s, can be described as an anti-realist. His writing draws heavily on ideas in Munsterberg’s 1916 text but is far more widely cited. Arnheim’s (1957) 1932 text *Film as Art*, as the title suggests is solely concerned with moving images as an art form. He argues that cinema is not art if it merely reproduces reality. In rejecting untreated film footage as art, Arnheim argues for the medium of film as being not art because it is not manipulated. He goes on to describe several ways that moving images are not real as a method to enable film as art. Within this argument he specifically addresses moving images and reality:

Film, like the theater, provides a partial illusion. Up to a certain degree it gives the impression of real life. This component is all the stronger since in contrast to the theater the film can actually portray real—that is, not simulated—life in real surroundings. On the other hand, it partakes strongly of the nature of a picture in a way that the stage never can. By the absence of colors, of three-dimensional depth, by being sharply limited by the margins on the screen, and so forth, film is most satisfactorily denuded of its realism. It is always at one and the same time a flat picture post card and the scene of a living action. (p. 26)

It is clear that Arnheim (1957) is discussing the *experience* of moving images rather than the film medium when he writes of reality. Each of the aspects of
film that he cites excludes the audience from reality. Similarly his criticism of then newer developments including sound, colour, and 3-D films are bound up in an argument against making moving images too real. This distinction between the ontological real and the experience of the real recurs often when recounting the historical relationship between moving images and reality.

Arnheim (1957) admits that film can be utilised as a recording medium to ‘copy’ the outside world, but he cautions filmmakers against this. For Arnheim, the most successful kind of film balances artifice and reality. In opposition to the approach of copying reality, (historical) avant-gardism is not good either, in that it is too ‘arty’. Neither outcome is the ‘complete film’. Arnheim describes the complete film as one in which the artist manipulates all available means of technology to strive for realism. To qualify as art though, film should explore the very aspects of its medium that differ from reality:

The complete film is the fulfilment of the age-old striving for the complete illusion. The attempt to make the two-dimensional picture as nearly as possible like its solid model succeeds; original and copy become practically indistinguishable. Thereby all formative potentialities which are based on the differences between model and copy are eliminated and only what is inherent in the original in the way of significant form remains to art. (pp. 158-9)

For Arnheim (1957), the complete film is a ‘mechanically complete reproduction’ and represents ‘an alternative to the stage’ (pp. 160; 159). Despite heralding the demise of film art, Arnheim’s version of the complete film surpasses the verisimilitude of silent film including titles, three-dimensional or coloured moving images in film, and synchronised sound films, for a total reality.

Vocabulary used by these theorists including illusion, copy, reproduction, real, simulated, and a new reality to describe the kind of representation that moving images provide, demonstrates sustained concerns with indexical relationships
but also the complexities of this representation. This is from an era in which true synthetic images were yet to emerge and the crux of cinematic art was its mechanical reproduction. At this point, the relationship between mechanised moving images and reality is relatively well defined. The additions of successive technologies, namely electronic and then digitally based, complicate this relationship.

Like his Formalist contemporaries, Hungarian practitioner-theorist Béla Balázs, primarily considered the art of cinema. Balázs writes of the unmanipulated material of film as ‘filmic subject’. For Balázs this is not reality, but also not art. It is the appropriate untreated material that, importantly for Balázs, only in the right hands, can be transformed from ‘the empirical fog of reality’ into cinema (p. 162). Echoing Arnheim (1957) in describing the process required, Balázs states that the ‘maker must bring into play every means of expression available to the art of the film’ (p. 162). Cinema in this formalist tradition is categorically not reality so long as it is art. He argues that cinema responds to and criticises reality. It does not provide a conduit to that reality.

For Balázs (1970), vision is cultural rather than natural and so moving images are not reality, not even representations of reality, but rather cultural vistas:

The “soul of nature” is our own soul which the cameraman picks out of the objective shapes of the countryside. Nature was not always naturally a subject and material for art. Man first had to permeate nature with his own humanity, turn nature into something human. (p. 97)

He advocates filmmaking that distorts these vistas to the point of new realities emerging. Importantly he qualifies this to ensure that these techniques be used only as part of a greater naturalistic structure:

But however surprising the outlines produced by a camera angle may be, the basic shape of the object cannot be changed by this means [distortion]. Then can it overstep the boundaries of realism? Yes, it can.
The picture of an object can be unreal even if it is an exact photographic reproduction of the object. This happens when the object is unrecognizable. There are certain perspectives and angles the strangeness, characteristic quality and unusual originality of which are cancelled out because they are overdone, so that one can no longer recognize the object to be represented. A reproduction of an object can be unusual and surprising only if we know what the object is. (p. 102)

Balázs (1970) argument recalls the introduction to recognition as a method for creating realism as framed in the Chapter One. This notion, particularly in cases where recognition is all that links the moving image to reality, will be discussed for digital images in Chapter Four. Suffice to note here that recognition can operate for the pictorially familiar and also for the unfamiliar if the recognition is based on laws of physics or surface material in combination with inference as can be seen in much science fiction film of the twenty-first century.

Balázs’s position is informed by the Prague School literary Formalists’ approach to *aktualisace* or *foregrounding* in which the familiar was made new for artistic purposes and was considered as distinct from distortion. Foregrounding became a common device within Modernism and Balázs’ writing reflects this influence. It is clear that the literary principles of foregrounding can be paralleled with cinematic techniques like the close-up and extreme close-up. This idea in addition to making a contribution to the discussion of perceived realism, offers a further appreciation of Niépce’s 1826 photograph that opened this chapter.

However, Balázs (1970) also writes of unseeable moving images of nature that exceed human vision but relegates their value to scientific only. He states that nothing can be a work of art ‘if it can be seen by human beings only through the intermediary of some mechanical contrivance and never as a typical, natural, immediate experience’ (p. 103).
Unlike the practices and presentation of spectacle cinema of the late nineteenth century, early twentieth century theorists can be seen here to grapple with the materiality of moving images directly. The argument made in Chapter One regarding the neglecting of materiality for apprehension is somewhat addressed through this theorising. What this rhetoric becomes however is a caution against making mechanical moving images too real, so as not to lose the art of the moving image. A nascent conceptual understanding of moving images as potentially synthetic emerges then through the writing of this time. Film is incontrovertibly from reality but the intervention of art-making—manipulating reality—is regarded as more than *trucage* and considered to be a harnessing of actuality for ideological and/or aesthetic gain. The construction of the mechanical moving image is here no longer regarded as necessarily being of nature.

As has been demonstrated, the early film Formalist preoccupations with establishing cinema as an art form, its distinction from other art forms and the phenomenological aspects of moving images offer significant insights into the essential qualities of film form and the relationship of cinema to reality. Many Formalist arguments rely on film form to establish technique and investigate the essential nature of film as a representation of reality in order to establish it as a distinct art form:

In summarizing the French experience of the 1920’s we see that the great discovery of the era was not the editing or the split screen or the tricky camera movement, but a simple, direct approach to the reality in front of the lens. Cinema, as we have come to know it does have a language, but it is not the language of the Impressionists. The subjective camera, which they were so fond of using, does not bring people any closer to the minds of the actors or the experience of the situation. It is by and large a distancing device; one which only serves to make the audience aware of the fact that they are watching an artificial construction. (Blumer, 1970, p. 39)
Increasing Realism: The Introduction of Sound, Colour and other Innovation

Towards the end of the first formative film theory period, synchronised sound was introduced. In a similar fashion to early cinema’s advances in the basic skills of ‘directing, lighting, camera work, cutting, and acting proper,’ the introduction of sound again transformed the medium and its perceived relationship with reality (Panofsky, 1997, p. 113). By engaging more than one sense, synchronised sound is one of the first iterations of technological change in moving images that demonstrably increases its verisimilitude. In an illustration of my earlier argument of successive technologies operating in reference to but not subsuming previous iterations, the introduction of sound is part of a lineage of technological innovations that resulted in a second more pronounced transformation of moving images in the 1950s. The introduction of sound was followed by several cycles of stereoscopic moving images offering more overt depth cues, colour images replacing monochrome, deep focus cinematography, a shift from nitrate to acetate film stocks, widescreen aspect ratios, and increased resolution of both images and sound.32

As noted in the Introduction, sound is not the focus of the thesis, but it is included here as it represents one of a series of technological developments that contribute to filmic representations of the real and role of the moving image as a spectacle medium. Many early sound films cut back and forth between sound and silence, heightening the effects of the new experience afforded by then novel technology. Ironically, the veracity of the film image was adversely affected with the introduction of sound. This was due to the optical sound track taking up part of the physical space on the film negative that had previously been used for recording picture. The result was that for the same spatial scale of screen image when compared to silent film, the print

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[32] For moving images, ‘aspect ratio’ refers to the proportional relationship between the width (first number) and height (second number) of an image. An aspect ratio of 1:1 then is a square image, and an aspect ratio of 16:9 is one of several standard widescreen proportions.
magnification was increased. This then, displayed more film grain and revealed more of the materiality of the medium, something that now mature cinema audiences—no longer as interested in solely the magic of moving pictures—disliked. It was this issue in part that initiated the development of widescreen presentations. This significantly increased the film imaging area and subsequently, the resolution of the projected image.

Further performative emphasis on new technologies can be also seen during the introduction of full colour to cinema at this time. Colour sequences were spliced into monochrome films of the late 1920s and early 30s prior to the use of colour becoming mainstream practice. These were often musical and significant action sequences as can be seen in King of Jazz (1930) and Hell’s Angels (1930) respectively.

In a flow-on development, the introduction of colour film made possible the first wave of stereoscopic film screenings. 3-D films of the late 1920’s and early 30s were achieved through anaglyph methods in which two almost identical images offset for the right and left eyes, as earlier stereoscopic photographs had been, were recorded with colour filters and then when screened, were decoded by spectators wearing complementary colour filters over the corresponding right and left eyes.

Panofsky (1997) writing in 1936 about the introduction of sound to film is critical of the creative possibilities for audio. He also argues that moving images with sound had not evolved from the theatre because the relationship between sound and vision is far more intimate than occurs on the stage. Panofsky names this the ‘principle of coexpressibility’ (p. 101). For Panofsky there is no more reality expressed in the sound film than in the silent film:

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33 Many black and white films leading up to the introduction of colour were tinted or toned based on techniques previously perfected for still photography, hence ‘monochrome’ rather than ‘black and white’.
The invention of the sound track in 1928 has been unable to change the basic fact that a moving picture, even when it has learned to talk, remains a picture that moves and does not convert itself into a piece of writing that is enacted. Its substance remains a series of visual sequences held together by an uninterrupted flow of movement in space… In a film, that which we hear remains, for good or worse, inextricably fused with that which we see; the sound, articulate or not, cannot express any more than is expressed, at the same time, by visible movement. (pp. 100-1)

Arnheim and Dulac, alongside many of the other writers and practitioners mentioned thus far, also held dissenting views about the value of sound for the cinema. Some such as Artaud saw it as a regressive move, more closely aligning moving images with the theatre and away from a new reality. Eisenstein (1949), Pudovkin and Alexandrov rejected the use of synchronous sound in a formal 1928 statement as a development that ‘threatens to destroy all its [cinema’s] present formal achievements’ (p. 257):

To use sound in this way will destroy the culture of montage, for every ADHESION of sound to a visual montage piece increases its inertia as a montage piece, and increases the independence of its meaning—and this will undoubtedly be to the detriment of montage, operating in the first place not on the montage piece, but on their JUXTAPOSITION. Only a CONTRAPUNTAL USE of sound in relation to the visual montage piece will afford a new potentiality of montage development and perfection. (p. 258)

Others, including Gance and Pagnol, saw it as a step closer to realising a more affecting filmic reality. Balázs embraced sound but only in the formalist tradition of it being a tool to increase the creative possibilities of film through technique rather than allowing a greater proximity to reality. For Arnheim the achievable pinnacle of film was the purity of 1920s silent cinema. Sound
destroyed this purity by attempting to bring moving images closer to reality through solely mechanical means.

As noted, Alan Crosland’s *The Jazz Singer* (1927) made for Warner Brothers, is the first feature length film to feature synchronised dialogue. It also presented a series of musical vocal sequences by Al Jolson. There had been earlier short form works that had incorporated synchronised sound but these were predominantly pre-recorded music or sound effects. The release of *The Jazz Singer* signals the decline of the silent cinema and the beginning of the ‘talkies’, although this was a gradual shift and even *The Jazz Singer* was shown as a silent film in the majority of the theatres for most of its run. Hugely successful box-office estimations of *The Jazz Singer*’s theatrical achievements are similar to calculations of the accomplishment of a more recent technological advancement in presenting reality—digital 3-D. Screenings of pioneering supposedly commercially successful digital 3-D films including *Chicken Little* (2005) and *The Polar Express* (2004) screened overwhelmingly in 2D as many theatres were not yet equipped to project stereoscopic moving images.

Panofsky (1997) later takes a more measured approach when discussing the then recent introduction of sound to moving images and nostalgia for the silent era:

In art, every gain entails a certain loss on the other side of the ledger; but that gain remains a gain, provided that the basic nature of the medium is realized and respected. One can imagine that, when the cavemen of Altamira began to paint their buffaloes in natural colours instead of merely incising the contours, the more conservative cavemen foretold the end of Palaeolithic art. But Palaeolithic art went on, and so will the movies. New technical inventions always tend to dwarf the values already attained, especially in a medium that owes its very existence to technical experimentation. (p. 116)
Panofsky’s (1997) observation picks up the previously introduced thread arguing against the subsumption of previous technologies by new innovations. Concurrent with the introduction of sound, colour and experimentation with a host of other peripheral technologies enhancing the filmic reality of moving images, another transformation was underway—the shift from mechanical to electronic imaging. This is discussed in the next chapter as part of an historiographical approach, but it is pertinent to note here that more than the impact of sound, colour, stereoscopy, widescreen presentation and other strategies to increase verisimilitude, the introduction of video and television does not incorporate film within its production or reception, but instead contours a new space for distinctly different viewing patterns. The essential element of the ‘tele-’ in television was the result of cultural and societal desires rather than the technology.

As noted in Chapter One, digital technologies can operate in a linear mode as effortlessly as non-linearly. Correspondingly, television can as naturally function in the space of traditional cinema as it does domestically. Clearly this did not occur in the twentieth century but the advent of High Definition (HD) video has brought television to the cinema with regular programming including global satellite delivery of sports events, remote film festival screenings and performing arts seasons including New York’s Metropolitan Opera to cinemas both live and time-shifted. The Digital Cinema Package (DCP) initiative in which cinema screenings are increasingly digitally projected from local encrypted data sources may well be served remotely when network bandwidth allows. This serving of content remotely is one of the essential premises of television and is infiltrating the cinema space through digital technologies.

The tactic of foregrounding new technical innovation through screening techniques including sound and colour as discussed above, is carried through to widescreen film presentations of the late 1920s and early 30s variously marketed as Magnascope, Fox Grandeur, Vitascope and 70mm widescreen
(Abrams, Bell & Udris, 2001, p. 83). More recent film continues to exploit this technique with Disney’s *Beauty and the Beast* (1991) opening with a relatively crude animation sequence that in a final shot is revealed to be artwork from a printed storybook that is then contrasted with the following sequences of superior organic flowing animation. Pixar’s *Monsters Inc* (2001) commences with a 2D title sequence of inanimate objects seemingly primitively animated and drawn in a typical 1950s cartoon style before revealing the technical accomplishment of state of the art digital 3D character animation. In a pictorial homage to Saul Bass, Steven Spielberg’s and Peter Jackson’s *The Adventures of Tintin* (2011) opens with a markedly flattened animation title sequence that offers retro-styled 2.5D motion graphics before revealing the technical triumph of state-of-the-art photorealistic motion-captured 3D (and optionally 3-D) digital animation.34

The most notable of the early film presentations utilising this technique for widescreen are the alternating single and three screen presentations of Gance’s *Napoléon* (1927). During early screenings of this work, at the commencement of the final reel showing the conquest of Italy, *Napoléon*’s single screen expanded to become a triptych that Gance spruiked as Polyvision. Evoking the composite views of nineteenth century panoramas discussed above, these scenes featured an aspect ratio of 4:1, each of the three screens showing different shots of the same action, a stitched panorama of the same shot, or alternate aspects of story (figs. 13 & 14).

Figure 13 From Gance, A. (1927), *Napoléon* [Motion Picture Still]

34 2.5D—two-and-a-half-dimensional—is a term used to describe an animation technique that digitally animates a series of 2D planes in faux 3D space. It is also referred to as ‘pseudo-3D’.

Ndalianis (2003 & 2000) argues for a baroque extension from traditional film to the more immersive simulator theme park rides, particularly the ‘movie ride’. In a neat inversion, Constance Balides (2003 & 2000) discusses immersion in terms of spectatorship through an examination of how some of the visual effects of the theme park—borrowed from film effect technologies—are used within more traditional film practice through an ‘immersion effect’ (2003, p. 317). Utilising camera positioning and movement, these phenomena ‘produce a kinesthetic effect similar to the visceral sense of an amusement park ride’ (2000, unpaginated). These arguments from Ndalianis and Balides can also be considered within the context of transformative digital moving image technologies of the 1990s, which will be discussed in Chapter Four.

The three simultaneous filmic realities offered by *Napoléon*’s sub-frames are the technical origins of multi-camera studio television, cutting from one camera POV to the next from the control room and displaying multiple images through picture-in-picture and split-screen arrangements. Contemporary films including Bryan Singer’s *The Usual Suspects* (1995) (and its inspiration, Akira
Kurosawa’s *Rashomon* (1950), Gus Van Sant’s *Elephant* (2003) and Pete Travis’ *Vantage Point* (2008) in which the duration of the film consists of repeated screenings of the same story told from different characters’ points of view, are also versions of screening these multiple realities, or what Cameron (2008) nominates as ‘modular narratives’. One edition of The North American DVD release of *Elephant* (2004), in addition to offering the originally intended (now) non-standard aspect ratio of 1.33:1, does not follow the theatrical screening sequence, instead presenting a menu with an option to play the story of the film in any order of the five characters’ perspectives. This offering of a spatial and temporal alternative is similar to the temporal disturbance put forth by the 2-disc DVD release of Chris Nolan’s *Memento* (2000), in which one of the hidden screen menu options on the second disc is to play the film in chronological order rather than the reversed sequence playback of the theatrical narrative.\(^3\)

*Memento* revels in the conflation of photographs with the objects they represent and its disconnected but sequenced time in turn echoes the disorientating diegetic time and space of Alain Resnais’ film *L’Année Dernière à Marienbad* (*Last Year at Marienbad*, 1961).

One of the most pervasive examples of multiple realities onscreen in contemporary film is Mike Figgis’ *Timecode* (2000). The formal visual composition of *Timecode* is comparable to sections of Abel Gance’s *Napoléon* (1927), particularly that film’s early snowball and pillow fight scenes that presents up to twelve-segment split-screen views.\(^3\)

*Timecode*, shot digitally but screened internationally at major commercial art-house cinemas predominantly as 35mm prints, presents a single shot for the duration of this ninety-three

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\(^3\) To access the chronological re-edit of *Memento* (2000), the viewer must select the clock icon on the first screened menu of Disc Two, then choose ‘C’ on the following five screens. A quiz then displays four illustrated panels of a woman changing a car’s flat tire. The quiz asks the viewer to place the panels in chronological order. In order to access the re-edit of the film, the viewer must incorrectly place the panels in reverse order. The film then begins playback in chronological order (this is a reordering of the existing data from the feature presentation, not new material).

\(^3\) For more detail on selected screen techniques as used by Gance in *Napoléon* (1927) within the context of French Film Impressionism see Blumer (1970), pp. 36-8.
minute film. This shot, however, is four simultaneous takes, each ninety-three minutes long, offering four different visual and numerous aural aspects of the same story unfolding in a quadrant split-screen presentation (fig. 15). These quadrants are at times split further with views of multiple surveillance cameras within a single quadrant and also frame within frame views of a hand-held camera viewfinder contained by one quadrant in the form of picture-in-picture. The action moves from location to location, introduces an ensemble cast of twenty-eight, and self-consciously plays out an unimaginative love triangle featuring a jealous lover and an anticipated death in an archetypal pool of blood.

Rhys Graham (2000) after noting that *Timecode* (2000) claims to be the first feature film shot in real-time in one take, details the production and screening

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37 The length of digital tape that the production was recording on wholly determined the duration of the moving image content.
details of an earlier split-screen production made under the same strictures. D-
Dag (2000) was made on New Year’s Eve in Copenhagen by celebrated
proponents of the Dogme 95 Manifesto—Lars Von Trier, Thomas Vinterberg,
Søren Kragh-Jacobsen and Kristian Levring—a collective that will be discussed
as part of a transition from analog to digital technologies in Chapter Four. For
this film, each of the four directors shadowed four corresponding characters,
recording their exploits on New Years Eve 1999. Somehow, the filmmakers
were able to convince seven Danish television networks to simultaneously
broadcast these four recordings on the evening of New Years Day 2000. In
addition to the four camera views, three more channels were commandeered.
These respectively screened a four-way split-screen view of the film—identical
to the spatial arrangement of Timecode, and showed a control room from
where the filmmakers were communicating with first, the camera operators and
secondly, the actors. Viewers could then use their television remote control
devices to switch between channels, creating a unique live edit of the
interrelated stories being played out over the seven synchronised channels.38

Adding to the stimulating filmic reality offered by this novel mode of
storytelling in which an audience can see multiple viewpoints of the same
action at times and at others multiple locations with linked action across them,
there is a self-reflexivity in Figgis’ choice to name the film production company
and office featured in the film after his own. There are also scenes of film
pitching, one of them a film almost identical to Timecode (2000). This film is
championed by Ana Paul the diegetic film director in Timecode as ‘a film
without a single cut. No editing. Real-time’. There are additionally call and
response relationships made between diegetic love-scene screen-tests and
temporally simultaneous filmic love scenes allowed for by the spatial montage
system employed. These techniques create an explicit hierarchy of reality
within the work.

38 For more on D-Dag (2000) see Weiberg (2002, pp. 5-6).
Despite these self-reflexive methods and the emphasis on real-time and simultaneity in the production and the screening of *Timecode*, particularly through the repeated views of clock faces, physically remote conversations on mobile phones, and several earthquakes all depicted across multiple quadrants, Figgis recorded these four simultaneous takes fifteen times, each time additionally incorporating improvised ideas introduced in previous takes (Fabe, 2004, pp. 230-1).

*Timecode* (2000) is an example of what Manovich (2001) calls ontological (as opposed to stylistic) ‘spatial montage’. In ontological spatial montage borders between different worlds do not have to be erased; different spaces do not have to be matched in perspective, scale, and lighting; individual layers can retain their separate identities rather than being merged into a single space; different worlds can clash semantically rather than form a single universe. (p. 158)

Like the spatio-temporality of *L’Année Dernière à Marienbad*, the reality of *Timecode* (2000) is not experienced naturalistically, but comprises multiple locations coexisting in a single screen space and alongside continuous time via four co-existing single shots. On one hand, Figgis can be seen to be following in the footsteps of Renoir and Hitchcock, subscribing to the realist views of Bazin and his preferences for the long shot and deep focus filming techniques of Wyler and Welles to create filmic reality rather than the expressionist approach of Eisenstein’s techniques of montage. On the other hand however, as Fabe (2004) notes, selective camera movement, particularly panning in *Timecode* functions as a stand-in for cutting from shot to shot. From this and some of the more self-reflexive elements within the story of the film it is likely that Figgis is arguing that this distinction is moot. Fabe (2004) goes on to argue that the spatial montage offered by *Timecode* replaces Bazin’s desired long take in offering an opportunity to interpret the filmic reality ‘in a way that is often foreclosed by linear montage’ (p. 240).

39 For a detailed discussion of the use of split-screen to depict ‘mental images’ and remote locations in early cinema see Bowser (1994, pp. 62-7).

It is not only Figgis who makes comment on form of the moving image over content in this context. Bozak (2008) links Figgis’ split-screen technique with the long take in *Timecode* (2000) arguing that digital processes lead to an aesthetic of excessive visual imagery which in turn signals the demise of picture-editing and ultimately, cinema. Fabe (2004) writing about narrative structure and *Timecode* argues that:

The novelty of the film’s experimental form is always something of a distraction, taking precedence over our absorption in the narrative and identification with the characters. The film deliberately pits the reality effect of a film shot in real time, with the actors giving naturalistic improvisational performances, against stereotypical character types and a hackneyed plot. The effect is quintessentially postmodern in that Figgis appears to be saying simultaneously that what you are seeing is for real and that it is all totally ridiculous. (p. 236)

**Conclusion**

The argument that Figgis privileges form over content is resonant of the earliest filmic works, particularly trick-films. Unlike Fabe’s (2004) view of *Timecode* (2000) in which the ‘novelty of the films experimental form is always something of a distraction’ however, in the context of the early trick-films filmic reality itself was the novelty and a self-reflexive aesthetic foregrounds the new technology as spectacle in its own right.

I am cognisant of Comolli’s (1986) warnings regarding the insulating of technology from grander stories when writing histories and this leading to the chronicling of largely hollow ‘firsts’ in history. The firsts detailed in this chapter serve though to illustrate a more expansive apprehension of the moving image alongside the momentary and immediate developments in moving image history—also portrayed as apprehensions.
Further, Branigan (1985, pp. 125-8) argues for the separation of technology from technique. Crucially, the use of technology through technique is mediated by cultural and societal impetus and this has an analogous relationship with distinctions between the apprehension and materiality of moving images. This dynamic also applies to both pairs for ‘each justifies the other in a hermetic circularity’ (p. 126). It is in these documented accomplishments of technology and technique as part of a plurality of historical initiations that a pattern of blended ontology and phenomenology can be discerned with regard to the relationship between moving images and reality. An enquiry into the era of mechanical moving images, mediated through technology and its application, is edifying. During this era, mechanised photorealistic reproduction is perceived and practiced as an essential component of a rapidly evolving pictorial system of representation.

The era of mechanical moving images is characterised on the one hand by a new and more veridical perceptual realism and on the other, a reinforcement of the indexical power of the photograph—now coupled to motion images. That these two aspects behave for the most part, independently of each other, is a distinction between the experience and essence of mechanised moving images and evidence for the argument that materiality is rendered subordinate to apprehension made in Chapter One. It is also a timely admonition that the perceptual realism and materiality of moving images operate autonomously of each other when considering indexicality. That Niépce’s early photographs appear to have less mimetic veracity than more recent synthetic digital images is testament to this argument. Indexicality cannot be discerned through looking at images; perceptual veracity is not a credible measure of indexicality. It is only knowledge of the technology or blends of technologies employed in an image’s creation that allows the exclusive categories of continuous or discrete to be assigned.

With the advantage of retrospection, this view of the transition from photography to film is augmented by knowledge of what was to come and an
ability to distil and corral these technical developments and their commentary through the lens of successive technologies. Although this cannot be an orderly account given the overlap and parallel histories already evident, this historiographical approach continues throughout this thesis as outlined in the Introduction. This is at the service of explicating the varied indexical properties of the moving image, framed by distinct and successive technologies.
CHAPTER THREE

Realism Effect? Verisimilitude and Perceptual Realism in Mechanical and Analog Electronic Moving Images of the Twentieth Century

Introduction

Crucial to the historical narrative of this chapter is the introduction of electronic images embodied by analog television and video, building on the developments chronicled in the previous chapter on mechanical moving images. And vital to the central argument of this thesis detailed in Chapter One is an indexical severance through spatial discretisation coupled to a shift from those mechanical to these electronic images. Despite the evidence offered within this thesis, this indexical rift is largely unacknowledged by theorists and practitioners. This chapter charts the technological advances and transformations of the moving image in the twentieth century. Additionally it chronicles the continuing use of perceptual realism to articulate the verisimilitude of moving images. Parallel to this history, an argument demonstrating how an approach focused on apprehension is flawed and an alternative reading that considers a more granular approach to the mediation of reality by moving images is advanced. Throughout, the transition between and coexistence of mechanical and electronic analog moving images of this time resists a succinct retelling largely because of the simultaneity and co-dependence of these technologies.

The Nature of Television

Alongside the developments in film practice and theory during the late 1920s and early 30s discussed in the previous chapter, television arrives. Television represents the introduction of analog electronic moving images that
supplement the predominantly mechanical technologies employed to realise moving images using the film medium. As for film, technologies of moving images are one of the major drivers of television, yet this is an example of realising a new form of moving images for which the uptake of technology is firmly grounded in societal and cultural desires: ‘the technology alone does not create the use to which it is put: technology is implemented… according to the prevailing patterns of use into which it can be fitted, and according to the emerging forms of social organisation with which it can align itself’ (Ellis, 1982, pp. 11-2). As noted in the previous chapter, the technology of television supports its potential to compete in the same exhibition space as cinema but this largely does not occur until the beginning of the twenty first century. The implementation of television in its desired configuration, reflecting the incursion of electronic technologies into the home, required the cooperation and resources of large commercial organisations, government regulation to manage the broadcast spectrum, and large audiences.

Friedrich Kittler (2010) deftly describes television as the first fully electronic manifestation of information theory—as defined by Shannon in 1948—articulating the fundamentals of communication:

First, it was a fully electronic convertor of images into currents, and thus a television signal source. Second, it was a fully electronic transmission circuit, and thus a television channel. Third, it was a fully electronic convertor of current into images, and thus a television receiver. Its fourth function, which only developed much later, was also to serve as an electronic image storage device. (Kittler, 2010, p. 208)

It is important to note distinctions between the natures of broadcasting and cinema and a similar point will be made below regarding the differing natures of television and video. In addition to the distinct social patterning of cinema, the only commitment for viewing cinema is to a specific performance at a specific place and time. No additional purchase of technology or particular domestic arrangements to house this technology is required. Further, the
production of filmic content—unlike television—necessarily precedes cinematic exhibition. Contrasting the development of cinema, both the broad technologies and logistics of television broadcasting are designed and for the most part implemented before production commences and the prior production of content is not required in order to broadcast this medium that can offer ‘live’ vision and sound.

Television was designed primarily to be experienced in the home. There are two momentary and one extended exception to this trajectory. The momentary concessions are a period during television’s introduction to Japan where public sets were sited on street corners and available for shared public consumption, and during WWII in Berlin where the *Volkferseh-Einheitempfänger E1* (people’s television) ‘stood in post offices and other public agencies… where its screen was enlarged so that it could be seen by many spectators at the same time’ (Ibid, p. 215). The more permanent arrangement of public television is within less industrialised territories where domestic ownership is rare for economic reasons. Recalling Branigan’s (1985) argument from the close of Chapter Two, it is clear that societal and cultural milieus contour the application of the technology of television enormously.

Television follows the precedent of radio transmission, making bandwidth available to hardware manufacturers irrespective of content production. This was the most attractive configuration to early advertisers who had previously been able to enter homes through newspapers and radio but not with the moving image. The role of advertisers in funding television production and more indirectly, generating further consumer spending after the initial television hardware purchase, has been both fruitful and complex.

This essential dominance of form over content in television has two fundamental ramifications in this thesis. The first is a greater distinction for television than for film between the creation of content and its subsequent exhibition. The second is that television takes much of its content from other sources—often filmic. Television is not defined by its content in the same way
that source material forming a study of cinema could be regarded as a collection of films made for that medium.

To discuss television then, is primarily to discuss the medium rather than a set of programs. In television, rather than making transmission bandwidth available for increasing volume of programming, content is licensed, commissioned, purchased and broadcast to fit transmission availability. It may move time-slots, be screened once or several times, be live, pre-recorded or a combination of both, segmented by location or time specific advertising and truncated at the broadcaster’s discretion.

The relationship between television images and reality is necessarily complex because of this deferred display, and if pre-recorded, secondary relationship to film, being the primary recording—rather than exhibition—media for moving images when televised. For the earlier technology of film presentation, even through iterations from the Original Camera Negative (OCN), Answer Prints, Interpositive (IP) Prints, and Dupe Negative (DN) copies before generating the release prints for cinema screening, the film projection print has a more direct material relationship with the film-camera recorded moving image than a corresponding television image does with its occluded camera sources. This deepens the technology-specific claims made by this thesis for the indexical status of only some analog moving images. Language used by Peirce and others regarding indexicality places emphasis on directness, existential connections, intrinsically showing referent objects, and having direct physical connections with their objects. The technologies of television (and video) are impoverished examples of these traits whereas filmic attributes, as outlined in the previous chapter, excel in this regard.

I invoke here Peirce’s summary—also quoted in Chapter One—of an Icon that denotes its object by ‘virtue of characters of its own which it possesses, just the same, whether any such Object exists of not’ (Peirce quoted in Short, 2007, p. 215). As argued in Chapter One and further elucidated in this chapter, analog television and video are better defined as Peircian Icons than indices, the
Television’s Long Naissance

Initial development of television began in the late nineteenth century and was a natural progression of radio, having commenced commercial broadcasting in 1920 with the addition of moving pictures. Early designers, engineers and innovators agreed on the basic structure for creating television. The first requirement was to be able to pictorially represent the original camera image by spatially breaking down recorded reality. The second necessity was to transmit these bits of recorded reality elsewhere, reassembling them at the receiver end to create a moving image comprised of a matrix of moving picture elements. This was the process already used to transmit newspaper photographs—and crucially, this process for printed matter used halftone reproduction as discussed in Chapter One and as will be argued for video below—to transmit data over telephone lines and so presented a logical method to follow.

The cultural and technological links with radio also extended to the uptake and use of the technology of television. Both were initially designed as predominantly ‘live’ media to be experienced in the home. Charles Francis Jenkins, one of the early television experimenters who ‘married the movie to radio’ with his ‘teloramaphone’ (Herndon, 1925, pp. 108; 112) acknowledges television’s links with the earlier technology of radio, its close proximity to reality, and also its categorisation as a live medium thus:

The home radio movie has arrived. We have now reason to hope that we will eventually sit at home and watch the world series exactly as it is played and hear the umpire and the crowd at the same time. People in the most isolated sections of the country will attend distant Fourth of July celebrations, or perhaps, the next presidential inauguration by radio,
and see and hear more of it than if they were in the crowd in front of the speaker’s stand. (quoted in Herndon, 1925, p. 107)

The technology of film recorded and played back reality of another time and place. Radio and television however, represented reality in near real-time. Notions of time-shifting and playback of pre-recorded content for consumers did not apply to television until much later in the twentieth century. Despite the experiences of film, radio, and television all being a one to many relationship, the scale of this ratio and the presentation context were far different for film than for both radio and television.

The early history of television is documented through an overtly nationalistic approach. The major inventors credited with developing aspects of television are the British inventor John Logie Baird, American Philo Farnsworth, German Engineer Paul Nipkow, and British electrical engineer A A Campbell Swinton. Webb’s book Tele-Visionaries: The People Behind the Invention of Television (2005) only mentions Logie Baird in passing. Correspondingly, Bignell’s UK book An Introduction to Television Studies (2004), doesn’t mention Farnsworth at all.

Shelford Bidwell, in a 1908 paper, outlines the work done to date in transmitting still photographs over long distances and the requirements for ‘telegraphic photography’. He goes on to discuss the possibilities for transmitting moving images in monochrome and colour as ‘the transmission of optical images over an ordinary telegraph or telephone line by a method in which advantage is taken of visual persistence’ (p. 105). Later the same year Swinton published descriptions and diagrams detailing the workings of CRTs:

This part of the problem of obtaining distant electric vision can probably be solved by the employment of two beams of kathode [sic] rays (one at the transmitting and one at the receiving station) synchronously deflected by the varying fields of two electromagnets placed at right angles to one another and energised by two alternating electric currents
of widely different frequencies, so that the moving extremities of the two beams are caused to sweep simultaneously over the whole of the required surface within the one-tenth of a second necessary to take advantage of visual persistence... possibly no photoelectric phenomenon at present known will provide what is required in this respect, but should something suitable be discovered, distant electric vision will, I think, come within the region of possibility. (p. 151)

There are three scientific breakthroughs that contributed to the transformation of mechanical moving images to electronic television. The first is J J Thomson’s discovery of the electron in 1897 and his experiments that confirmed that cathode rays were made up of electrons. The second is the manufacture of vacuum tubes. These allowed the electronic amplification of electric current. Vacuum tubes were the beginning of practical electronics and were the core elements of almost all electronic inventions until the invention of transistors acting as amplifiers and switches in 1947 and these were not incorporated into electronics until the early 1960s. The third is the discovery that selenium, having been used for toning photographs since the mid-nineteenth century, could also be used as a photoreceptor to convert the varying amounts of light falling on a sensor into varying strengths of electric current. These three technical achievements enabled the transmission of moving images over electric lines to a remote location.

There are differing milestones in the development of television and disagreement between historians as to what constituted the invention of television. The time-lines, responsibility for, and even evidence of demonstration for the technology of television are mired in longstanding controversy. Some historians have focussed on the ability to electronically record and then playback moving images whereas others argue that the broadcasting element was a crucial requirement in achieving success. The first images of television though, whether electronic or electro-mechanical, were
both visually striking and clearly orchestrated to be moving representations of reality:

While the little crowd of neighbors and friends watched a small screen which formed a panel in the receiving set, there suddenly appeared on it the silhouetted figure of a girl. There was no scenery. The details of the dancing figure were not shown. But the shadow-like figure moved—it danced. (Herndon, 1925, p. 107)

A switch was thrown, lights flicked on and a motor burred. The witnesses filed before the television machine and there on the little screen they saw the head of a smiling woman with a telephone headset on, moving from side to side, nodding. It was the telephone operator in Washington. The image on the screen was like a picture postcard in clearness and about that size, but it was a postcard come to life; the figure moved. (“Television Now Reality”, 1927, p. 20)

The tone and language of these responses are not limited to the experience of seeing early television. The effect of scientific firsts and a fascination with the technology that created it can be observed at other pivotal moments of recent innovation and with the use of startlingly similar language. Rodney Brooks is a pioneer of evolutionary robotics, developing humanoid robots that evolve in the context of the real world. This is a strategy that Brooks believes will generate intelligence ‘at the heart of the machine’. He recalls: ‘one night, the physical robot actually moved… it completely surprised me—it moved! When I switched the things on, the lights flashed and the machine came to life’ (Briat, 1993).

Brooks’ experience is relevant not only because of the similarity in his description of a new motion technology to responses to early television imagery but also because of the link between robotics and CGI through the premise of the ‘uncanny valley’. This hypothesis, originally devised by Japanese roboticist Masahiro Mori as 不気味の谷現象 (Bukimi no Tani Genshō) in 1970, proposes
that the closer a robot visually presents as being human—more real—the more positively humans will respond until a point is reached where this response is dramatically reversed and humans feel uncomfortable and unsettled, even repulsed, by this representation. MacDorman (2005; 2006; 2006a; 2009) notes, after Mori (1970), that motion exacerbates the effect. The uncanny valley then, is literally the dip in the graph where a positive response to a non- but near-human form drops away sharply as seen in Fig. 16.

Caption: Masahiro Mori proposed a relation between human likeness and shinwakan, which may be roughly translated as rapport or comfort level: more human-looking robots are perceived as more agreeable until we get to robots that look so nearly human that subtle flaws make them look creepy. This dip in their evaluation is the uncanny valley. The valley, Mori argued, would be deepened by movement.

Fig 16 From MacDorman, K. F. et al. (2009) Computers in Human Behavior 25, p. 696 [Figure]

Those working with CGI for motion pictures appropriated the theory of the uncanny valley in the 1990s. Digital creations created through CGI representing lifelike humanoid forms visually risk presenting as ‘too real’ and therefore weird, creepy, or unnatural. These handiworks belong to the uncanny valley. Filmic characters in The Polar Express (2004) and Beowulf (2007) are
frequently cited examples of this effect with each film attempting to present photorealistic moving depictions of humans through CGI.

The other disagreement that is crucial to this thesis is which technology can be said to represent the earliest demonstrations of television. Farnsworth was working with CRTs using electronic technology solely (although there is some evidence of patent applications for mechanical devices related to television components), but Baird’s system was electro-mechanical and achieved the transmission of reflected light on moving subjects with halftones in 1926. (Magoun, 2009, pp. 32-7; Abramson, 1987, pp. 83-5). Farnsworth in 1927, the same year as the release of previously noted film, The Jazz Singer, was able to capture a simple black and white geometric shape using projected backlight as an electronic image. Vladimir Zworykin had already filed patents covering some of the innovations of Farnsworth, although he had not realised television in the way that Farnsworth did. Zworykin also went on to develop television as a viable enterprise for radio company RCA. In 1928, Kenjiro Takayanagi demonstrated CRT television images in Kanda, Tokyo. He was also instrumental in creating the first Japanese television transmissions in 1930 (Yoshimi, 2010). As noted above, early Japanese television sets, even into the 1950s, were placed in public places for communal viewing. Conversely, the other televisual viewing anomaly, German public viewing, was closely linked to war propaganda and ceased when the last of the German television transmitters were bombed by the Allies. The Japanese experience then, counters a Western social intention of almost exclusively domestic viewing (“Television for the Home”, 1928).

The earliest development of television in principle that can be traced back from mature television technology is the mid-nineteenth century work of philosopher Alexander Bain. In expanding his experience with offset printing that renders images as a dot screen via the process of halftoning, Bain proposed the transmission of a system of points contained by the image bounded by a rectangular grid (Abramson, 1987, p. 6). This important lineage demonstrates
the principle of sampling through halftone screening for the earliest known
documentation of television principles. This is clearly a discretising process and
one that draws on the techniques of halftone printing transposed to theoretical
moving images. In application, the earliest developments are credited to Paul
Nipkow, who in 1908 described a mechanical image-scanning device that he
thought could then send images travelling like telegraph signals—also
discretised—to a remote location. His was the first documented plan for a
system that scanned moving reality as a picture element (or pixel) matrix,
converted it to electricity, and transmitted it elsewhere (Magoun, 2009, pp. 8-9).

This process of dissembling the image and transmitting it as a discrete series of
points similar to the telegram is in opposition to the cohesive and continuous-
tone image-making techniques of mechanical photography and film.
Nonetheless, in another example of the decoy of perceptual realism when
considering indexicality as noted in Chapter Two, diagrams of Nipkow’s
system look not unlike some of the pre-cinematic parlour toys discussed in that
chapter including the phenakistoscope and zoetrope that use a similar aperture
with a light source behind to illuminate the viewing space (fig. 17). In
Nipkow’s design however, the aperture can operate as a camera to record the
brightness of scene or release light through to the viewer as a series of screened
images (fig. 18).
Figure 17  Unknown, (1879), Phenakistoscope [Etching]

Figure 18  Herndon, C. A. (1925), The Latest Prismatic Disc [Photograph]
Baird’s invention used light as a reflected source rather than the emitted CRT approach. With the benefit of retrospection, some of the flat screen technologies television uses today including Digital Light Processing, flying spot scanners, and the Grating Light Valve are extensions of Baird’s inventions that were overshadowed at the time by the fully electronic CRT and an industry that embraced electronic technologies over mechanical innovation.

The endeavour of creating television involved a series of inventions beyond those already noted. These include saw-tooth scanning, flyback high voltage power supply, DC restoration, and electron multipliers (Salt, 2002). Early television was a mixture of electronic and electro-mechanical technologies that evolved over the next twenty-five years to become a solely electronic technology. Further, at the close of the twentieth century, the television medium re-embraced some of the neglected mechanical innovations of the 1920s and implemented these in digital flat screen television technology.

Interestingly, this parallels Manovich’s (2001) argument discussed in Chapter Two regarding the production of digital moving images. Manovich argues that digital VFX work in film is a return to the mechanical origins of hand rendered animation for digital photorealism outcomes. Digital display technologies for film and television have also returned to their mechanical origins in some of the methods used to generate digital moving images.

The development of television as a viable broadcasting system unfolded over a number of years. What could have been a breakthrough medium bringing new electronic pictorial representation to the world in the late 1920s took until the early 1950s to become a form of mass media communications. It was initially held up by issues of patents and economic control, then the Great Depression.

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in the decade before WWII. The war further delayed systematic broadcast as television transmission tower signals acted as beacons signalling large targets for enemy aircraft. The initial BBC broadcasts that had begun in London from Alexandra Palace in late 1936 for two hours of programming a day (except Sundays) were halted on September first, 1939, and did not resume until June seventh, 1946 (BBC, 2010). Broadcasts in America and Germany occurred only sporadically throughout WWII.\textsuperscript{42} The recovery of television worldwide occurred over a number of years and this was in the time of food and clothes rationing that continued for several years after the war. In Britain, it took until the early 1950s to add transmission to the North of England, Wales and central Scotland and this re-instatement of television was seen as a matter of national pride. Britain had lead in the advancement of television transmission prior to the war and was determined to do so after. There was also the drive of economic recovery and the power of advertising to consider.

The greatest economic drive and audience anticipation for the resumption of broadcasting following the live broadcasts of parts of the 1936 Berlin Summer Olympics throughout Berlin and Potsdam during WWII was about transmitting real-world events. This furthers the argument that television was technology operating at the service of societal and cultural directives. A clear sign that television as a new type of moving image reality had arrived was more than twenty million people watching the BBC television broadcast of the coronation of Queen Elizabeth II in 1953.\textsuperscript{43} In the USA, the equivalent moment was the orchestrated screen birth of the character Lucy McGillicuddy-Ricardo’s baby (and the same day off-screen birth of Lucille Ball’s second daughter) during the second season of \textit{I Love Lucy}, also in 1953. More than

\textsuperscript{42} Kittler (2010, pp. 212-8) documents the technical development of television during WWII contextualising it within the realm of war technologies from a German perspective that extends beyond usual references to the 1936 Berlin Summer Olympics and The ‘Nuremberg rally crowd scenes’ (p. 212).

\textsuperscript{43} See Henrik Örnebring’s \textit{Writing the History of Television Audiences: The Coronation in the Mass-Observation Archive} in Wheatley (2007, pp. 170-83; 216) for a detailed account of the relationship between UK television and the 1953 coronation.
seventy percent of American televisions tuned into this episode of fictionalised reality (“Radio: Birth of a Memo”, 1953).

Australia came to television reality relatively late being one of the last industrialised nations to commence commercial broadcasting in 1956. The impetus for the timing, informed by the Royal Commission on Television (1953-4), and the power of the live event in this instance was the opening ceremony of the 1956 Summer Olympics in Melbourne. At this time broadcasts commenced in Victoria and New South Wales only, not reaching the Northern Territory until 1971.

During the 1950s, television was still regarded as a live medium to be consumed in the home, much like the initial dreams of radio with pictures. This is despite programs such as *I Love Lucy* (1951-7) being recorded on 35mm film and then electronically scanned before transmission. This gap between production reality and consumption desire reflects the initial structuring of television broadcasts and also early film screenings. It is true though, that much local content in territories other than Britain and America was produced as live-to-air and not recorded prior to the introduction of videotape technology in the early 1960s.

The introduction of colour to television in the 1950s is an additional example of moving images sampling and compressing the electronic visual signal representing reality. This was predominantly for economic reasons, akin to the impetus to be able to transmit multiple channels in black-and-white that led to television having reduced resolution when compared to the photomechanical basis of film. The requirement to transmit three times the information as for monochrome television—one channel for red, green and blue respectively—was regarded as prohibitively expensive in terms of bandwidth and so the chrominance component of the signal was compromised. This disassembling of the television signal, compression of colour and the addition of synchronisation data (prefiguring digital image metadata), coupled with spatial discretisation through shadow masks and separate fields within the frame discussed in
Chapter One, makes a compelling case for television and video that shares these characteristics to be categorised as Peircian Icons, rather than Indices. Kittler (2010) describes this outcome with a further nod to Shannon’s (1948) information theory as indirectly foreshadowing a structuralist approach to film language, but one focused on the transmitted signal rather than content:

In contrast to radio signals, therefore, television signals never corresponded to analog vibrations, but rather they were extremely complex assemblages. Like a spelled-out sentence, they were composed of various different elements and they adhered to the appropriate rules of syntax; you could even say they had their own electronic punctuation marks, which naturally consisted of synchronization signals. (p. 220)

As Balázs (1970) had predicted—also in 1948—hardware manufacturers drove the advancement of television and film media, with new programming developed as various forms of moving images matured. Novel content and new realities were created to expand and fashion new markets for technologies of moving images. These trends continue through to the end of the twentieth century and into the next through experimentation and delivery of stereoscopic television and film, the introduction of colour images and digital SD and HD broadcasting alongside novel programming formats and multimodal tevisual experiences.

What can be discerned in the following section is the independent development of film technology alongside television and video. As noted in the Introduction, the insertion of television does not extinguish or subsume filmic technology and in a parallel to these developments, the distinctive indexical relationship that film has with reality is contrasted with the iconic relationship offered by electronic moving images represented by television and video. The double recursion of television re-presenting continuous filmic images as discrete images highlights the indirectness and is a precursor to the allusory mode of address favoured by digital moving images discussed in Chapter Four.
Deep Focus Cinematography and Technology

Alongside television’s development in the 1930s and 40s, optics and photomechanical film technology continued to evolve and in the late 1930s, deep focus photography made a return to dominant cinematography practice. The earliest actuality films displayed deep focus predominantly because of the medium focal length of lenses in use at that time let relatively more light into the camera. In addition, the majority of films were recorded outdoors in bright sunlight (Salt, 1992; Comolli, 1996 & 1986). Then, in the mid 1920s, the introduction of panchromatic film stock changed the visual aesthetic of filmic reality. New panchromatic film stock with a wider range of colour sensitivity (when compared to previous orthochromatic film), and changes in lighting techniques of that time, produced a generally shallower depth of field. This was because the lens aperture had to be opened up further to allow additional light into the camera. As Belton (1996) notes, this mimicked the shallow depth of field of earlier and then-contemporary still photography because of the technologies used to create in-camera realities. Additionally, lens coatings first introduced in 1939 allowed a much greater transmission of light to the film plane and this, in combination with further advances in panchromatic film stocks including Kodak’s Plus X and Super XX, signalled a return to deep focus cinematography. Belton (1996) argues that this re-embrace of deep focus cinematography is ‘an indirect product of technological changes introduced in the transition-to-sound period’ in the 1920s and attributes this line of reasoning to Comolli (1986, p. 265). Although I agree with Belton’s argument and note that Comolli’s argument supports it, it does so to a different end, that of ideology. In Comolli’s argument, rather than depth being an effect of the camera, the camera itself is an effect—one for

44 For a detailed technical introduction to panchromatic film stock and other moving images’ technologies introduced between 1925 and 1929 see Salt (1992, pp. 179-94). For a statistical film style analysis that illustrates the use of camera film technologies from the late 1920s to the late 1950s see Salt (ibid, pp. 219-26).
recreating reality. Comolli maintains that just because the cinema is based on scientific principles does not mean that it is not shaped by ideology:

Not only is deep focus in the early cinematic image the mark of its submission to these codes of representation and to the histories and ideologies which necessarily determine and operate them, but more generally it signals that the ideological apparatus cinema is itself produced by these codes and by these systems of representation, as at once their complement, their perfectionment, [sic] and the surpassing of them. (p. 115)

This signals that Comolli’s (1986) view of the gains offered by late 1930s panchromatic stocks are simultaneously technical, ideological and aware of cinematic genealogy. It is not a gain in the increased speed of film but a gain in faithfulness ‘to natural colours’, a gain in realism. The cinematic image becomes more refined, perfects its ‘rendering’, competes once again with the quality of the photographic image which had long been using the panchromatic emulsion. The reason for this ‘technical progress’ is not merely technical, it is ideological: it is not so much greater sensitivity to light which counts as ‘being more true.’ The hard, contrasty [sic] image of the early cinema no longer satisfied the codes of photographic realism developed and sharpened by the spread of photography. (p. 116)

Comolli’s (1986) argument more broadly is that an ideological mutation occurred through the shift from moving images employing ‘reality codes’ to ‘narrative codes’. This transition was most significantly realised through the introduction of sound film that privileged the voice on screen.

Rick Altman (1984), like Branigan (1985), argues that Comolli (1986) and others conflate notions of technique and technology. In an explicitly semiotic analysis, Altman contends that Comolli (1986) contributes to the destruction of ‘the possibility of understanding technical/technological history in a fully
dialectical manner’ (p. 113). Altman argues that what Comolli (1986) and others ignore in making this distinction ‘invisible’ is the importance of ‘automization of accepted technique[s] by new technology’ (p. 113). For Altman, akin to my discussion of Elsaesser’s (2006) argument regarding the subsuming of previous technologies into successive iterations in the previous chapter, each successive technology of moving images must represent not reality, but the reality ‘established by a previously dominant representational technology’ (p. 121). Altman’s approach means that ‘there is no such thing as representation of the real; there is only representation of representation’ (ibid). Further, this form of representation of reality is not confined to moving images but to all artistic representation and achieves this most simply through quotation. ‘In order to represent properly, each new technology must… succeed in representing not reality itself, but the version of reality established by a previously dominant representational technology’ (ibid). Altman argues that in turn, printing represents or quotes speech; perspective painting represents architecture; set design of sixteenth and seventeenth century theatre quotes perspective painting; nineteenth century photography quotes painting; late nineteenth century moving images quote theatre, and sound film represents the silent film era. He describes these iterative shifts as ‘translations’ and outlines how each new expression of ideology as described by Comolli must embrace that new ideology but also ‘seem to be expressing’ the previous one (p. 121). This logically leads to an arrangement of endlessly sequenced representations within representations:

For anything that we would represent is already constructed as a representation. The structure of representation is thus that of an infinite mise-en-abyme with the new apparatus having to represent the old, itself representing the previous one, and so on. (p. 121)

Cubitt (2004) discussing the ‘enhanced reality’ offered by digital visual effects (VFX) uses this same term in describing one option for filmic representation as being a ‘cosmos of nested virtualities, one inside the next, in a potentially
infinite *mise en abyme* (pp. 258-9). This notion and the potency of Cubitt’s turn of phrase will be discussed in Chapter Four alongside arguments for the extended representation made possible by digital technologies particularly for fantastical photorealism within the genre of science fiction film.

Bazin (2004) in an earlier and more straightforward argument on ‘total cinema’ snubs his Marxist critics in claiming that technical change does not come from economic or historical impetus but through an indefinable will to innovate. It is, he argues, technology that allowed for deep focus cinematography and created ‘a dialectical step forward in the history of film language’ and in representing reality through moving images (p. 35). On this point, Bazin discusses the work of Orson Welles and William Wyler. In a renowned argument, he describes how select works of Welles and Wyler feature very deep focus across several planes within the frame and allow a new form of action—the single shot—with what would have previously been several distinct shots of foreground, mid-ground and background. Bazin argues that the effect of deep focus offers a closer link with reality because it respects the spatial relationships within the frame. A number of different views of the action with altered framing between each shot are replaced in deep focus cinematography by a single unifying view of the action. According to Bazin (2004), with the addition of long takes, the story plays out in real time and most importantly, in real space. The audience can choose to focus on any part of the frame in focus, mimicking the way the real world is perceptually experienced. For Bazin, deep focus is ‘based on a respect for the continuity of dramatic space and, of course, of its duration’ (p. 34).

Problematically for Bazin’s argument, many of the deep focus techniques in the specific films he discusses have since been demonstrated to have been constructed in-camera or in post-production rather than using wide-angle lenses and deep focus to the extent he argues for (Bogdanovich, 1972; Bordwell, 1997 & 2007; Morgan, 2006). In fact, older and more established techniques
of back projection and multiple exposures were often used to create the illusion of the entire frame being in focus (figs. 19 & 20 respectively).

Figure 19 From Welles, O. (1941), *Citizen Kane*, composited frame [Motion Picture; DVD frame grab]
Bordwell (2007) extends this line of criticism further in the case of Welles’ *Citizen Kane* (1941), linking the technique of deep focus to the publicity and marketing of the film. This phenomenon can be viewed as a second more sophisticated wave of trick-film techniques but this time around the audience is not aware of the trick, and is astonished by the effect of the trick rather than the trick itself.45

In a later expanded essay on depth of field, Comolli (1986) closely paraphrases his earlier (1996, p. 113) argument railing against Mitry and Bazin’s ‘succumbing to the attractions of the view which sees the film text and the evolution of film language as determined by technical progress’ (p. 431). According to Comolli, Bazin and Mitry cared only how the technology was used, not what it was used for.

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45 For an alternate reading of Bazin’s analysis reliant on his use of ‘impression’, particularly of coherent space, see Morgan (2006, pp. 456-9).
Charles Harpole (1980) takes issue with the historical accuracy of Comolli, Mitry, Barr, Bazin and Ogle’s arguments regarding the waning of deep focus cinematography between the years 1925-39—prior to its resurgence in the 1940s—and the implications of those arguments for the ideology, technology and aesthetics of the moving image. Although acknowledging that there was no mention of ‘deep space composition’ prior to 1940, he argues that ‘pictorial deep space representationalism, instead, can be seen to evolve in a non-linear way along a broad gradient of styles/usages throughout the history of film’ and supports this with numerous filmic examples exhibiting deep focus (p. 15).

A pattern of innovation and imbrications with societal and cultural fashion emerges regarding the roles that technology and technique play in transforming reality and aesthetics for moving images. The camera and post-production technologies creating deep focus cinematography and images used in conjunction with long takes extend a preoccupation with perceptual realism and add to technological examples offered earlier in the thesis including the introduction of colour, sound, widescreen and 3-D in cinema of the first half of the twentieth century. Many of these technical innovations were subsequently reintroduced in the 1950s to prop up the economically ailing cinema industry by attempting to create new audience demand against the electronic representations of reality that television was offering. Here too however, the thesis thread of perceptual realism dominates, contributing to established methods of discerning and measuring photorealism. The prominence of perceptual realism as a method for making claims for the verisimilitude of moving images obviates claims for the veracity of the moving images based on materiality, essential for indexicality.

**Ontology and Realist Claims on Reality**

Reflecting an archaeological approach to history advocated in the Introduction, revisiting twentieth century writing and readings on the moving image yields
substantial caches of argument that are concerned with the materiality of the image as an essential element in arguing for relationships between moving images and reality. Daniel Morgan (2006) offers a reminder that:

If we need to develop new theories to keep up with a rapidly changing media landscape, it is also important not to forget the ambitions of classical theories. Unlike much contemporary media theory, classical theories are interested in the kind of physical objects images are. They start with the idea that the nature of the physical medium is a necessary part of our thinking about the images it supports. (p. 443)

Formalists, as discussed in Chapter Two, dominated the initial periods of film theory over the first three decades of the twentieth century. There was also a smaller countermovement of theorists advocating realism beyond those associated with the earliest mechanical moving images. This approach that began with spruiking by actuality filmmakers as to the mimetic representation of their moving images provides an alternate line of enquiry in the history of the relationship between reality and moving images. Both the Formalist and Realist movements of this early period were centrally concerned with establishing moving images as art.

Prominent Formalists including Munsterberg, Arnheim, and Balázs, held that it was the differences from reality, and other art forms, that made film an art. Realists argued that it was the ability of film to represent reality with such veracity that made it an art. As noted in Chapter Two, the early leading advocates of Realist cinema are predominantly documentary makers and theorists including Flaherty, Grierson, and notably Vertov; distancing himself from his Formalist contemporaries including Eisenstein and Pudovkin. One of the defining characteristics of the early Realists is the attention given to the social responsibility of film-art. For these Realists, moving images are required to play their part in politics rather than entertainment, and represent the social conscience of the real world as it is experienced. This approach has matured and softened over the past ninety years but many Realists have focused on
social philosophies, relegating moving images to a supporting method of
communication. Two Realists who also embrace the medium of moving images,
and explore their inherent material nature in addition to the social outcomes of
moving images, are André Bazin and Siegfried Kracauer.

Alongside the post WWII Italian-led neorealism that advocated making filmic
narratives of reality rather than making moving images that imitated reality,
Bazin (1960) published The Ontology of the Photographic Image. Diametrically
opposed to the Formalists’ view; particularly Arnheim’s, Bazin argues that it is
the lack of human intervention that is key to defining photography and
(importantly) cinema. It is film’s objectivity that allows it to ‘produce a reality
of nature’ (p. 9).

Bazin’s mimetic approach to the ontology of moving images with indirect
reference to the philosophy of Peirce is discussed in Chapter One. However it
is important to briefly revisit Bazin’s position in this chapter because of its
importance to distinctions between film and reality and to the context of
successive technologies of moving images. Unlike Kracauer, Bazin considers
cinema representations of reality to be ones of space. Moving images represent
the volume of subjects and the spaces they inhabit. For Kracauer cinematic
realism is instead about the creation of content that presents as realistic
through its materiality.

Bazin (1960) describes cinema as extending photography’s status of ‘the object
itself, the object freed from the conditions of time and space that govern it’ (p.
8). Cinema then, for Bazin is ‘objectivity in time… now for the first time, the
image of things is likewise the image of their duration’ (ibid). Bazin’s (2004)
‘myth of total cinema’ broadly regards the technologies of moving images
including colour, sound, improvements in film stocks, optical camera effects,
and widescreen, as progressing cinema eventually to a perfect illusion of reality.
From early visions ‘in which inventors conjure up nothing less than a total
cinema that is to provide that complete illusion of life which is still a long way
away’ to ‘silent and sound film as stages of a technical development that little by little made a reality out of the original “myth”’ (pp. 20; 21):

The guiding myth, then, inspiring the invention of cinema, is the accomplishment of that which dominated in a more or less vague fashion all the techniques of the mechanical reproduction of reality in the nineteenth century, from photography to the phonograph, namely an integral realism, a recreation of the world in its own image, an image unburdened by the freedom of interpretation of the artist or the irreversibility of time. (ibid)

For Bazin though, if cinema were to succeed in replicating reality it would also cease to be cinema. This directly addresses this thesis’ theme of distinguishing between moving images and reality. Bazin’s argument proposes an implicit failure in cinema attaining perfection—becoming indistinguishable from reality. It is destined to remain artificial but for Bazin it is this artifice that makes cinema art.

Bazin (2004) writes of both realism in film and the realism of film particularly when discussing the achievements of cinema in the 1930s and 1940s. His more than 1500 published texts are far more in quantity concerned with specific film content analysis, and only some of this is related to the ontology of film, which is often described in reference to particular moving images as realism and further, a subjective realism arguably associated with psychology (Morgan, 2006; Rosen, 2003). The relationship between these two lines of enquiry is one of language and form, or of genre and style. He advocates the use of specific technological innovations including deep focus cinematography, as discussed above, and long takes to achieve realism. In deconstructing filmic works he writes of technology with the rationale that ‘as good a way as any towards understanding what a film is trying to say to us is to know how it is saying it’ (p. 30). Despite this, Philip Rosen (1987) points out that Bazin does not directly address knowledge of how a sign is formed but that this is implicit in Bazin’s argument for indexical photographs and moving images.
My central argument regarding indexicality is premised on knowledge of how the image is formed—through its mediation by technology—in order to distinguish its indexical status. This is pitched against a dominant view of perceptual realism in order to allocate a specific authenticity. Bazin’s appeals to Peircian indexicality through examples of the fingerprint, death mask and footprint in the sand all refer to events not captured by the camera but events of the past: ‘apprehension in photographic and filmic images is of a production that has previously occurred, for the spatial field and objects depicted were in the camera’s “presence” only at some point prior to the actual reading of the sign’ (Rosen, 1987, p. 13). Leaving aside distinctions between signifiers and signs or between indices and markers of indices, Rosen argues that Bazin’s following of Peirce’s indexicality requires knowledge not of what the object looked like but how it was formed. For moving images this means that the viewer must understand how the image was produced in order to subscribe to its indexicality. This position regarding verisimilitude better describes the relationship between moving images and reality and their discernment than one reliant on apprehension alone.

It is clear that Bazin’s stance is a blend of realism and formalism as he writes of the interventionist construction of moving images. However he aggressively distinguishes between those filmmakers who take a formalist approach; who ‘placed their faith in the “image” and those that put their faith in reality’ (p. 24). He particularly singles out those photographic ‘expressionists’ employing the ‘tricks’ of montage as creating moving images that ‘did not show us the event; [they] alluded to it’ (p. 25).

The filmmaker Éric Rohmer, a colleague of Bazin’s in the 1950s, summarises Bazin’s contribution noting that ‘without a doubt, the whole body of Bazin’s work is based on one central idea, an affirmation of the objectivity of cinema’ (quoted in Cardullo, 2007, p. 15). Bazin’s realist stance does not tackle the notion of mediation however. The issue of what the moving images does to
reality through its creation, even if objective, is notably missing from his writing and from much writing following a Bazinian model.

Siegfried Kracauer wrote consistently from the 1920s until the 1960s but much of his earlier work was only published both in German and English in the 1970s. This means that much of the commentary and criticism of his writing presents as out of sequence. For example, portions of Kracauer’s writing on ephemera and reality assembled in *The Mass Ornament* (1995) predate in writing, but not in publication, Barthes’ related writings in *Mythologies* (1957; 1972). Kracauer was most certainly a realist and one with a social bent. His writing overall is underpinned by concerns with reality and the effects of mass media. Kracauer’s filmic reality is mimetic and in segments, similar to Bazin’s, but for Kracauer (1960) there is also a social mimesis at work in which the moving image not only represents reality but also institutionalised desires and national efforts to control and subjugate. Film does this by virtue of its ability to record and represent ‘material reality’ or ‘physical nature’.

In his influential text, *Theory of Film: The Redemption of Physical Reality*, Kracauer (1997) outlines a system of Platonic realism containing ever increasingly verisimilitudinous reality dependant on what kinds of reality are being recorded and depicted. The Platonic realism that Kracauer subscribes to is problematic in the sense that lived realities must engage directly with time and space. He does not address how moving images’ depictions of a theatrical performance or a painting for example, is less real than ones more closely aligned with nature. Awkwardly, the ontology of moving images and their relationship to reality is mediated for Kracauer by what is being depicted. Reminiscent of the Soviet realists, moving images are combinations of raw reality and constructed technique, a unique blend that rather than creating the appearance of something new, for Kracauer, restate the initial reality.

Kracauer (1997) splits the materiality of moving images cleanly. There are the basic properties of moving images and then, their technical properties (pp. 28-9). Curiously though, the photographic legacy and technical heart of moving
images is described as part of the basic, rather than technical properties. Kracauer argues that the photographic is not distinguished from reality, it is so closely aligned that it is beyond questioning in terms of technique. This leaves the technical to consist of the ‘effects’ of in-camera and post-production techniques that make up the resultant work. These technical properties are then unsurprisingly relegated to a supporting role in realising the reality of ‘nature’.

As a method of linking moving images to reality, Kracauer distinguishes between the basic properties of photography that maintain an indexical link to the world it records, and the non-photographic techniques that take on a supplementary role. This is argued in Kracauer’s view as to which moving images are important and which are trivial. Moving images that in Kracauer’s (1997) realist view of photography demonstrate reality with less reliance on the technical—as he defines it—are more important works and crucially, are more real. These are films that ‘picture real life’, that ‘represent nature’, that ‘concentrate on physical existence… afford insight and enjoyment otherwise unattainable’ (pp. 36-7). For the filmmaker, it is important to not allow formalist tendencies to operate independently of the basic properties of moving images: ‘it must always be kept in mind that even the most creative film maker is much less independent of nature in the raw than the painter or poet; that this creativity manifests itself in letting nature in and penetrating it’ (p. 40).

In Section III, Kracauer (1997) reiterates this stance through a process he calls ‘composition’. This is the second opportunity that a filmmaker has to represent moving images following decisions made during the recording process. Kracauer classifies types of films according to their engagement with composition from experimental film through to ‘film of fact’ and arrives at a reckoning of various filmic types’ proximity to the cinematic ideal. This taxonomy can be regarded as the outcome of charting the relative incursions of reality against the substitution of reality in genres of moving images. This echoes the early Formalist views regarding literary adaptation and the choice of
appropriate material to work with for moving images as outlined in Chapter Two. It *does* matter what is being recorded and composed for Kracauer in making decisions about truthful representation. Strangely though, the classification of documentary film that would be expected to uphold Kracauer’s ideal representation in *Theory of Film* realised through newsreel and educational films, fails to afford much discussion. It seems that Kracauer is too preoccupied railing against filmic avant-gardism to make more than a satisfactory assent of documentary practice:

> All such documentaries as show concern for the visible world live up to the spirit of the medium. They channel their messages through the given natural material instead of using the visuals merely as a [sic] padding. Moreover, relieved from the burden of advancing an intrigue, they are free to explore the continuum of physical existence. The suppression of the story enables the camera to follow, without constraint, a course of its own and record otherwise inaccessible phenomena. (p. 212)

He does though, criticise documentary film practice that is motivated by propaganda or that exploits reality at the service of artistic expression as in Ruttman’s *Berlin: Die Sinfonie der Grosstadt* (1927), a precursor and visually similar film to Vertov’s avant-garde, reflexive, and more widely known *Chelovek s kino-apparatom* (1929) discussed in Chapter Two (p. 207). Kracauer eventually arrives at the ‘found story’ as best embodying his cinematic ideal and despite what has been discussed in term of constructed documentary reality in Chapter Two, Flaherty’s *Nanook of the North* (1922) and the films of Italian-led neorealism are for Kracauer the pinnacles of this ideal.

Underlying Kracauer’s (1997) argument is a foundation that first considers technology and its role in moving images. He argues that we have become disconnected from nature and reality through science, which has abstracted our experience of the world. Despite allowing us more knowledge of the natural world, it has presented this from new perspectives, not humanly scaled. The ‘purpose of cinema’ is to lead us back to a relationship with reality by showing...
it more fully, rather than utilising it to create new realities (p. 298). For Kracauer,

film renders visible what we did not, or perhaps even could not, see before its advent. It effectively assists us in discovering the material world with its psychophysical state, its state of virtual nonexistence, by endeavouring to experience it through the camera… the cinema can be defined as a medium particularly equipped to promote the redemption of physical reality. Its imagery permits us, for the first time, to take away with us the objects and occurrences that comprise the flow of material life. (p. 300)

Son et Lumière in 1950s Spectacle Cinema

Bazin’s and Kracauer’s materialist stance relies on the power of photography and particularly its indexical nature to establish the truth claims of moving images. This position moves beyond arguments made earlier in the twentieth century that predominantly considered the relationship between moving images and reality through its apprehension, assuming the verisimilitudinous nature of moving images as discussed in Chapter Two. In a cyclical motion, however the mid-twentieth century returns to a preoccupation with perception and a striving for ever-increasing photorealism. Television and film technologies are simultaneously vying for attention in this period however and each—despite their claims of realism—function and are constituted of distinctly different matter.

The 1950s witnessed a re-introduction of some of the filmic moving image technologies first introduced in the late 1920s and 30s in a bid to regain audiences and present a screen experience to rival the attraction of the new screens of television that were beginning to dominate cultures of the moving image. These breakthrough film technologies had not been sustained the first time around because audiences were by then predominantly regular filmgoers...
who desired content and familiarity, no longer the awe and amazement of early cinema. Leveraging developments in technology that increased perceptual realism, theatres now offered extensions of traditional cinema including widescreen and 3-D that surpassed the technical accomplishments of earlier iterations. This was in addition to introducing colour, stereo sound, and the drive-in, all working in concert as an attempt to entice audiences to the cinema just as television was taking hold (Gomery, 1996). The McLuhan-like phenomenon of every medium containing another, here of newer technologies utilising the previous medium as an effect—as argued against in Chapter Two—is prominent in cinema of the 1950s and does function in this period as Elsaesser (2006) describes. McLuhan’s notions of figure and ground—medium and context—feature here too, with cinema presenting the technologies of moving images as its subject. Scott Bukatman (1995) notes with regard to the display of early moving images that audiences of this reintroduction of spectacle cinema, ‘indicated a comprehension of the terms of the exhibition. Some pleasure, however clearly derived from responding to these entertainments as if they were real’ (p. 255).

There were numerous competing widescreen cinema formats introduced in the 1950s. Each one paired a camera system and a shooting format with an exhibition context specific to that format. Better known formats include Cinerama (introduced 1952), Cinemascope (introduced 1953), VistaVision (introduced 1954), Superscope and Techniscope–Super 35 (introduced 1954), Todd-AO (introduced 1955), Technirama (introduced 1956), MGM’s Ultra Panavision (introduced 1957), and Super Panavision 70 (introduced 1959).

Cinerama is particularly interesting to this thesis for three reasons. It was the first of the widescreen formats to screen in cinemas; it was overtly concerned with the filmic medium; and it marketed itself almost exclusively on the basis of its proximity to reality.\footnote{The name Cinerama has been noted as an anagram of ‘American’ or alternatively, a contraction of ‘cinema’ and ‘panorama’ (Babish, 2004, unpaginated).} The origins of wide screen cinema go back to late
nineteenth century 70mm experiments including Edison’s Home Kinetoscope and trials by Birt Acres. In 1929 Fox Movietone released the feature length *Fox Movietone Follies of 1929* in 70mm but widescreen technologies for reasons that are unclear, did not draw large audiences at that time (Sackett, 1990).47

Figure 21 From Alberini, F. (1911), unidentified 70mm film, reproduced in Usai, P. C. (1996, p. 9), [Motion Picture frame reproduction, likely an example from the Panoramico Alberini]

Frederick Waller exhibited the results of a film shoot with eleven 16mm cameras on a parabolic screen at the 1939 World’s Fair in New York City. This was the progenitor of Virtual Reality (VR). Waller had specifically attempted to replicate the way that the human eye works and calculated the viewing angles and scale to fill an audience’s peripheral vision. This approach and its underlying principles were followed by many of the creators of other later competing widescreen formats (Belton, 1993). However, this notion that widescreen cinema formats replicate the proportions of a human field of vision and so represent reality with greater verisimilitude than less wide formats is empirically challenged by Ernest Callenbach (1963). He demonstrates with the assistance of Atkinson’s *Visual Field Chart* (1941), that ‘the human field of vision is circular’; widescreen formats ‘occupy a minute fraction of the total visual field’; and that the choice of aspect ratios for screen proportions ‘are aesthetic and not physiological’ (p. 25). This layering of perceptual realism and intuition regarding aspect ratio again reinforces a necessary separation of

47 For a detailed reading of the historical, economic and social implications of widescreen formats particularly with regard to the movie industry’s manipulation of spectatorship and leisure time, see Belton (1993).
perception and materiality when considering indexicality. What may be instinctually considered proximate to reality cannot be trusted to provide evidence of indexicality.

Waller went on to collaborate with Hazard Reeves who provided multichannel sound to Waller’s immersive moving images during the Second World War (WWII) as part of the first virtual screen-based combat training tool for the American military (Crist, 1943). This technology in domestic form became Cinerama, debuting in New York on September 30, 1952 with the feature length film, This is Cinerama.

Lowell Thomas, a Hollywood producer and director, had commissioned this first feature-length Cinerama film in 1950 after seeing the possibilities for Waller’s invention. By the early 1950s, Waller had reduced the filming rig to three cameras, each with a 27mm lens approximating the lens of the human eye, and set 48˚ apart. Each lens captured one third of the image and shared a single focusing mechanism and shutter, simultaneously exposing three separate filmstrips (Sackett, 1990). The three recordings were played back synchronously in the theatre, along with seven channels of sound and a host of mechanical gadgets to spatially unify the three film projections (fig 22). It is debatable as to whether this projection technique, often utilising vibrating combs to blur the intersection of the frames to unify three discrete film frames as one image, is continuous or discrete. Cinerama and other immersive projections are arguably examples of discrete analog moving images as they are formed from discretised parts.

Cinerama and the other filming and screening technologies of 1950s widescreen formats strongly recall the configuration of Gances’ three channel camera rig for Napoléon (1927) discussed in the previous chapter (figs. 23 & 24), but also for projection, the multi-turreted Magic Lanterns of the nineteenth century (figs. 25-7).
Figure 22  Cinerama Releasing Corporation, (September 30, 1952, p. 5), *This is Cinerama: Program Booklet, World Premiere*, [Printed Matter]
Figure 23  Cinerama Releasing Corporation, *Cinerama* camera [Photograph]

Figure 24  Gance, A. (c. 1926), *Napoléon*; *Polyvision* camera recording rig [Photograph]
The marketing approach for *This is Cinerama* (1952) clearly sought to draw audiences away from the domestic screens of television and back into the cinema. Evening gowns, red carpet arrivals and pre-booking of much sought after tickets differentiated 1950s widescreen presentations from both cinema
that had preceded it, and from the encroaching technology and differing social patterns of television. As there were relatively few theatres equipped to be able to screen Cinerama titles, people travelled great distances, and purchased tickets months ahead via post to ensure that they saw the new spectacle. ‘Excursion’ train services were run specifically to take patrons to Cinerama screenings (see figs. 28-30). From its opening at the Broadway Theatre in New York, *This is Cinerama* screened for nine months, and then moved to New York’s Warner Theatre for the remaining portion of its two-year run.
This *is Cinerama* (1952) was undoubtedly about the medium and the new reality that the Cinerama format offered. As Sackett (1996) notes, ‘there was absolutely no story in *This Is Cinerama*‘ (p. 98). The Cinerama format was marketed with the tag line ‘It puts YOU in the picture!’ and positioned itself as
a moving images experience that more closely mimicked reality than anything that had come before it. ‘Cinerama plunges you into a startling new world’ was the text featured on the cover of the Premiere Souvenir book from *This is Cinerama* (Cinerama, 1952) and subsequent screenings claimed ‘YOU become part of the World’s greatest theatrical attraction’ (Thomas & Cooper, circa 1952). Less prominently used was ‘Cinerama, so exciting you’ll grab your leg!’ (Thomas, 1952).

Lowell Thomas (1952), spruiking the first Cinerama release, unapologetically relegates content to a supporting role:

> We talked and planned for days and finally agreed that in our first presentation nothing should be done to take the spotlight away from Cinerama. If, to take an extreme example, in our first picture we had some tremendous attraction, let’s say Charlie Chaplin doing *Hamlet*, the focus of attention would be either on the great clown or on the new approach to Shakespeare. If we had concentrated solely on *Aida*, and all of *Aida*, our work would have been closely associated with what people thought of our *Aida*… We didn’t want to be judged on subject matter. This advent of something as new and important as Cinerama was in itself a major event in the history of entertainment. The logical thing to do was to make Cinerama the hero. And that is what we have tried to do. This, our first, is a demonstration. A portion of our show takes place inside Milan’s La Scala and our cast here includes more than 600 players. A portion of it takes place in the famous Cypress Gardens of Florida where boats and water skis defy the laws of gravity. Cinerama’s stereophonic sound is demonstrated with a thousand Scotch bagpipes and, in another portion of the show, with one of the finest symphony orchestras ever brought together. In introducing our new kind of hero, the Cinerama camera, we have brought to the theater a new kind of emotional experience. (Thomas, 1952, unpaginated)
The opening of *This is Cinerama* (1952) is useful in continuing the previous discussion concerning foregrounding of new technologies as part of the introduction of colour moving images. It commences with a black and white standard 35mm image, much smaller than Cinerama’s vast screen size, within which Thomas narrates an approximately ten-minute documentary detailing the history of art making from cave paintings through to attempts to create mechanised moving images in the late nineteenth century. This is all a preamble, and in visual contrast to the real feature that then envelops the screen and supposedly, the entire visual field of the audience. The screen image expands to three times its initial width covering 146˚ wide and 55˚ high, monochrome becomes colour, and the famed Rockaway’s Playland Atom-Smasher Roller Coaster POV sequence begins, complete with terrifying screams (fig. 31).

Caption on reverse: Artist Karl [in fact his name was Alexander] Leydenfrost depicts the breathtaking roller coaster scene which engulfs the audience in "This Is Cinerama", first production in the new multi-dimensional motion picture medium

Figure 31 Leydenfrost, A. (1952), Promotional Postcard for *This is Cinerama* [Printed Matter]
Notably, this opening scene clearly visually references the fairground ride POV shots from Epstein’s *Coeur Fidele* (*The Faithful Heart*, 1924) but without the added layer of overt cinematic impressionism and also Gance’s *Napoléon* (1927) discussed in Chapter Two: ‘Gance tied the thing [the camera] to anything that moved: horses, boats, even onto the chest of an opera singer. During a snowball fight, in the section dealing with Napoleon’s childhood, the camera itself became the snowball and was thrown around at the actors’ (Blumer, 1970, p. 37).

Nine Cinerama features were released, and the majority of these were non-story based. Story did eventually come to the Cinerama format however, and was heralded as another milestone. Billposters for *How the West Was Won* (1962) declared that this was ‘the first time Cinerama tells a story’ and the premiere tickets reinforced this with ‘The FIRST dramatic story in Cinerama’. Despite the focus on medium, creating a new blend of filmic reality, and eschewing of story by the format generally, the idea of story strongly featured in Cinerama advertising material. Publicity for the Irish premiere of *This is Cinerama* (1952) promoted the film as a transporting experience just as Krauss (1982) and Panofsky (1997) describe stereography of the late nineteenth century and the advertising copy also respects the distinction made by Krauss between the real and the experience of the real: ‘for the first time a motion picture reaches out to bring you into the story. In seconds you are lifted out of your theatre seat, moving breathlessly with the picture, surrounded by adventure, spectacle and thrills. Cinerama is the only entertainment that really puts you in the picture’ (Thomas & Cooper, circa 1954). Similarly, the other two narrative-based Cinerama titles, *Cinerama Holiday* (1955) and *South Seas Adventure* (1958), recall the Foreign Views and Hales Tours of half a century earlier. *South Seas Adventure* invited audiences to escape with the new Cinerama to the tropical isles of your dreams… skim the vast Pacific to remote lands where fire gods shout their thunder
from atop volcanos… walk beneath the tropic sun with Gauguin’s beloved bronze maidens… adventure with Cinerama to the moon drenched exotic South Seas—and come face to face with all the beauty and excitement on the face of the earth! (Cinerama, 1958)

The reality of Cinerama however, was one that was significantly constructed. Cinerama images were envisaged to be visually all encompassing and were located between 3-D and panoramic moving images in terms of their perceptual veracity. Cinematographer John Boyle (1952) writing of the technical construction of Cinerama format images in-camera contends that ‘the film process attains the effects of real life by surrounding the viewer completely with action and sound in an environment’ (p. 497). Cinerama’s three-lens production method precluded close-ups as the camera positioned less than one metre away from its subject yielded a generous mid-shot. It also limited production to a single camera rig rather than the then popular multi-camera coverage of action (Barr, 1963). This pragmatic view meant that the camera subject was always aesthetically placed within the context of a physical environment.

Boyle (1952) and Belton (2004a) also note the odd blocking of actors required to establish meaningful eye-lines in the resultant projection. In production, actors’ marks had to be offset to compensate for the parallax of the three screen images totalling almost thirty metres in curved width. An actor looking from one camera field directly at another actor in a different camera field would not result in their gazes meeting because the three cameras were each pointing in a slightly different direction. So in the shooting process, the blocking of performances was heavily modified in order to produce screened performances that matched audiences’ expectations of reality. Cinematographer Harry Squires, describing the operational aspects of Cinerama rigs, makes a matter-of-fact note regarding receiving impressions of reality when on set and recording moving images: ‘the framing of the scene can be observed [by the crew] by
installing the direct viewers [for each camera], looking through them one at a time and integrating the total view mentally’ (2010, unpaginated).

Other competing widescreen film formats of the 1950s also focused on medium and the immersive properties of moving images in recreating reality. Mike Todd Jnr. who directed the famed rollercoaster sequence in *This is Cinerama* (1952) left Cinerama Inc. with his father just prior to its premiere and together they formed their own company and created a new format; TODD-American Optical (TODD-AO). They intended to replicate the experience of Cinerama but with less complex technical requirements with the aim of having more widespread distribution of film prints in more theatres.

Two of the best know TODD-AO releases using the tag line ‘You’re in the Show with TODD-AO’ were *Around the World in 80 days* (1956) and *Oklahoma!* (1955). One of the challenges of working with a vastly increased image size to offer increased veracity with widescreen formats was the problem of visual authenticity. This was compounded by the extensive use of miniatures in *Around the World in 80 Days*. Lee Zavitz, the special-effects director on that film commented that: ‘our problem… is absolute convincing realism. Any tiny flaw will be magnified when the picture is shown’ (quoted in Stimson Jnr., 1956). Although releasing two titles that were not story based—*The Miracle of TODD-AO* (1956) and *The March of TODD-AO* (1958)—TODD-AO predominantly produced well-known story based films including *Porgy and Bess* (1959), *The Alamo* (1960), *Cleopatra* (1963), and *The Sound of Music* (1965).

As noted by Belton (1996), newspaper advertising for *Oklahoma!,* features the mimetic realism offered by TODD-AO and again, the transportive properties of immersive moving images, claiming ‘something wonderful happens! Suddenly you’re there… in the land that is grand, in the surrey, on the prairie! You live it, you’re a part of it… you’re in Oklahoma!’ (fig. 32).
Similarly, Scott Bukatman (1998) notes that publicity for the Cinerama release of *Search for Paradise* (1957) ‘explained: “plot is replaced by audience envelopment”. In such large-format events, the causal chains of narrative are displaced by a more participatory bodily engagement’ (p. 252). Again perceptual realism trumps materiality despite the evidence of technology facilitating 1950s immersive cinema. The apprehension of photorealistic

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48 For an international perspective on Widescreen Cinema of the twentieth century see Belton, Hall & Neale, (2010). For a thematic overview of particularly a 1950s context, see the ‘Widescreen’ issue of *The Velvet Light Trap: Review of Cinema*, 21 (Summer 1985).
moving images is considered before the how of its construction and presentation. Even for formats that eschew narrative and present moving image spectacle for entertainment and transportive purposes only, verisimilitude continues to be judged on a subjective and psychological basis as Rosen (1987) argues for Bazin’s blends of realism above.

3-D cinema in the 1950s

Stereoscopic moving images represent the other major attempt by the cinema industry to attract filmgoers in the 1950s. They compete directly with widescreen cinema in terms of realism as widescreen’s encompassing of peripheral vision contributes significantly to the illusion of depth possible by moving images. It is also another example of industry driven by economic impetus, excavating previously abandoned technologies of moving images (Zone, 2007 & 2004). The format wars of the 1950s are two-fold; those between different film formats and technologies; and those between film and television. The competition between film formats is particularly pronounced with widescreen and short-lived 3-D initiatives. The drive for market success is evidenced by trade advertisements of the time. Twentieth Century-Fox (1953) describes its Cinemascope screenings of *The Robe* (1953) as ‘the modern miracle you see without the use of glasses’. Warner Brothers Pictures (1953) in a trade advertisement extol the virtues of the company and their technology in announcing the Warner SuperScope format:

> to the members of the motion picture industry—worldwide—who rightfully look to Warner Bros. to make the firmest and surest advancements in modernizing our always improving techniques, this is the announcement of Warner SuperScope. This again confirms a confidence in pathfinding and leadership that began when the art and business of making motion pictures was very young. For those who are concerned with the future aspect of the industry as well as the aspect
ratio of the motion picture screen, we have never made an announcement of more importance.

The multi-page pamphlet closes with the reassurance that ‘all productions in Warner SuperScope will also be photographed by the Warner All-Media Camera in WarnerColor, 3D and 2D to meet any desired aspect ratio, and with WarnerPhonic Sound’ (Warner Brothers Pictures Inc., 1953). Remarkably, in late 2010 a similar company line on (now digital) 3-D was announced. Calling it a new standard for the company, Warner Brother’s President Alan Horn announced on March 18, 2010 at the North American movie theatre industry trade show, ShoWest, that the entire studio’s major movie releases from that date forward, would be distributed in 3D. This includes the five major feature releases for 2010 and nine releases for 2011 (Cinemaexpo, 2010). The majority of titles, including the big budget Clash of the Titans (2010) were not shot in 3-D, but converted as part of postproduction to a predominately negative reception (“Clash of the Titans Reviews”, 2010).

From a wider perspective, film companies of the 1950s were also aware that they were competing with the real-time broadcasting reality offered by television, given that many of the same major companies touting widescreen were also trialing 3-D cinema. There was significant effort made to attract audiences by cropping existing non-widescreen films and attempting to screen them as widescreen presentations albeit at much reduced resolution and clarity, but significantly less cost than dedicated widescreen productions. 1950s 3-D films demonstrate a preoccupation, as there had been for widescreen, on both perceptual realism and the medium of stereoscopy as a technique for presenting reality as actuality, rather than story (fig. 33).
3-D films of the 1950s were short-lived and failed to attract audiences in any significant numbers. Mitchell (2004) attributes this to the low quality of projection introducing widespread eyestrain at most of the non-premiere screening locations, the quality of glasses (as opposed to just having to wear glasses), and the reduced quality of the filmic content offered. The possibilities offered by 3-D technology in representing reality were not achieved at this time.
Despite many different genres of films made or re-purposed for 3-D, in Mitchell’s words: ‘most of them were bad films’ (p. 209).

The majority of 3-D cinema releases occurred in 1953 and early 1954 (Belton, 2004). Demonstrating the intense economic competition, a number of competing commercial 3-D films were released in the same two-week period in New York in February 1953. These films, similar to the late 1930s and early 40s anaglyph screenings of *Audioscopiks* (1936), *The New Audioscopiks* (1938), *New Dimensions* (1940), and *Third Dimensional Murder* (1941) were as much public demonstrations of 3-D technology as they were entertainment.49 *Triorama’s* (1953) opening, emblematic of early anaglyphic 3-D fare, drew little reaction. This film employed Bolex’s stereoscopic technology recording on 16mm film and comprised four short works totalling thirty-five minutes that screened at a much smaller size than competing formats because of its originating format.50 A week later however, *Bwana Devil* (1953) opened and generated far greater success. It was a low-budget production, was feature length and it presented a narrative form far more appealing to audiences. It also marketed itself based on the realism of stereoscopic technology: ‘A Lion in your Lap! A Lover in your Arms!’ but was at its core, an exotic romantic drama (fig. 34). *Bwana Devil* (1953) used yet another 3-D system to mimic reality dubbed *Natural Vision*.

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49 *New Dimensions* (1940) is a remake of *Motor Rhythm* (1939) in Technicolor 3-D, itself a remake of *In Tune with Tomorrow* (1939) originally commissioned for the 1939 World’s Fair.

50 The four short works shot on Bolex 16mm and comprising *Triorama* (1953) in screening order are; *Sunday in Stereo*, *Indian Summer*, *American Life*, and *This is Bolex Stereo*. They are travelogues and advertisements for Bolex’s stereoscopic hardware and film format.
Mitchell (2004) argues:

That *Bwana Devil* was a bad film was acknowledged by both critics and audiences at the time of its release, yet the public flocked to it. And with box office revenues decreasing annually since 1947, anything that brought people into theatres was considered worth pursuing, as soon as possible. As a result, the initial batch of 3-D films were low budget quickies shot in 11-18 days and though some higher budgeted, higher quality 3-D films appeared toward the end of 1953, the process has never really escaped its association with poorly made exploitation films, an association that would also negatively impact the attempts to revive 3-D in the 1970s and 1980s. (p. 209)
Mitchell (2004) does acknowledge that there were quality 3-D films but that they were relatively lesser known.\footnote{Additionally, Zone (2004) argues for a similar boom period of stereoscopic spectacle cinema in the United Kingdom at this time focused on the purpose-built stereoscopic cinema venue Telecinema—commissioned for the 1951 Festival of Britain (pp. 220-2).} One of these lesser-known 3-D films is Alfred Hitchcock’s *Dial M for Murder* (1954). Hall (2004) discussing the film’s rarely screened subtle 3-D cinematography, writes of the distancing effect of using 3-D rather than it offering a closer integration of spectators with the action:

In particular, the placement of objects or furniture in the immediate foreground obtrusively calls attention to the space around and between the actors, and between the actors and the camera. Such obtrusiveness, though not of the vulgar kind so enjoyably and knowingly exploited by *House of Wax* [1953], has the effect of emphasising the space of the action itself, and certain details of the *mise-en-scène* which do, occasionally, protrude from the screen. Ultimately, it introduces an imaginative distance from all the film’s characters in favour of an awareness of the plot, and the whole film, as a mechanism for the production of suspense. (p. 246)

Another notable aspect of *Dial M for Murder* (1954) is that it is an extremely faithful adaptation of the stage play of the same name by Frederick Knott. This rendition of Knott’s story is textually and visually so similar that as Hall (2004) argues, it is easy to see what its ‘director added or changed, and of the specifically cinematic methods used to shape dramatic emphasis and guide the spectator’s attention’ (p. 243). The role of 3-D cinematography then, is delineated from an alternate theatrical telling of the story, and allows comparison between two different forms of performance and narrative—of representation.

As a predecessor to the physical constraints exhibited in the principle photography of Sidney Lumet’s *12 Angry Men* (1957), David Fincher’s *Panic*
Room (2002), and Richard Schenkeman’s The Man from Earth (2007), all but a few of the scenes in Dial M for Murder (1954) are photographed in a single set constructed for the production. The film is also linked to Hitchcock’s other filmic adaptations; Rope (1948); Rear Window (1954); and in part Lifeboat (1944), as experiments exploring unified space. This use of a single set of Dial M for Murder (1954) as physical limitation, combined with the film’s 3-D cinematography, provides for literally new views of Knott’s work.

Although a filmic telling of this story could far more easily than a staged play move beyond the physical confines of the apartment, Hitchcock notes, in terms of the reality offered by moving images, that ‘a confined space can be as cinematic as an expansive one’ (quoted in Hall, 2004, pp. 243-4). This is a view also shared by Barr (1963) writing about the aesthetic impact of Cinemascope and widescreen’s ability to suggest ‘inner reality… the internal movement: the essence of things’ (pp. 15-6). Barr writes of ‘landscape films,’ widely agreed to be appropriate for Cinemascope, as being contrasted with ‘more confined drama’, but goes on to argue that the ‘dichotomy often expressed between interior and exterior drama is a false one’ (p. 15). For Barr, part of the strength of recreating reality in widescreen cinema is to be able, through image aspect ratio, to make for a more ‘open [and] more complex image’ (ibid). This is to allow the viewer to interpret images visually and respond without as much direction from the filmmaker. Without any single prescribed reading, and echoing Bazin’s (2004) argument regarding Welles’ and Wylers’ deep focus productions of the late 1930s and early 40s above, the image can be ‘more subtle and more authentic’ (pp. 20; 18).

Reminiscent of the visual compositing employed to achieve deep focus in Welles’ Citizen Kane (1941) and conforming to the previously discussed foregrounding of new aspects of iterative image technologies, the obviously flattened rear-projected street scenes in Dial M for Murder (1954) serve to highlight the depth of the set’s interior. To achieve an audience awareness of the claustrophobic space of the apartment, several of the 3-D camera positions
achieve the impossible. It can be seen through examining sequences of shots where objects are prominently placed in the foreground to achieve this distancing technique, that the camera Point of View (POV) is at times from inside a wall, from below floor level, or above the ceiling line. This heightens the desired psychological effect but tellingly, does not disrupt the spatial harmony of the diegetic space. The depth reality that is offered by 3-D cinematography, although at odds with the known spatiality of the film’s apartment, does not conflict, but instead enhances the reality of the space and the audience’s psychological reaction to the action, including for the most part, their detachment from identification with the film’s characters. Perceptual realism representing apprehension again is the primary measure of authenticity.

The kinds of special effects described as essential to widescreen and stereoscopic cinema of the 1950s ‘reintegrate the virtual space of the spectacle with the physical space of the theater’ (Bukatman, 1995, p. 265). For Bukatman and other theorists including Cubitt (2004), Barbara Maria Stafford (1991), Jonathan Crary (1990) and Susan Buck-Morss (1994), cinema is an effect. Bukatman argues after Crary (1999 & 1990) that

representation begins to have less to do with the world “out there” than with the psychological conditions of vision, conditions that can now be simulated. Thus the experience of a three-dimensional image is no longer any guarantor of “reality”, but is more a physiological sleight-of-hand. (p. 258)

This notion—foreshadowed in Chapter One—that the reality contract is moving away from a relationship between image and reality and towards a link between image and spectator will be taken up in detail in Chapter Four with particular considerations of digital images but it is already apparent that the simulation often associated with digital moving images has a strong lineage in earlier analog spectacle cinema, both mechanical and electronic. The iconicity, rather than indexicality of electronic moving images is the impetus of this shift in that it offers an indirect representation of reality. The specific technological
mediation that determines iconicity or indexicality for analog electronic images transparently underpins the apprehension of these moving images. My argument made in Chapter One that a shift to an internal recognition is sufficient for perceptual realism and it in turn, is sufficient to ascribe veracity on one hand occludes the relationship between moving images and reality but on the other, draws attention to the mode of address that these electronic images embody.

The End (for now) of Spectacle Cinema

The close of the 1950s is a time when a significant break between recording and screening film formats occurs. This represents a parallel development to the production and consumption configuration of television discussed above. During the late 1950s Panavision, Inc., Eastman Kodak and Technicolor collaborated on a film system that allowed production with standard 35mm film photography and then the resultant camera negative to be enlarged to create large panoramic 65 or 70mm screening prints of acceptable quality. The materiality of production at this time becomes demonstrably distinct from the materiality of display. There is a similarity here to a material disconnection between the production and display of digital moving images and also the different media used by television for production and display. For manipulated digital images there is often a shift in mode between the virtual 3D space used to produce digital Visual Effects (VFX) and the 2D space that they are screened in. This material divide is more clearly demonstrated by television for which material may originate on film or analog video or digital video and be displayed as an analog electronic signal or as a digital signal.

This blowup process from 35mm to 70mm film prints in the late 1950s can be closely aligned to developments in the 1980s when numerous Hollywood productions began shooting on Super 35 format. This is a film format that uses conventional 35mm film stock but records a larger image area by also
recording on the spatial area of the frame usually reserved for the optical analog sound track. This is a reverse process to the addition of sound data to the filmstrip in the 1920s described above. The result is an increase in image area of between 30% and 50% but is almost always justified in terms of production costs rather than image quality (Carlin, 2010). Carlin argues that the introduction of Super 35 in the 1980s ‘broke the direct link between acquisition and distribution formats. *For the first time*, cameras shot one format, and projectors showed another’ (p. 30, my emphasis).

Clearly, given discussion above of the large format precedent set in the late 1950s, Carlin’s (2010) claim is erroneous but it does highlight the importance of acknowledging the distinct materiality of production and display including any disparity, even within the same medium. The transformation of the moving image, particularly its reprinting or dubbing (and in doing so, creating new instances of filmic works), is not reserved for electronic images—whether digital or analog. It occurs across all forms of the moving image. Tracing the production of, and ascribing an indexical status for specific moving image works is not a straightforward endeavour.

The Super 35 venture was an early acknowledgement of commercial acceptance in favor of the large screen IMAX format and the drive-in as a venue. It also inadvertently ended the era of large format film production like TODD–AO and Cinerama. Robert Gottschalk, then president of Panavision Inc. interviewed regarding the processes, refers to the constant striving for the illusion of reality and minimising of the effect of film mediating between reality and the screen work. He anticipates Bukatman’s comments on reintegration above, spruiking the new blow up processes as ‘producing a “velvet” appearance, an almost three-dimensional effect which, when the projection is especially good, makes the screen seem almost to disappear completely’ (quoted in Loring, 1964, p. 226).

It was also at this time that it became apparent that some film technologies responsible for creating the reality of moving images, many of them
reconfigurations of earlier innovations, had become mainstream and would continue to flourish, and others were determined to be fads and consigned to history based on economic imperatives. Widescreen aspect ratios effectively trialled in the 1950s became de facto standards for recording and screening motion picture film through the next fifty years. Stereoscopic films, and other ventures including Smellovision and Aromarama were largely left behind as casualties of industry fickleness and for want of significant audiences.

Stereoscopic moving images make three reappearances in the 1970s, 80s and through digital technologies in the late 2000s and these most recent developments will be discussed in the next chapter. Barr (1963) argues that it is ‘possible to see the history of the cinema as a nicely arranged series of advances…One has to ascend by stages…The cinema evolves by a form of Natural Selection: technicians and financiers provide the mutations, and their survival depends upon whether they can be usefully assimilated at the time’ (pp. 8-9). Similarly, in a comment that recalls Barthes’ reality effect in the explicit use of production techniques to create representations of reality, John Lasseter, a creative head and executive at animation studio Pixar, believes that ‘every technology that comes into film is first a gimmick’ (quoted in Bunbury, 2010). Armes (1974) contends that for the cinema,

new technical ideas are not developed because the artists engaged in filmmaking demand them. For such people telling new kinds of stories in such a way as to use the full possibilities is generally a demanding enough occupation. New techniques are pressed upon the cinema by outside forces… The sound film—after the first excitement—was no more popular that the silent film. The reasons why some changes, like sound and wide screen, are permanent also have nothing to do with their artistic impact. The main reason is an economic one. (pp. 87-8)

The overarching argument that the constantly increasing veracity achieved by moving images through mid-twentieth century technologies makes possible new kinds of images that in turn are closer to reality, sits in opposition to the
arguments of Gunning (1997; 1989; 1986) and Burch (1990 & 1986). Burch, writing of early and silent cinema, contends that early moving images displayed a ‘primitive style of representation’ but that this did not restrict them to being primitive in their formalist properties including the absence of close-ups and intimate characterisation. Burch (1990) badges this the ‘classical persona’, arguing that this occurred not only because the technology available at the time restricted breadth in depictions of reality (pp. 186; 197). Similarly Gunning (1997 & 1986) as discussed in Chapter Two, writes of the importance of exhibition and spectacle for early film as the primary motivator of image choice rather than an inability to create story. This is further supported by Gunning’s (1989) focused argument regarding early trick-films having employed post-production editing rather than the then more widely accepted view that they used solely techniques of in-camera manipulation also discussed in Chapter Two. This signals preference rather than an inability to create sequenced narrative cuts within scenes. These early spectacle and trick-films can be regarded as the first examples of an alternative to the dominant story film that was to emerge, and a form of anti-realism that continued throughout a slow reveal in the history of moving images.

The next section chronicles theoretical discourse that followed the industrial upheaval of the 1950s. What had previously been on the fringes of other accepted fields of study including philosophy and sociology in the 1960s became ‘film theory’ proper. This is also a period that is dominated by an explicit focus on moving images as signs.

**Cinema, Signs and Meaning**

The 1960s ushered in a new age for the critical study of moving images. There are several broad concerns of film theory during this period. Auterism, which treats moving images as an outcome of the artistic expression of the film maker; phenomenology, in which the experience of watching and listening to moving
images is interrogated; and the re-emergence of differences between cinema and other art forms or cinema’s specificity, prominent in the writings of Jean Mitry and Christian Metz.

The largest shift for film theory during this time was towards structuralism. This approach, displacing traditional auterism, draws initially on Saussure’s structural linguistics and to a lesser extent on Peirce’s writings on semiotics, and is exemplified by the writings of Christian Metz, Jean-Louis Baudry, and Stephen Heath. Broadly, this shift can be described as part of a greater change in visual culture and a preoccupation with linguistics that encroached on many other areas of culture. Significantly, it also realigned discourse away from the predominantly ontological concerns of a previous generation of film theorists like Bazin and Kracauer to new concerns with methodology. At this time, anything that could be considered a system of signs was ripe for semiotic interpretation and this kind of analysis was applied to a wide array of cultural phenomena.

Pre-empting this shift, Bazin (1960) closes *The Ontology of the Photographic Image* with the trailing remark ‘on the other hand, of course, cinema is also a language’ (p. 9). The most basic intent of structuralist investigations for moving images of this time is to define film as a language. Structuralism for moving images regarded film as a system of signs organised through cultural codings; as it did many other cultural experiences. At this time, being more Saussurean than Peircian, it was often concerned more with the relationship between signs, than between sign and referent.

There was theory at this time however, that was concerned with the relationships between moving images and reality. Some of the underlying questions about film as language were concerned with the specificity of film, and other semiotic questions grappled with the nature and depiction of filmic reality. Theorists tackling these questions include Christian Metz, Pier Paolo Pasolini, Stephen Heath, and Gianfranco Bettetini.
Metz is a substantial figure in film theory of this time. His central inquiry in this area followed the systematic and comprehensive approach of Jean Mitry who attempted to exhaustively deal with all aspects of film. Metz’s enquiry worked to establish the rules by which cinema paralleled and was distinct from natural languages and whether cinema was a language system or a language. He concluded that cinema was a language, not a language system, in that cinema does not have a fixed syntax or lexicon but is nonetheless a literary language. It is not possible to successfully argue that a cinematic sequence is ungrammatical, only that it may use different syntax or vocabulary from another film.

Alongside this line of enquiry and motivated by it, Metz was concerned with what was specific to cinema, linking to the earlier concerns of pioneering theorists discussed in Chapter Two including firstly Dulluc and Epstein and their search for ‘quintessence’ of film and then Arnheim and Balázs leading to discussion of the theories of Bazin and Kracauer above. In articulating the specifics of film language through its methods of expression, Metz (1982) also nominates the specific attributes of moving images as ‘cinematic codes’ and subcodes that separate moving images by degrees from other linguistic forms and from reality:

Film… produces an impression of reality much more vivid than does the novel or the theatre, since the inherent effect of the cinematic signifier, with its particularly “faithful” photographic images, with the real presence of movement and sound etc., is to bend the fiction-phenomenon, ancient though it is, towards historically more recent and socially specific forms. (p. 119)

He acknowledges the important role that technology holds in distinguishing film from other languages. The technology of the moving image and other art forms allows for rapid and immediate changes to language not possible given the inertia of natural language. Technology is also, though complicit in the ‘lack’ that the moving image presents as reality. Metz (1982) describes ‘the whole arrangement… [as] (the absence of the object, replaced by its reflection),
Recalling Metz’s (1982) comments on ‘the other scene’ to describe the distinction between theatre and film noted in the Introduction, he defines what is recorded as a ‘signifier’ that despite offering more ‘extensive’ perceptual information, is in fact presenting ‘false’ perceptions, concluding that ‘every film is a fiction film’ (pp. 43; 45):

What is characteristic of the cinema is not the imaginary that it may happen to represent, but the imaginary that it is from the start, the imaginary that constitutes it as a signifier… The (possible) reduplication inaugurating the intention of fiction is preceded in the cinema by a first reduplication, always-already achieved, which inaugurates the signifier. The imaginary, by definition, combines within it a certain presence and a certain absence. In the cinema it is not just the fictional signified, if there is one, that is thus made present in the mode of absence, it is from the outset the signifier. (p. 44)

Pasolini reached an opposing conclusion to Metz regarding the language of cinema. Although respected as a film theorist in Italy, Pasolini was better known as a film director outside of Italy (Barnett, 2005). His approach to film theory was overtly semiotic and he claimed that the ‘real structure of all work is in its linguistic structure’ (Muscio & Zemignan, 1991; Barnett, 2005, p. xxxi). Pasolini outlined—with a noted aversion to Metz’s semiotic approach without a language system—a formal audiovisual grammatical approach to the semiotics of the moving image analogous to oral and written language. He described ‘cinemes’ that correspond to the objects depicted in any given shot and specifically filmic ‘kinemes’ analogous to the phonemes of language. Pasolini described the smallest ‘unit’ of film language as ‘the various real objects that compose a shot’ rather than the ‘image’ (ibid, p. 200).
Selected writings of Pasolini’s deal with the relationship of reality to the moving image but from an inverted perspective when compared with much other film theory that anchors the source of a mimetic filmic relationship in reality and considers the moving image as a representation of reality and so therefore derivative. For Pasolini who equated reality with action, and action as ‘the first language of men’, ‘reality is, in the final analysis, nothing more than cinema in nature’ (ibid, pp. 204; 198). He described his linguistic approach to literature, and film as ‘one of the cornerstones of my way of seeing reality’ (quoted in Barnett, 2005, p. xxxi):

In reality, we make cinema by living, that is, by existing practically, that is, by acting. All of life in the entirety of its actions is a natural, living film; in this sense, it is the linguistic equivalent of oral language in its natural and biological aspect. By living, therefore, we represent ourselves, and we observe the representation of others. The reality of the human world is nothing more than this double representation in which we are both actors and spectators. (Barnett, 2005, p. 204)

Pasolini argued that moving images are nothing more than a written ‘manifestation’ through ‘mechanical reproduction’ of natural language or the action of reality sharing the same codes and the same structure—a translation. Additionally, this supports both his analogy and distinction between oral and written language (Barnett, 2005, p. 205).  

This structural linguistic approach leads to responses characterised as filmic post-structuralism in the 1970s and add feminist and anti-colonialist approaches to the psychoanalytic and semiotic analysis of moving images. These responses, often adding a hyphenated term to semiotics when considering reality as for structuralist approaches, do so usually from the viewpoints of subjective spectatorial perceptions and desires rather than

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52 For a more detailed account of Pasolini’s semiology and its context within Italian film semiotics see Muscio & Zemignan (1991).
considering the mimetic properties of moving images and their relationship with reality. When considering reality, these analyses are fixed on the perceptual reality through spectatorial engagement and a strictly constructed self. The self is only accessible through signification, not through ‘empirical reality’ (Miller, 2000, p. 406). These arguments interrogate impressions of reality through moving images and link them to dream states, to unconscious desires, and to pleasures including narcissism, voyeurism, fetishism, and identification. Importantly, and foreshadowing the Iconicity of digital images discussed in Chapter Four, the notion of mimesis in apparatus theory of this time is largely focused on the relationship between spectator and image, not between images and reality.

As noted in Chapter Two, Baudry (1975) draws on the allegory of Plato’s cave to describe moving images and the physical context that spectators watch them in, as a way to argue for spectators’ regression to a primitive narcissistic state, unable to distinguish between themselves and the world. This take on identification follows Lacan’s notion of the mirror stage of human development and its application to the cinema, resulting in an experience of spectatorial delusion. Metz’s (1982) view of this part of apparatus theory indirectly references the ‘fascination with the medium’ approach taken by Gunning and Burch, as Metz argues that this less real signifier increases the possibilities for identification. In an echo of a Lacanian desiring the desire of the other, the spectator importantly identifies first with his own act of looking and then with the depicted image in order to create a subjective reality (Metz, 1982, pp. 45-52). Metz’s (1982) psychoanalytic views regarding the context—‘immobile; he is plunged into a relative darkness, and above all, he is not unaware of the spectacle-like nature of the film object’—and pleasure of looking represented here as Freud’s scopophilia, combined with spectatorial distance and invisibility, can also be aligned with the previously noted Krauss and Panofsky writings on the disembodied experience of viewing screen-images (p. 116).
It can be seen that the 1970s presents a return to engaging with cinema’s specificity. Whereas theorists including Eisenstein, Arnheim and Balazs in the late 1920s and early 1930s were focussed on cinema’s differences from theatre, the 1970s as detailed above in discussion of the writings of Comolli, Baudry and Metz, were concerned in part with what was distinctive about the cinematic apparatus, now through the filters of semiotics, psychoanalysis and ideology. Emblematically, Stephen Heath (1981) writing of a semiotic approach to the cinematic apparatus argues that ‘specificity is defined not by technology or technico-sensoriality [sic] but in terms of codes… some of these codes being particular to cinema’ (p. 223). He does however, establish a hierarchy that privileges the ontology of the moving image—even at the service of psychoanalysis—through largely ‘unbroached by this current work… technological codes’:

The subsequent attention to the cinematic apparatus, rather than to the cinematic language, might be taken as refinding the instance of technology, its insistence in a new form. In one sense, that attention does, as was said, come back to the first moments of cinema ['in the first moments of the history of cinema, it is the technology which provides the immediate interest: what is promoted and sold is the experience of the machine, the apparatus’ (p. 221)], to the basis of the apparatus itself; it stands up-stream to film, spectator, code, implicates large anthropological figures (the recourse to Plato’s myth of the cave is indicative), engages something of the primal scene of cinema (a history that is always there before the meaning of its films and as their ultimate return): in short, raises the psychoanalytic evidence of ‘the apparatus’. (p. 224)

Apparatus theory of this time was speculative. It did not lead to empirical research regarding the technologies of the moving image despite the overarching concerns of these enquiries. Miller (2000) describes apparatus theory as an enquiry into ‘the impact of the technical and physical specificity of
watching films on the processing methods used by their watchers’ (p. 403). This was primarily however, an investigation of the cinema as a ‘social machine’ rather than a technological one because of the then guiding frames of psychoanalysis and Althusser’s Marxist ideology. Reality for these theorists complies with Althusser’s notion of ideology in which the privileged viewer is presented with what looks like reality but is not; presents objects and people as being there when they are not; and the cinema reflecting cultural messages as truth, acknowledging the Lacanian mirror. Apparatus theory of this time does however, depart from considerations of solely representation, adding the materiality of cinema alongside the ‘ideological and/or psychoanalytical ramifications of cinema’s basic apparatus’ in an enquiry that is additionally concerned with reality and the moving image (Altman, 1984, p. 115).

Recalling my earlier comments regarding Barthes’ reality effect, the 1970s and 80s also offered a reappraisal of the classical film text and also the classic realist text, drawing heavily on Barthes’ reality effect often employed as an ‘artistic orchestration of apparently inessential details as guarantors of authenticity’ (Stam, 2000, p. 143). Apparatus theory’s project that articulates the cinema’s presentation of illusionistic representation as reality resonates here, as the classic realist hallmarks of continuity editing and linear narratives are crucial to the impact of the moving image as real. A number of film theorists at this time including Colin MacCabe (1985), Stephen Heath (1981), and David Bordwell (1985) were particularly interested in the ways a film text makes invisible the formalist aspects of the work in creating a (notably perceptual) illusion of reality.

MacCabe (1976 & 1985) linked the nineteenth century novel to film arguing that moving images present a rational system to present reality drawing on the methods and power of the novel. The spectator reads the text of the film and responds as for the novel, effortlessly slipping in and out of a diegetic framework. This is made possible by moving images that present from a realist perspective ‘not just a rendering of reality but a rendering of a reality made
more real by the use of aesthetic device [sic] … this “more” is not quantitative but qualitative: it measures the extent to which the essence of the object represented is grasped’ (MacCabe, 1976, p. 9). This position is indebted to Bazin’s argument regarding realism and reality in Italian neorealist film texts as representing ‘pure cinema’ and also in relation to the ‘technique of the American novel’ (Bazin, 2004a, p. 38). In an prominent argument, Bazin writes that ‘one merit of the Italian film will be that it has demonstrated that every realism in art was first profoundly aesthetic… *Ladri di Biciclette* [Bicycle Thieves, 1948] is one of the first examples of pure cinema’ (ibid, p. 25).

In a radical departure from the dominance of structuralism at this time, the philosopher Stanley Cavell (1979) in his 1971 text *The World Viewed: Reflections on the Ontology of Film* formally rejects the notion that moving images are signs or even strictly representations in the sense that ‘theory’ articulates. Cavell philosophically maintains that film’s photographic basis means that the people and objects depicted in film are the ‘subjects’ of the film and contribute to the film’s essence. Given their absence from the film there is also then, an absence of reality. This is not a simple realist position however. Cavell is promoting the role of philosophy in film theory and after Merleau-Ponty and Mitry, instigating a return to film-philosophy away from cultural theory. In Cavell’s argument, moving images ‘displace’ reality. Summoning a similar inversion to that offered by Pasolini when articulating the relationship between images and reality, Cavell (1979) writes of the reality of photographs and films as being

*of* the world… the camera being finite crops a portion from an indefinitely larger field; continuous portions of that field could be included in the photograph in fact taken… When a photograph is cropped, the rest of the world is cropped *out*. The implied presence of the rest of the world, and its explicit rejection, are as essential in the experience of a photograph as what it explicitly presents. (p. 24)
Cavell (1979) attempts as part of this argument, to distinguish between moving images and other forms of depiction as others including Bazin (2004) and Kracauer (1997) have, but this is at the service of arguing for the automation of film rather than arguing for its reproduction of reality. Cavell argues that it is a ‘mechanical defeat of our presence to that reality’ (p. 25). Acknowledging a sense of spectatorial invisibility—Freud’s scopophilia—and the anonymity that comes with it, is paramount to understanding Cavell’s argument regarding moving images and reality: ‘how do movies reproduce the world magically? Not by literally presenting us with the world, but by permitting us to view it unseen… The photographic nature of film is key to allowing our spectatorial ‘displacement [to] appear as our natural condition’ (pp. 40; 41).

As with his contemporaries, Cavell (1979) is additionally concerned with the social machine of cinema. He describes moving images as seeming ‘more real than reality’ and that ‘movies convince us of the world’s reality in the only way we have to be convinced’ (p. 102). He applies this argument to moving images specifically when discussing the screen and here links to some of the concerns of apparatus theorists in acknowledging the role of technology in mediating reality:

The fact that in a moving picture successive film frames are fit flush into the fixed screen frame results in a phenomenological frame that is indefinitely extendible and contractible, limited in the smallness of the object it can grasp only by the state of its technology, and in largeness only by the span of the world. (p. 25)

This argument is furthered by the philosopher Kendall Walton (1984) regarding photography ‘extend[ing] our visual powers’ as part of a ‘contribution to the enterprise of seeing’ (p. 251). Walton argues that photographs are not ‘duplicates or doubles or representations of objects, or substitutes or surrogates for them’ (p. 252). His claim for the ‘condition of
photography’ is that we see, quite literally, ‘our dead relatives themselves when we look at photographs of them’ (ibid).

Heath (1981), despite writing in a similar register to Metz, uses similar vocabulary to Cavell (1979) as quoted immediately above in advancing an argument that resonates with Barthes’ reality effect and builds on MacCabe’s (1985) Althusser-inspired hierarchy of discourse. Heath valorises the form of moving images in creation of cinematic narrative thus:

Frames hit the screen in succession, figures pass across screen through the frames, the camera tracks, pans, reframes, shots replace and—according to the rules—continue one another. Film is the production not just of a negation but equally, simultaneously, of a negativity, the excessive foundation of the process itself. (p. 62)

In discussing camera movement and spectatorial identification, Heath (1981) argues that ‘classic cinema does not efface the signs of production, it contains them… it is that process that is the action of the film for the spectator—what counts is as much the representation as the represented, is as much the production as the product’ (p. 51). He considers that the ‘trick’ realised by stylistic approaches to camera placement and movement in classic realist film heightens the notion of film form and ‘process’ and that rather than being a celebration of ‘transparency’ or ‘invisibility,’ departs from a traditional perspective system and—in an echo of the discussion of Krauss’ (1982) and Panofsky’s (1997) arguments regarding still-image stereoscopy in Chapter Two and the discussion of 1950s Cinerama above—ambulates the spectator. ‘What moves in film, finally, is the spectator, immobile in front of the screen… the spectator is moved, and related as subject in the processes and images of that movement’ (pp. 53; 62). Writing on the realism of cinema as narrative space, Heath argues for the role of cinematic space in this same spectatorial movement (p. 62). This claim also acknowledges a debt to Bazin through Heath’s earlier comment on cinematic realism as ‘a realism in which space is all important’ (p. 43).
Heath (1981) tackles the relationship of film to reality and the technologies of moving images explicitly. Subscribing to the notion of pure memory after Metz’s ‘imaginary signifier’, Heath argues that filmic reality is recorded but that this recording has not previously been anything else. He also focuses on the material properties of film in creating moving images made of a series of stops in time, the times stops of the discrete frames, film depends on that constant stopping for its possibility of reconstituting a moving reality—a reality which is thus, in the very moment of appearance on screen, as the frames succeed one another, perpetually flickered by the fading of its present presence, filled with the artifice of its continuity and coherence. Every film a fiction film… as the impression of ‘reality itself’, the scene intact, unviolated; and in the distance on which it nevertheless plays for its mode of solicitation as spectacle, the mode of presence in absence, a real time there on film but not the same real time which is shown on film gone for ever. (p. 114)

Heath adds the ‘interior machine’ of psychology to the cinema machine considered by Gunning, Tsivian, Bottomore and others in Chapter Two (Heath, 1981, p. 222). For those writers it is important to remember that early moving images were presented as cinematic form that contained film as an essential element rather than a presentation of the filmic work itself. The moving image experience for early theorists and practitioners as discussed previously was one of the cinematic apparatus and Heath’s (1981) updating of this model to explicitly include the spectator’s psychological experience reflects a broader concern of theorists at this time. These include MacCabe (1985), Jean-Louis Comolli (1986) and Kaja Silverman (1983), who filtered the technology and essentialism of moving images through a psychoanalytic lens. Heath within his primary concern for semiotic dialogue, importantly returns to the role of technology and the cinematic form drawing it inside his notions of representation focusing—after Metz—on the machine’s why rather than its
how. Heath attempts, as noted in the Introduction, to balance the technological with the ideological when considering the cinematic apparatus:

Attention to the cinematic apparatus, rather than to the cinematic language, might be taken as refinding the instance of technology, its insistence in a new form. In one sense, that attention does, as was said, come back to the first moments of cinema, to the basis of the apparatus itself; it stands up-stream to film, spectator, code…engages something of a primal scene of cinema… in short, raises the psychoanalytic evidence of ‘the apparatus.’ (1981, p. 224)

From Film to Video—Mechanical to Electronic

Much of the theoretical writing and practice of the twentieth century up until the 1970s is modelled on mechanical moving images as discussed above. The widespread introduction of television in the 1950s that offered new electronic images and repurposed mechanical images through allusory presentation galvanised a regard for filmic moving images. What electronic images also did at this time however, was introduce a sense of the synthetic in the apprehension of analog electronic moving images. This was predominantly though visual aesthetics and a perceptibly impoverished image quality. The quality of ‘live’ representations of reality through television valorised and erroneously reaffirmed the indexicality of the image. This was due to the continuing dominance of perceptual realism as touchstone for measuring indexicality, now coupled to a scant knowledge of the materiality of process. Audiences understood that live broadcast was a photorealistic representation of another place—tele- and vision. Most importantly this phenomenon was considered an extension of filmic reality. What has been shown in Chapter One is that the electronic moving image technology that is embodied by television is fundamentally a process of discretisation, not the continuous image that is often regarded as representing all analog images. The continuity
of photorealism and moving images in apprehension has proven to be a stronger trope than consideration of the distinct technologies that create these visions. Hence, an attribution of indexicality to electronic- alongside mechanical- moving images.

Video as a literal discretisation of the technology of television introduces then either another unremarkable storage medium for indexical moving images, or as taken up by this thesis, a further opportunity to re-examine the claims of continuity for analog electronic images.

Armes, writing in 1974, argues that cinema up until the 1970s belongs to the nineteenth century. The whole technical apparatus of the cinema—celluloid, special lighting, enormous technical crews involved in the shooting—is quite outdated in an electronic age. What television transmission failed to do, namely break down the idea that films are essentially something to be viewed in public cinemas, may well be accomplished by video tape when this becomes fully available. The time is not too far distant when people will be able to play video tapes of films in their own homes as easily as they now play gramophone or sound tapes. (1974, p. 89)

Video can be divided into three broad categories in application. The use of video in broadcast television; its use in amateur contexts including the recording and independent playback of video images recorded by the user from both cameras and from broadcasts; and the use of video as a medium in opposition to the medium of film. A further essential distinction must also be made between analog and digital video, both located within the broader category of electronic moving images.

The differing natures of broadcast television and video as foreshadowed in the opening of this chapter are not dissimilar to distinctions between cinema and television. Video can be considered to be closely aligned to film in that each video recording is a discrete work in the way that each film or audio recording
or photograph is a discrete work. Television, as argued above, can be viewed as a collection of timeslots akin to cinema being regarded as a collection of films but with an important difference in the ratio of works to screening, evidencing the at times, repurposed nature of television. Similar to difficulties in divining the indexical status of particular moving images through apprehension, there is no way when viewing video footage on television to perceptually discern whether the video represents a live broadcast or pre-recorded material without knowledge of the recording status of that particular frequency and timeslot. The timeslot in television becomes the equivalent of the single work for video and film.

The introduction of video as consumer device began in 1967 with Sony’s Porta Pak, which was followed soon after by offerings from Panasonic and JVC. Industrially however, the BBC for example, had been using an Ampex Video recorder since either 1956 or 1958 (Magoun, 2009, pp. xviii, 132; or Armes, 1988, p. 68, 83; Kittler, 2010, p. 221). The Porta Pak was a two-piece hardware bundle consisting of a tethered portable video camera supporting half-inch tape rather than the two-inch tape used professionally and with a corresponding loss of image quality given the smaller surface area available for recording, and a corresponding Video Tape Recorder (VTR). This technology succeeded domestic film formats including 16mm, 8mm (or Regular-8) and Super 8, offering the paradigm shift of being able to immediately review moving images recorded by the device and re-record on the same physical section of tape rather than an alternate take as required by film production that optically preserves any prior recording. This shift applies to all three categories of video. In commercial television broadcast, ‘instant’ video replays best represent this shift, in an amateur context it is the fast-forward pause and rewind capabilities that are superior to the manipulation of film in the same domain, and when considering video as a medium it is the ability to seamlessly mix live and pre-recorded moving images.
Video’s instant-replay technology is also an incursion into the generational and iterative timelines established between photography, film and video. Previously, photography’s technical capacities preceded film, which in turn preceded video. The ability to immediately review electronic moving images represents the removal of a previously inherent photographic latency and is evidence of a break in the historical sequence of motion imaging technology dutifully following still imaging, and mechanical technology offering functions that are then reinvented through electronic means. Hollis Frampton writing on his first experience of video production recollects:

I made a [video] piece, a half-hour long, in one continuous take. Then I rewound the notation and saw my work right away. That was three years ago [1970-71], and to tell the truth, some part of my puritanical filmmaker’s nature remains appalled to this day. The gratification was so intense and immediate that I felt confused. I thought I must be turning into a barbarian… or maybe even a musician. (Jenkins, 2009, p. 266)

This facility to review video footage immediately post-exposure was available well before its availability to still photography through the Liquid Crystal Display (LCD) on the Casio QV-10 digital still camera in 1995 and for digital film cameras following this. Still photography, as noted in Chapter Two in the context of Marey’s work, avoids analog electronic imaging almost entirely and embraces digital imaging as an immediate successor to photochemistry.

Before video, 16mm film was used widely throughout the mid twentieth century in commercial, educational, industrial, documentary and hobbyist contexts. In professional contexts it was used extensively for producing content for television particularly in the 1950s and 1960s because of television’s smaller screen size and less apparent resolution loss when compared to video projected on relatively larger cinema screens. Early iterations of the 16mm format were considered prohibitively expensive for non-commercial use and in 1932 the 16mm film format was halved and 8mm film was introduced as an amateur format. Super 8 followed in 1965.
In addition to recording amateur footage, as with consumer videotape after the introduction of the Porta Pak, consumers could purchase commercial films on 16 and various 8mm formats for home viewing with a matched format film projector. The corresponding activity for video occurred in 1972 when Philips made available a domestic videocassette recorder that allowed time shifting of television broadcasts. By 1985 when Sony introduced the first integrated ‘Handycam’ video camera, consumer video formats had usurped both 16mm and 8mm film formats for most amateur production outside of student film and some documentary productions.

Altman (1984) describes the videocassette of the 1980s as ‘the full scale quotation of one medium by another’ and argues that ‘only with the video medium will it finally become convenient and common to actually own one’s feature film’ (p. 123). Altman considers video’s distinction from film to be defined in part by an ability to take ‘possession of the apparatus’ and is here primarily discussing commercially produced feature films but his view ignores the audiences’ ownership of many earlier moving image works on film as described above. The notion of quotation is also problematic when considering the apparatus as Altman describes, in that this different medium of video represents the original work as ontologically and phenomenologically distinct. I argue that video is not merely ‘meet[ing] the reality demands of the old’ through quotation, but rather, creating a new work that quotes but does not reproduce (p. 123). This sets analog video on the path to presentationism as realised by digital video and as will be discussed in Chapter Four and briefly below, in a revision of Spielmann’s (2008) distinction between analog video and digital media.

The nexus of the new immediacy and democratised ownership of analog video was pointedly made during the publicity surrounding George Holliday’s video recording of Los Angeles (LA) police officers beating Rodney King on March 3, 1991.

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1991. This bystander video recording was screened worldwide in the immediate aftermath of the event and transformed Holliday from observer to filmmaker and King from an unknown victim of police brutality to a civil rights icon. The officers’ subsequent acquittal led to the widespread LA riots of 1992. King then reappeared on broadcast television, this time directly addressing the camera and citizens of LA during the riots, pleading: ‘People, I just want to say, you know, can we all get along? Can we get along?’ (USA Today, 2007). These activities are direct progenitors of contemporary social networking digital media tools, particularly the portable video recording functions integrated into mobile telephones that can immediately and directly upload High Definition (HD) video to online-networked spaces for widespread consumption without any external sanction. The possibility for social change through video activism is realised through a plethora of organisations that promote the use of video as a Do It Yourself (DIY) tool to present moving image representations of reality not depicted by mainstream media and promote shared ownership of media. These include the New York City based Witness; DevMedia: Media for Development and Democracy; The Video Activist Network; Canada based IMPACS and Media Awareness Network; the Independent Media Centres; and the UK based Undercurrents Alternative News.

In a further acknowledgement of McLuhan’s (1995) notion of a medium containing another and Altman’s (1984) problematic argument above regarding the quotation of media by other media, television draws on both film and video as source material in addition to live broadcast. Video however, unlike most film, does at times draw on television as content to repurpose moving images as discrete works. This phenomenon can be seen in television recordings of broadcasted live events repackaged for DVD consumption.54 In a McLuhan framework, television naturally contains video, which may contain a

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54 These events range from sporting matches to opera performances, from rock concerts to ‘dwarf throwing’ competitions.
film, which contains a screenplay, which contains a manuscript and so forth, resulting in a pictorial and conceptual *mise en abyme* as articulated above by Comolli (1986) and Cubitt (2004).

Conversely, video can also be perceived as more closely aligned with television than film. Vitally for this thesis with its focus on technology, video shares the electronic basis of television rather than the mechanical basis of film and offers technologically related but different moving images from television. The core distinction between film and video within this thesis is that film cameras and projectors are predominantly mechanical devices whereas video cameras and related display technologies are electronic, akin to television. This, crucially, has paramount implications for any indexical relationship with reality.

Television and video can be associated materially in ways that film and video or film and television can never share. In distinguishing between, and arguing for the familial relationship between video and television, Yvonne Spielmann (2008), as discussed in Chapter One, argues that ‘on the basis of shared technology, they [electronic ‘media images based on time’]… connect the electronic medium of video with the cultural forms of television’ (p. 50). It is valuable to further examine Spielmann’s claim in this chapter dealing specifically with a history of electronic technologies.

Spielmann (2008) describes video’s ‘lack of fixity’ as the quality that ‘separates it from the passage of discrete images in film’ (p. 49). She is here, in part referring to the interlaced capture and display of analog video in contrast to film’s progressive frames whereby the image frame is composed of discrete fields within the frame, taking the form of alternating odd and even horizontal lines. Importantly the context is one in which Spielmann is arguing for how mechanical moving images are different from electronic ones. She goes on to differentiate between electronic and digital moving images with video and television belonging to the ‘category of recording media’ alongside the ‘older technologies of the gramophone and film’ rather than ‘digitally coded, numerical media’ (p. 52). However, Spielmann’s overarching argument is one
in which analog video is perceived to be also closely aligned with the ‘digital simulation image’. Video is regarded as a rehearsal for the transformative digital image:

In determining the characteristics of technical transformation imagery, the position of video is central: on the one hand, the electronic medium rests on analog recording technology, yet it establishes, on the other, the essential features common to electronic and digital media in processuality and transformativity through flexible forms of audiovisuality. In this respect, the electronic principle of the processual image type finds a way forward and a dimensional enlargement in the more highly complex digital image type. (p. 5)

Spielmann describes analog video as: ‘contain[ing] two interlocking half images, a technical necessity for stabilising it, which produces the impression of the image’; and ‘the result of two image fields intermeshed with each other’; and further: ‘two interlocked half images belong[ing] to the definition of “image” in video and television so that all the information in an image is composed of linear images (even and odd lines) staggered in time’ (pp. 49; 47). I agree that the method of rendering contemporary video to screen and recorder differs from film, and that analog video can be more closely aligned with digital images with regard to indexicality as noted in the Introduction and Chapter One but not entirely in the way that Spielmann (2008) claims. I argue that in addition to the field recording method, unlike film’s exposure and recording to a full progressive frame, analog video parses the frame to its component electronic parts including luminance, chrominance and spatial location and then records these discretely to continuously moving tape. This attribute also contributes to the broad notion of video as a medium constantly moving rather than presenting a series of stills. As proposed by Bain’s nineteenth century printing technique forging the foundation for proto-television discussed in the opening of this chapter and arguments made regarding halftone reproduction in Chapter One, video represents its Peircian object by breaking reality into
smaller discrete non-figurative units than a film frame and in displaying such images, does so employing discretisation.

Digital video optionally uses a progressive scan technique—rather than interlaced—in recording and playback. This behaviour is similar (but not the same) to that of film, capturing and presenting an entire image frame rather than overlapping two or more fields of video within that frame. Both technologies also exhibit a shutter effect between frames, but the digital video image much more subtly. A notable distinction from film though, is that this digital video frame is still scanned and rendered on screen temporally left to right and from top to bottom rather than the simultaneous entire frame exposure or projection of film cameras and projectors.

This is a different reference but the same ‘lack of fixity’ that Spielmann (2008) argues for. Progressive scan is also an important aesthetic feature of digital video helping to achieve a widely desired ‘film-look’ because of these specific image capturing and playback methods. The techniques of digital progressive scan then, bring video closer to film’s mechanical imaging methods and visual aesthetic but do not replicate them. I have argued in Chapter One however, that analog video more closely approaches ‘digital simulation’ than Spielmann allows (p. 52). For Spielmann, ‘fundamental differences remain, which must, therefore, be stressed, if we are to assess adequately the interconnection of video- and computer- based machines’ (ibid). I have demonstrated earlier in this thesis that Spielmann’s distinction between electronic and digital is moot for moving images and their relationship with reality and will briefly return to Spielmann’s argument regarding the ontology of video in the discussion of digital video in Chapter Four.

Conclusion

Digital images, discussed only fleetingly in this chapter, revisit elements of mechanical moving images through their use of progressive scan and parsing of
individuated components of the visual signal. They operate in contrast to the flow of images attributed to analog video. The similarities of these processes present analog video as an outlier in moving image media, operating neither like film nor digital images. This view additionally positions analog electronic moving images as rehearsals for digital technologies. The same arguments that isolate video from film situate analog video as a precursor to digital moving images. These conflicting views can be sustained only because of the shallow approach to the material attributes of moving image technologies leading to misrecognition of the true nature of moving images delineated by materiality.

The view of analog video representing electronic moving images as proto-digital imaging is even more pronounced for the materiality of analog video. The indexical severance that characterises the relationship between analog electronic images and reality—and in doing so, materially links them to the discretisation of digital images—also demonstrates a correspondence of process in the generation of such images. The widespread marginalisation of analog video as evidenced by discussion of arguments offered in Chapter One by Gaut (2010) and Mulvey (2006) that amalgamate video with the other analog medium of film in favour of an analog/digital divide, is simultaneously understandable and unwarranted when considering how closely related analog electronic images are to their digital counterparts.

It is the introduction of digital moving images that decisively displaces perceptual realism as the primary measure of authenticity. Apprehension ultimately surrenders to the strength of materiality, if only because the materiality of the digital is less tangible: ‘now, the reader cannot rely upon his or her experiences and senses of what is real, based upon photography’s similarity to human sight, to decipher the veracity of these kinds of composites because they are too well done.’ (Richin, 1990, p. 34). The seemingly effortless manipulation of pro- and a-filmic reality ushers in a new era for moving images that belatedly considers their materiality—and its absence—as a central concern when negotiating moving images. Regardless as to the reasoning
behind this apostasy, the new focus ultimately reveals the significance of materiality in discerning reality through moving images. Doane (2003) describes this impulse

as though the object of theory were to delineate more precisely the contours of an object at the moment of its historical demise… it is the intense and privileged relation to contingency, assured by photographic indexicality in the abstract, that can be loved again, this time as lost… does the theory adequate to its object only emerge at the moment of its loss? (pp. 85-6)

I have argued that this indexical loss occurred long ago and is only belatedly recognised. Doane’s (2003) ‘historical demise’ occurs at the close of analog imaging technology but its cause and true nature rest with the cumbersome passing of mechanical moving images and the ascent of the analog electronic.

It is pertinent to recall Irvin’s (1953) words from Chapter Two: ‘the 19th century began by believing that what was reasonable was true, and it would end up believing that what it saw a photograph of was true’ (p. 102). Irvin’s claims for veracity for moving images in the nineteenth century are capsized by a twenty-first-century disavowal of these claims embedded in a cautious return to prominence of the materiality of the moving image alongside its vanishing.

It can be easily discerned then, how the importance of analog electronic images in history is subsumed within a more easily recognised digital revolution. It is the similarity between the analog electronic and the digital however, that illuminates differences between mechanical and electronic processes rather than those between analog and digital. Viewing these developments through a lens of successive technologies beyond the binary division of analog and digital provides the evidence of spatial discretisation for electronic analog images as is widely accepted for digital moving images; the subject of the following chapter.
CHAPTER FOUR

Reality, Simulation and Presentationism: the Transubstantiation of Digital Moving Images

Introduction

Much theoretical consideration of analog electronic moving images discussed in the previous chapter neglects the material aspects of film and video because of a preoccupation with perceptual verisimilitude facilitated by rapidly advancing imaging technologies. Underpinning this apprehension however, is the materiality of these electronic moving images. The indexicality of these images is severed through the discretisation argued for in Chapter One. The much-heralded demise of indexicality erroneously attributed to digital images, in truth occurs with those analog electronic images. Despite the monumental transformations to image making and reception facilitated by contemporary technologies, a preoccupation with apprehension as a method for discerning indexical veracity continues for considerations of the relationship between digital moving images and reality, but is now destabilised. The digital filmic object wanes and finally, the largely historically unacknowledged materiality of moving images of the twentieth century is belatedly foregrounded alongside its expiration in another truage of technologically mediated spectacle cinema.

The result of this revelation is a renewed focus on the ever-diminishing substance of moving images. The prompt of the intangibility of digital images allows materiality to share centre stage with perceptual realism at the close of the twentieth century. With the absence of a filmic referent however, apprehension is able to segue into a defining position alongside a reconfiguration from a relationship between image and referent to one that unites image and viewer in an insular fashion. What had been previously a dichotomy between ontology as represented by materiality, and
phenomenology—through apprehension—is displaced by the absence of indexicality in conjunction with an absence of materiality in digital images.

The ontology of digital filmic reality is now a contract of apprehension between the moving image and viewer. Illustrative of the mutability of digital media, the digital images discussed in this chapter are combinative in that they can be composites of pro-filmic reality and synthetic construction; simulative in that they are clearly Peircian Icons rather than indices; allusory in that they are autonomous rather than directly referenced, and assimilative in construction. These components of digital images synthesise in a mode of self-contained presentationism.

One of the effects of the re-emergence of Gunning’s ‘cinema of attractions’ as digitally enhanced spectacle cinema has also been a de-emphasis of the previously foregrounded narrative aspects of cinema and an increased focus on audiences’ direct interactions with the photographic technologies of reproduction and representation—at times approaching ‘technophilia’ (Moszkowicz, 2002, p. 302). Baker (1993) describes this approach as ‘if the quest for technological magic, exceeding the effects in previous movies, becomes the paramount concern’ (p. 41). Polan (1986) attempts to corral the indistinctness of spectacle in cinema as ‘a containment, in which awareness of any realities other than the spectacular gives way to a pervading image of sense as something that simply happens, shows forth, but that cannot be told. This is the fiction of the spectacle, its Imaginary’ (p. 56).

In a technical production context there is a corresponding approach to this drive toward insularity. Many digital formats transform analog film, video and digital capture to specific colour spaces.\footnote{Colour spaces are mathematical representations of predetermined colour gamuts. These geometries are often pictorially represented in the three-dimensional space of a cone, cube or sphere.} Rather than considering and working with the relationship between the digital data and the depicted scene—referred to as Scene Linear or Scene Referred—it is common to target a specific colour...
space that matches the image outcome. These include most commonly Rec709 for HD video, the device agnostic Cineon/DPX and more recently Academy Color Encoding Specification (Academy ACEs) for Dfilm. This methodology reveals a preoccupation with the display of the resultant images over the source. The manipulation of image fidelity refers to its destination as an apprehended photographic image, not its referent. The representation and reproduction of digital moving images increasingly considers the presentation of the photograph rather than the depicted scene. A new inward-looking form of moving image materiality emerges; one that holds apprehension as essential.

This engagement with specifically digital production and reception technologies ushers in a new era for photographic realism after almost a century of narrative cinema, during which time the photograph and photographic moving images were incontrovertibly of reality (Walton, 1984). It is clear that digital cinema technologies have changed the way in which audiences and theorists regard the construction and presentation of the moving photographic image and its increasingly complex relationship to the real and photo-real. Achieving simulatory photorealism is now incremental. Film critic Jim Schrembri (2011) for example, describes J J Abrams’ film Super 8 (2011) as offering ‘staggering photo-realism’, a quote used in The Age newspaper’s online masthead for that edition as ‘staggering photo-realism behind new sci-fi mystery thriller’ (The Age, 2011, my emphasis).

**Attributes of Digital Images**

As noted above, this shift can be described as moving from representation to simulation and repealing the swing from showing to telling described in Chapter Two. Further I argue, simulation as the embodiment of Peircian iconicity—with digital moving images long ago having discarded the

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56 Additional common digital film colour-spaces—but restricted to images originating from particular hardware—including RED’s REDcolor2, ARRI’s Alexa Log C, and Sony’s Log S format.
operations of indexicality—promotes autonomous presentation. Most importantly, as noted in Chapter One, a Peircian iconic sign denotes its object because of a quality that is shared. But additionally, an icon has this quality independently of the object.

The notion of digital presentationism extends Musser’s (1995; 1991) argument for the presentational aspects of early cinema incorporating Gunning’s (1989a) refutation of the primitiveness of filmmaking of this era and also after Pierson’s (1999) description of ‘formally bracketing the presentation’ of CGI effects in Hollywood science fiction cinema of the early 1990s (pp. 165; 72). Pierson also notes Landon’s (1992) argument for the real narrative of early digitally manipulated science fiction film—discussed below—as located in the presentation of the digital on screen, although this is at the service of simulation.

The digital moving image ‘is construed as an iconic simulation—immaculate in its photographic credibility, yet always lacking an existential relation to the real’ (Ng, 2007, p. 173). With this context, audiences now accept that the photo-realistic imagery that they encounter may or may not have a pictorial relationship with the physical world (Cubitt, 2004). Cubitt (1999) argues that digital spectacle cinema ‘brings on marvel at the capabilities of the medium itself, throwing before the audience the specificity of the medium as well as a terminal form of illusion that succeeds by exceeding the apparent limits of the medium’ (p. 129). This view of the digital moving image as spectacle is also an apt description for Musser’s (1991) take on the presentational properties of early cinema.

I nominate this global change from representation, through simulation, to insular presentation, as transubstantiation. I employ this term rather than perhaps transfiguration, metamorphosis, transformation, conversion, or transmutation because this shift is one in which the appearance of moving images remains the same but their materiality is inextricably altered. Transubstantiation accounts for the apprehension and the materiality of digital moving images in ways that other vocabularies cannot. It is equally for this
encompassing of both perception and materiality that transubstantiation is not applied to analog electronic images despite the indexical severance argued for in previous chapters. In addition to the material changes invoked by the discretisation of analog electronic images argued for in Chapter One, there is a perceptual change that is readily observed. Analog video and television images do not look like film images. Digital images however, through their mutability—or Spielmann’s (2008) ‘optionality’—can present as, masquerade, or impersonate the visual appearance of any moving image technology (p. 49).

Simulation as part of this process is defined after Kittler (2010) and Spielmann (1999a & 2002) as the

physical processes that create visibility—such as the registration of light rays, or chemical and mechanical manipulations—are copied or duplicated in a type of fakery which pretends (simulates) that we are still dealing with the actual photography of film. But, on the contrary, what is actually manifested is the dissolution of the factual. (Spielmann, 1999a, p. 135)

McQuire (2000), Hansen (1991), Gunning (1986; 1989; 1989a; 1993; 1994a), Gaudreault (1987), and Musser (1995; 1991) all note a return to showing when describing a link between the spectacle of contemporary cinema and ‘cinema in the 1900s, with people going to see the apparatus rather than a specific film, and the “experience” being advertised largely on this basis’ (McQuire, 2000, p. 54). Michele Pierson (1999) in acknowledging CGI of the early and mid 1990s as a re-finding of the cinema of attractions prefigures Andrew Darley’s argument regarding the role of spectacle in ‘halting motivated movement’ (Darley, 2000, p. 104). Pierson describes 1990s CGI in terms of visual excess. It is too bright and shiny by far, the hyper-chrominance and super-luminosity characteristic of the CGI effects produced over this period imbued the digital artefact with a special visual significance. This visual significance
was augmented by a style of arts-and-effects direction that, by bracketing the computer-generated object off from the temporal and narrative flow of the action, offered it up to the contemplative gaze of cinema audiences. (p. 173)

In support of digital mutability and transubstantiation, audiences largely do not distinguish between analog and digital materiality if presented with unspectacular referenced photorealism when relying on moving images as evidence of reality. This can be seen in a plethora of photographed and edited political documentaries employing the now standard tools of the trade—digital video cameras—that rely on a filmic moving images as evidence. These include The Cove (2009), representing the capture and killing of dolphins for meat in the small harbour town of Taijii, South of Kyoto, Japan, and Voices of Iraq (2004) in which the Iraqi subjects of the film were loaned up to 150 consumer digital video cameras and recorded themselves on location during the Iraq war. Unchallenged, these moving image works present actuality footage—digitally captured and edited—as reality in perceptually the same way their film counterparts offered moving image certainty in previous years. Materially though, these digitally generated films are distinct from film-based actualities, particularly for the relationship they have with reality. The technology employed to render these images is optically cinematographic in reception but synthetic in its construction.

There is a dissipation of viewing contexts as part of a conversion to digital technologies. It was less than a year after Tim Berners-Lee’s completion of the first version of HyperText Markup Language (HTML) in 1993—first proposed in 1990—that provided the implementation of the World Wide Web (www) that the American Broadcasting Company (ABC) first delivered television content on the web. Conventional television at this time began to lose a grasp on domestic viewing alongside the media industry’s push for hybrid and convergent hardware that blended computers with cinemas and televisions as exemplified by Home Theatre Personal Computer (HTPC)
products like Microsoft’s ‘Media Home’. A plethora of other digital storage and screening devices have since emerged that serve moving images to viewers. These devices are enormously varied in size from cinema scaled televisions to tiny portable screens for watching and listening to moving images. They are likewise varying in image quality, with some digital screens improving the technical quality of images when compared to analog screens and others vastly reducing it. What underpins this is well described by Magoun (2009) as the ‘death’ of television:

The concept of a population all passively watching the same professionally produced program simultaneously—much less on a common type of display—at a government-approved broadcast standard, was fast becoming a phenomenon of the past, resurrected for sports championships and national disasters. (p. 157)

In a utopian view of what this digital revolution has brought and with an unacknowledged focus on only technologically progressive sectors of industrialised nations, Magoun (2009) sees the new television as ‘everyone… [using] blended video content with audio, text, and data in a seamless, four-dimensional web. Anyone could create, edit, transmit, receive, or interact with anyone else’s material, at a variety of resolutions and bandwidths, at their convenience (ibid).57

Chronologically, the broad penetration of digital technologies for the moving image respects distinct stages of the image-making process. The uptake of digital processes commences with post-production, adds image capture in production ten years later and finally offers digital screening and distribution more than twenty years after the first commercial uses of Computer Generated Imagery (CGI) in post-production for visual effects. These three stages include

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57 For a detailed history of the introduction of High Definition Television (HDTV) with a focus on the interrelationship between technology and politics, see Brinkley (1997). For a more recent chronicle that includes a longer history, see Magoun (2009, pp. 145-177). See Newman (2011) for an introduction to the domestic impact of a transition to high definition digital television ‘remade in the image of the film screen’ (p. 134).
more specific areas of production converted to digital processes including cinematography, sound recording, sound design and mixing, picture-editing, visual effects, set design, distribution and exhibition. Similarly, as discussed in the Introduction, moving image theory from the 1980s onwards, presents distinct approaches across time and alongside digital technologies becoming increasingly imbricated within image making and screening processes.

The Introduction of Digital Technologies to Moving Image Production

The valorising of visual effects, or manipulations of photographic reality for automated moving images begins notionally, as discussed in earlier chapters, with Méliès. Visual effects can additionally be seen to contribute substantially to the aesthetic of other cinema including 1930s epic cinema and many 1950s B-grade science fiction films. These 1930s and 1950s visual effects were often considered sub-standard based solely on a lack of photorealism but are reflective of technical capabilities of that time. In summary, they were regarded as a best attempt to create believable synthetic reality onscreen. La Valley (1985) describes the blending of special and visual effects within analog films of the 1950s as ones in which ‘we can see the bad matte line… the poor rear projection, and the miniatures which detonate like a bunch of matchsticks (which they often are). The tricks do not work and the plot is interrupted’ (p. 146). As early as 1927, Antonin Artaud (1988) imagines ‘a film with purely visual situations, whose drama would come from a shock designed for the eyes, a shock drawn, so to speak, from the very substance of our vision and not from psychological circumlocutions of a discursive nature which are merely the visual equivalent of a text…a visual cinema in which even psychology is engulfed by actions’ (p. 411).

Paradoxically, the introduction of digital technologies provides for more perceptually believable photorealism but simultaneously transports the materiality of these images further from that reality. Furthermore, digital
technologies reduce the latency of the image, that with the film negative had previously required developing and printing before being able to be viewed. This diminished latency is however—as noted in Chapter Three—also a trait of analog video with instant review and video-split on-set—a long-standing pre-visualisation technique in both video and film practices.

An historical striving for photorealism as part of the project to create perceptually convincing visual effects on-screen conspicuously improved with Stanley Kubrick’s 2001: A Space Odyssey (1968), the winner of an Academy Award for Special Visual Effects in that year.58 A huge budget and extreme attention to detail in the creation of non-terrestrial environments coupled with the use of new in-camera techniques resulted in higher production values and a more convincing photorealism—one that most audiences had never experienced. Kubrick remarked that: ‘I felt it was necessary to make this film in such a way that every special effects shot in it would be completely convincing—something that had never before been accomplished in a motion picture’ (quoted in DeMet, 1999, unpaginated).

2001: A Space Odyssey (1968) visually presents many applications of technologies that were in development at the time of the film’s production, giving audiences a sense of possible futures anchored in then current technological research (this idea will be revisited below with regard to Steven Spielberg’s Jurassic Park [1993]). Technologies depicted that eventually became reality include ‘heads-up’ cockpit displays now commonly used in the aviation industry, flat screen television displays, video-phones, voice-print identification for security log-in to computer systems, and computer based chess games pitting human against machine that already existed in primitive form in 1968.

One of the major techniques leveraged to achieve these effects in 2001: A Space Odyssey (1968) was front projection (DeMet, 1999; Trumbull 1968; Lightman, 1999).

58 This award commenced in 1939 and was called Best Special Visual Effects following previous years’ Special Achievement Awards for Visual Effects. In 1977 the award was renamed Best Visual Effects.
This mirrored glass effect has its roots in the nineteenth century conjurers’ technique of Pepper’s Ghost. It relies on a half silvered mirror set at 45°—usually to the camera—and both the camera and projector axes aligned to create a compositing image in-camera. Lightman (1968a) describes the ‘advanced technology’ of front projection for *2001: A Space Odyssey* as an ‘extensive use of a completely new departure in the application of front-projection for background transparencies’ (p. 420). Babette Mangolte (2003) argues for a common view of the film as spectacle cinema after Annette Michelson’s (1969) much earlier essay that identifies the immersive experience of 70mm screenings (Mangolte, p. 272). This study compares favourable box office takings for 70mm screenings of *2001: A Space Odyssey* arguing that these screenings offered viewers an immersive sensation of weightlessness against visually disadvantaged and poorly attended 35mm screenings.

With the exception of early computer tracking of camera movement allowing tighter integration of effects and live action footage in George Lucas’ *Star Wars* (1977), moving images began utilising digital technologies first in post-production for visual effects. I have established that sound as part of moving image histories is outside the scope of this thesis but it is significant that digital vision chronologically follows the introduction of sound in digital production and post-production in part due to the more modest bandwidth, less demanding computing requirements and the consequently lower cost of working with digital audio. It is important to note that because of the visual bias of film theory and production, there is a paucity of material from the first twenty years of digital moving images that focuses on sound (McQuire, 2000). The visual image has comprehensively dominated the digital transformation of cinema despite this revolution being led by sound.

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59 For a detailed description of configurations and methods for front projection see Ryan (1993, pp. 399-415). For information on the visual effects techniques used in Kubrick’s *2001: A Space Odyssey* (1968) see Trumbull (1968), and Lightman (1968 & 1968a).
Digital Post-Production

The first commercial feature film to employ digital visual effects is arguably Steven Lisberger’s *Tron* (1982), integrating between five and sixteen minutes of digital effects but using predominantly analog cel animation for the majority of the film’s visual effects.\(^{60}\) This ‘extensive use of computer graphics’ was a major selling point for the film despite the small duration of finished film work that CGI created for the film; ‘gone with *Tron* are the days of fairy dust, Jiminy Cricket and lisping ducks’ (Hutchison, 1982, p. 73; Salkin & Stone, 1982, p. 20).\(^{61}\) Recalling the mutability of digital visual aesthetics, a new electronic aesthetic was promoted by *Tron* that represented computer imaging and did not dwell on the fact that older analog cel animation techniques were employed to create the bulk of this vision. Fan magazines of 1982 consistently summarised the digital technologies used to create the VFX for *Tron* as ‘true’, ‘real’ and ‘perfect’ alongside accounts of the huge numbers of pixels or frames or calculations required (ibid).

Two years later, Nick Castle’s *The Last Starfighter* employed twenty-seven minutes of CGI. In 1989, *The Abyss*, written and directed by James Cameron, extended previous technical achievements by adding morphing techniques to a CGI cache in creating the film’s ‘pseudopod’ creature. Cameron went on to

\(^{60}\) Arguable in that Ridley Scott’s *Alien* (1979) had already employed computer-generated images—to show a computer display of predominantly text characters. This was CGI self-reflexively representing itself in a mode that was palatable to audiences of that time. The film also included a rudimentary wire-frame model of the planet that the spaceship was to land on, also appearing on only a computer display screen. Additionally there were a number of films including Richard Donner’s *Superman* (1978) that had used computer graphics within title sequences, separated from the main body of the film’s imagery. This distinction recalls the discussion in Chapter One on Méliès’ moving image practice and the recognition of ‘firsts’. Gaudreault (2007) in deconstructing the ‘single apparent shot’ for Méliès’ trick films notes that Edison was making trick films earlier than Méliès, but importantly, for pragmatic rather than illusory purposes (pp. 169-70). On this point see Musser (1995) for a chronicle of Edison’s moving image achievements between 1888 and 1918 (p. 57).

\(^{61}\) The volume of CGI work in *Tron* (1982) is debatable but at the upper end of estimates, Baker (1993) writes that there were ‘sixteen minutes of completely computer–generated work (which was considerably less than originally intended) and many of the backgrounds for live action were also produced by computer’ (p. 35).
refine this set of morphing techniques in 1991’s *Terminator 2: Judgement Day*. Building on an increasing interest in blending referenced and fantastical reality for spectacle cinema, Steven Spielberg’s *Jurassic Park* (1993) discussed below, offered the ontological conundrum of photorealistic digital dinosaurs, neither completely fantastical nor referenced. *The Mask* (1994), directed by Chuck Russell, presented digitally reworked traditional animation techniques applied to live action filming and Robert Zemeckis’ *Forrest Gump* (1994) offered digital compositing of fictional characters with historical (real) people and objects. Noting the strong science fiction focus in the majority of these films, this genre and its links to spectacle cinema and technology will be discussed at length below.

**Digital Production and Computing**

Capturing moving images digitally began much later than digital post-production. The introduction of ‘prosumer’ digital video cameras in 1994 from Sony and Panasonic with Sharp and JVC following the next year, diversified the video medium and established more direct connections with digital computing—the heart of binary representation.62 This was achieved through computer techniques commissioned to create the cinematic elements of virtual sets and actors, through digital compression of moving images, non-linear editing and other image manipulation. Even the notion of ‘capturing’ digital images reflects the new role that cinematography holds in the digital realm. Rather than being an essential method that is responsible for the look and materiality of moving images, on-set optical cinematography can be seen as a form of Eisenstein-like data gathering in latent form in order to manipulate and craft meaningful moving images in digital post-production.

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62 ‘Prosumer’ is a term coined by Alvin Toffler (1980) after McLuhan’s notion of consumers becoming producers and is a portmanteau of ‘professional’ or ‘producer’ and ‘consumer’. In a media technology context, prosumer often refers to hybrid audio-visual products that are positioned between the two markets.
Computers also created hybrid forms of cinema targeting internet delivery, video games with cinematic sequences and game play, and motion rides often situated in theme parks using moving images—as noted in Chapter Two.63 These theme park rides particularly, promoted cinematic narrative within the kinetic energy of the ride and complementary kinetic energy to the presentation of cinematic narrative. Computers have also blended desktop digital design and text to create time-based typographic opening and closing credit sequences for moving image work that technically exceed the achievements of their analog counterparts. Manovich (2001) notably refers to these motion graphics as ‘typographic cinema’ (p. 287).

More broadly the use of digital technologies for moving images—particularly computers—creates new approaches to the spatiality of the screen as a mutable display via multiple discrete images within a single frame (as discussed in the previous chapter featuring Figgis’ *Timecode* (2000) and as can be seen in the early digital works of Peter Greenaway, particularly *Prospero’s Books* [1991]). Film title sequences can also be credited with tangibly bringing the operations of the computer and cinema together.

Approaches to narrative alongside the introduction of computer technologies also reflected the non-linear structure of digital technologies as illustrated by the story structure of Tom Tykwer’s *Lola Rennt* (*Run, Lola, Run*, 1998), shot using a mixture of 35mm film and digital video, Peter Howitt’s *Sliding Doors* (1998) and Duncan Jones’ *Source Code* (2011), also shot with a combination of 35mm film and a number of digital video and alternate film formats. These works explore ‘if-only’ or ‘what-if’ possibilities through an invocation of ‘divergent or parallel narrative possibilities’ (Cameron, 2008, p. 6). Although

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the visual aesthetic and cinematographic style of these films, particularly *Lola, Rennt* reflect a digital zeitgeist, this was not an entirely novel approach as earlier analog films including the three scenarios in Krzysztof Kieślowski’s *Przypadek* (*Blind Chance*, 1981/87) and the time loop of Harold Ramis’ *Groundhog Day* (1993) explore similar structures in investigating the alternate outcome scenarios that many video games were exploiting as structural spines in the late 1990s. David Bordwell (2011; 1985; 1985a) consistently argues that these kinds of modular narratives demand ‘clarity through varied repetition’ and are not so different to ‘combinations and transformations of inherited conventions’ (2011, unpaginated). 64

Manovich (2001) refers to structures like these as being representative of ‘database cinema’. He describes the shooting of moving images as the gathering of entries to a database that is subsequently edited in post-production to form a singular narrative. 65 Manovich also though, argues that cinema ‘exists right at the intersection between database and narrative’ and that these are competing structures (p. 237). He refers to an oscillation between the two structures with the birth of photography being database driven, followed by moving images being narrative driven and the digital revolution returning media to a privileging of the database again. Manovich doesn’t explain how the digital moving image privileging a database structure fits this oscillating model given that the basic sequence of capturing the moving image and editing it into a sequence remains the same despite a transition to digital technologies. He also


65 Peter Greenaway is one filmmaker cited by Manovich that attempts to reconcile these two forms explicitly in his work and he does this through coding systems comprised of numbers, alphabetic symbols or colours. Greenaway extends his practice beyond cinema to gallery installation, visual and sound design for opera and other forms of art to express these ideas. See Manovich (2001, pp. 238-9).
makes a special case for ‘computer films’ as being database driven but also describes ‘almost all fictional films [as] narratives, with few exceptions’ (p. 234).

Clearly there are gaps in Manovich’s (2001) model some of which are about confusing medium with technology. Video for example exists in both analog and digital forms but materially has markedly different properties in each. Television for Manovich is another bifurcating path between ‘representational technologies… [and] real-time communication technologies’ with the path chosen being representation (p. 162). In Manovich’s argument, television privileges narrative yet on reflection, is an ideal candidate—being a collection of timeslots to be populated with moving image content as discussed in Chapter Two—to represent his argument for database cinema.

Armes (1988), strangely coy regarding how closely digital video and computers were becoming aligned, locates analog video as offering ‘live action’ elements combined with computing technologies. Rather than viewing digital cinema as beginning to appropriate video, film and computer technologies, he makes a case for the video form bridging moving images as ‘an act of direct intervention’ with the abstract dealings of the computer:

The video recorder is both a precisely engineered machine (designed to ensure, for example, the steady passing of the tape past the heads) and an electronic sound and image processor. Similarly, electro-magnetic tape has a sensitivity to light akin to that of photographic emulsion, while being as inherently manipulable and transformable as a pure computer-style information system. (p. 213)

Despite the widely celebrated union of motion pictures and computers in the at least six years prior to the publication of Armes’ 1988 text (and also its reprinting in 1995), he, after Couchet (1988), positions analog video as holding an important and unique position in the future of moving images. This is distinctly different from a view that marginalises analog video in favour of the digital as discussed in Chapter Three, or more sustainably, Spielmann’s
(1999) view, discussed in previous chapters and above, that ‘the electronic image can be considered in term of its intermediary position between film and digital images, where the representational functions of the analogue are crossed with the digital effects of simulation’ (p. 134). However, Armes’ linking of the use of light in differing moving image technologies certainly applies to digital video and film. The lasers that read data from optical media, the display technologies of digital screens, and computer assisted picture editing and Visual Effects (VFX) more than adequately fulfil his observations about the importance of light, not only to the creation of analog moving images as he argues, but also digital ones. What Armes does not grasp is that although both video and ‘computer-style information systems’ are ‘inherently manipulable and transformable’, the random access, scale of spatial and colour resolution, and storage possibilities offered by digital computer systems are far more mutable than for analog video. In no manner can analog video be justified as equal in this way. The fine granularity of digital media able to address a single pixel within a frame of millions creates a new scale of resolution and resolving power against video’s single frame or even arguably a single field, line, or chrominance or luminance channel within a video frame.

**Digital Cinematography**

The uptake of digital cameras for capturing moving images commercially was not centred on the well funded and established American film industry as had been experienced with post-production, but instead on an avant-garde Danish based film movement founded by Lars von Trier and Thomas Vinterberg, producing films adhering to and centred on the anti-cosmetic Dogme 95 manifesto. Aware that the availability of digital cameras offered a new democratisation in filmmaking, the pair was drawn to the possibilities of high

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66 Light based digital screen technologies include Digital Light Processing (DLP), Plasma Display Panels (PDP), Light Emitting Diodes (LED), Liquid Crystal on Silicon (LCoS or LCOS), Organic Light Emitting Diodes (OLED) and Liquid Crystal Display (LCD).
technical image quality combined with the low cost and relative portability of new handheld cameras. This was made more attractive when linked to the possibilities for desktop computer digital non-linear editing in post-production. Von Trier’s *Idioterne* (*The Idiots*, 1998) was the first commercially released feature film shot on digital tape—using Sony’s VX-1000 digital camcorder. Vinterberg’s *Festen* (*The Celebration*) released the same year was shot on analog Hi-8 videotape under the same Dogme 95 restrictions. Both films were however, distributed on 35mm film for public screenings. Audiences and distributors did not make distinctions between these two Dogme 95 films based on the analog/digital technology divide for production. These releases were followed by the previously discussed split-screen Figgis film, *Timecode* (2000), which used digital technologies for the entire live-action production from shooting through to post-production. The image quality of *Timecode* shot on four modified Sony DSR-1 digital cameras is located between *Idioterne* and George Lucas’ *Star Wars: Episode II—Attack of the Clones* (2002). Lucas’ film was the first mainstream film to shoot and complete post-production on a professional digital camera system that rivals 35mm film production in image quality.

Digital video cameras of this time used videotape rather than hard drives or solid-state memory storage but this was merely an alternate medium to store digital data unlike the linear recording of analog videotape that, when used with digital editing systems, requires digitisation. Reflecting the staggered

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67 Berys Gaut (2010) and others describe *Festen* (1998) as having been shot ‘with digital cameras’ but this is incorrect (p. 10).

68 The camera used for *Star Wars: Episode II—Attack of the Clones* (2002) was the Sony HDW-F900 CineAlta, jointly developed by Sony and Panasonic. It provided high definition 24 frames per second capture competing with the quality of 35mm film capture. It is widely credited as instigating motion picture industry debate around digital cinematography replacing traditional 35mm film production. There are two earlier feature films photographed with the HDW-F900. They are Michael Polish’s *Jackpot* (2001) and the French film *Vidocq* (released in the USA as *Dark Portals: The Chronicles of Vidocq* in 2001) directed by Pitof (Jean-Christophe Comar)—more widely known as a European visual effects supervisor.

69 ‘Ingesting’ digital format tape based media into a NLE system copies digital files from the camera tape to the computer or network Hard Drive. It does not ‘digitise’ the camera tapes.
introduction of digital technologies to moving image production and pre-empting the Digital Intermediate (DI) process for film discussed below, many analog camera recordings in the first years of digital moving images were digitised and then edited on computer based editing workstations, often then exported back to analog video tape or to mylar film stock at the conclusion of post-production. Digital video cameras stored moving images digitally on tape and differ from later digital camera storage solutions in that the data was not randomly accessible until transferred to desktop computer systems.

Digital Distribution and Screening

The distribution and screening of moving images was the last core segment of moving image production to make a transition from analog to digital in cinemas. Public audiences first saw digital cinema projection in 1999 with the limited digital release of Lucas’ Star Wars: Episode I—The Phantom Menace in the USA, and John Lasseter’s Toy Story 2 in the UK. Both of these films were also screened from 35mm film prints in far greater volume worldwide. Lucas’ film blended CGI effects and digitally generated characters with optically shot footage whereas Pixar’s Toy Story 2 was CGI animation with no optical camera component. It was not until the second half of the 2000s that digital projection became part of a regularly accessed installed base for the digital distribution and screening of commercial moving images in cinemas.70

The term digitising camera tapes is a hangover from the historical process of digitising analog camera tapes into digital editing systems for non-linear editing.

70 For an excellent chronicle of the changeover to digital cinema distribution and projection and some attendant issues, see the eight-part series of articles from David Bordwell (2011a-2012e): Pandora’s Digital Box and Bordwell’s (2012f) subsequent expanded and further contextualized version of these blog posts in his self published ebook, Pandora’s Digital Box: Films, Files, and the Future of Movies. See the 10th revised edition of Bordwell & Thompson’s (2012) Film Art: An Introduction for material related to digital distribution and projection not present in earlier editions.
Regarding domestic consumption of digital images, DVD players and film titles released via DVD began appearing in Japan in 1996 and in the USA in 1997, Europe in 1998, and Australia in 1999. In 2003, DVD rental titles first outperformed analog VHS tapes in the USA and major retailers stopped selling VHS only player/recorders in 2003 (Fisch, 2010). Hard drive based digital video recorders were introduced in 1999 providing ample technology overlap in both recording and playback technologies with analog Video Cassette Recorders (VCR). Several manufacturers offered hybrid VCR and DVD player/recorders both mounted in one console for a number of years. The introduction of digital recorders coincided with the advent of terrestrial digital television broadcasts worldwide. The gradual switch-off of analog television broadcasts began in 2006 and will be completed in most territories by 2012. Government regulators in many countries mandated that televisions sold after 2007 contain digital rather than analog tuners to receive free-to-air broadcasts. Much content digitally broadcast still originates in analog form and this will continue for some time. The location of digital conversion in the distribution pathway is gradually being shuffled toward the source images however, with some originally analog material now only existing in digital form. This phase completes the industry conversion from analog to digital for moving images following post-production and then production in turn. The transubstantiation described here results in a perceptually identical yet materially distinct form of moving image that now dominates the apprehension and ontology of ‘film’.

Digital Intermediate

Digital moving image technologies introduce a blurring of the synthetic and natural. No longer restating the initial reality, they operate autonomously via a

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71 See Rodowick (2007) pp. 7-8 for a tabulated timeline of the uptake for digital technologies within the film industry.
mode of presentation alongside representations of the real. Prior to the introduction of digital Visual Effects (VFX) it was more perceptually evident what was directly from pro- or a-filmic reality and what had been manipulated in-camera or in post-production. In contrast to digital compositing, Manovich (2001) describes this kind of analog keying with multiple images as creating ‘disjointed spaces’ (p. 152). The introduction of digital VFX provides an increasingly blurred line between digital and analog photorealism. The majority of American studio films from the decade beginning 2000 host a variety of ‘invisible’ VFX including grain reduction, frame cleanup, wire removal from stunt work and hue colour shifts to create required visual moods or better continuity by matching tone and contrast. These pathways for analog based film shoots that are also distributed as film prints, are part of a process know as Digital Intermediate (DI). DI is the most widespread example of a set of hybrid practices that involve digitally scanning analog moving images on film, manipulating them digitally, and then exporting film negative prints using a film recorder to create new sub-master prints. These are then subsequently used to generate further prints for screening. This last stage of the process is now becoming less utilised with a digital file increasingly representing the final work. Becoming more prevalent is a full digital pathway of digital camera capture followed by digital editing and post-production. This results in a digital file master for distribution and digital—D-Cinema—screening.

Manipulation of photographic moving images does not begin with digital images. As discussed in earlier chapters, there is a long history of intervention in the recording and representation of reality as far back as the first years of mechanical imaging. What is notably different about digital manipulation is the relative ease of achieving this, even allowing for differing technologies, and the perceptual realism of the resultant effect.

Elsaesser and Buckland (2002) writing of digital compositing argue that:

Although optical composites can always give the impression that the two separate events occupy the same screen space, they eventually fall short in convincing the increasingly sophisticated spectator that the separate events occupy the same diegesis. Digital compositing equipment does not have the technical limitations inherent in optical printers, and so it can create a seamless blend of live action and animation, leading to the deception that the composited events do occupy the same diegesis. (p. 211)

Laura Mulvey (2004) writes of the introduction of the digital and its offering of ‘seamless special effects that erupted onto screens from the mid 1990s, further marking the moment when celluloid cinema aged, its longstanding link with reality overshadowed by simulation’ (p. 143). There are numerous techniques for manipulating analog moving images in film post-production in addition to in-camera techniques of filtering light, production and costume design and the choice of specific film stocks, but the distinguishing characteristic between analog and digital manipulation relates to scale as noted above.73 In the analog film processing stage of production the balance of cyan magenta and yellow can be manipulated through colour ‘timing’ to alter the hue of the resultant image and this is usually done to achieve a balanced and colour accurate outcome for the print. Film images can additionally be subjected to various non-standard lab processes post-exposure that further manipulate the final image. These include bleach bypass and retention processes including ENR, ACE and CCE that through differing methods retain silver in the latent image; film flashing in which the film negative is exposed to small amounts of light providing de-saturated colour and offering more

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73 This concern with scale in a micro sense relates also to a macro thread of scale and the dissipation of viewing contexts for digital cinema. Mary Ann Doane (2005 & 2007) argues that ‘scale has re-emerged as one of the primary markers of cinema specificity’ (2005, p. 1). This is also evident— although not in the way that Doane argues—with handheld cinematic devices discussed by Lynch (2005a) and Lucas (quoted in Corliss, 2006) in a later section of this chapter.
shadow detail in the final print; and cross-processing camera reversal stock as if it were a camera negative resulting in select oversaturated colours and increased contrast. All of these manipulations affect the visual presentation of the whole image. The smallest unit that can be addressed as part of these photochemical processes is an entire frame (or more often, an entire roll) of film.  

Unlike photochemical processes, digital manipulation in post-production of analog film or digital moving image capture can operate at a sub-pixel level, treating only one edge of a single pixel in one frame comprising millions of pixels. ILM digital effects supervisor Dennis Muren explains that a digital model is really separate from its movement, which is separate from its surface detail, which is separate from its lighting. We can change all or part of the image at will. We can tune each process until it’s perfect—that’s the biggest difference between CG and traditional effects (quoted in Vaz & Duignan, 1996, p. 228).

The DI process is routinely used to replace the kind of analog work described above but with a far greater level of precision. The digital equivalent of these photochemical colour correction processes within DI is referred to as digital ‘grading’. The Cohen Brothers’ film O Brother, Where Art Thou? (2000) was the first major feature film to be digitally graded in its entirety with the intent of creating an overall ‘look’ rather than introducing specific visual effects.  

The directors wanted to create a North American depression-era dustbowl look for the film despite shooting in a very green Mississippi. Digital grading allowed the post-production team to selectively de-saturate the green tones, create a custom colour palette across the entire duration of the film, review these changes and then export the results back to a film print (Prince, 2004, pp. 27- 

74 For a more detailed explanation of non-standard film processing options see Case (2001, pp. 66-73) and Ryan (1993, pp. 280-285).

75 DI was used previously in a feature film context for Gary Ross’ Pleasantville (1998) and Lucas’ Star Wars: Episode I—The Phantom Menace (1999) but these were to achieve specific visual effects rather than replace photochemical manipulations affecting colour to create a ‘look’.

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All of these tasks are non-destructive, allowing not only a previously unprecedented level of control but also the possibility of implementing alternate looks and choosing the most agreeable result from a vast array of choices.

Cinematographer Newton Thomas Sigel, ASC, was the Director of Photography for *Confessions of a Dangerous Mind* (2002). Speaking to Debra Kaufman (2003) about redefining principle photography as a result of the DI process between the stages of production and post-production, he says:

> The digital intermediate is a tremendous opportunity to have yet more control (over the image). You’re continuing the process of cinematography when you color-correct your film, and you can have an impact almost as great as when you did your original photography. With contrast, power windows, recomposing and primary or secondary color correction, you can really reshoot your film in post. (p. 80)

Similarly, Richard Misek (2010) writes of digital colour grading as ‘mak[ing] possible such extreme chromatic alterations that it is not enough to say that a film’s colour can now be *adjusted* in postproduction; rather, a film’s colour can now be *created* in postproduction’ (p. 405).

**Simulating Analog Photography**

Untreated digital moving images have a multiplicity of visual aesthetics because of digital media’s optionality but are variously described as ‘sterile, cold, perfect, and artificial’, ‘clean’, ‘grainless’, slick, ‘shiny’, smooth, ‘clear’, ‘seamless,’ and sharp (Tudor, (2010); Prince (2004), p. 31; Spielmann, (1999), p. 140). There is no film grain to texture the image and so filter the visual representation of pro- or a-filmic reality in frame. A loose approximate visually perceptual equivalent of grain in digital moving images is noise. A film shot of static objects has a unique pattern of grain in each frame and so this static
representation varies—typically 24 times per second. This grain is the silver halide crystals embedded in the film emulsion that react to light and give filmic images a particular dynamism, successively changing with each frame resulting in a coarse perceptible atmosphere between the action and the viewer. This frenetic pattern of silver is also the attribute that softens the filmic image and one of the things that sets it apart from digital moving images. The lack of grain in digital images renders them at once perceptually clearer and contrarily, less perceptually real.

The slower the film stock is rated, the smaller the grain in the emulsion and the more light required to achieve the same exposure. This, coupled with advances in film stocks over the last century means that film grain has become ever smaller and less visually perceptible. Stephen Prince (2004) speculates that ‘in a perverse way, perhaps the grainlessness of digital video represents the ideal and ultimate goal of this evolution. In actuality, though, scrubbed of grain, the digital image looks unnaturally clean and shiny’ (p. 31). Prince also writes of an idealised Bazinian increased depth of field as a core attribute of the digital video ‘look’ and describes digital video as being inherently opposed to shallow depth of film.

Since the publication of his paper however, digital video has increasingly repurposed cine- and 35mm stills- camera lenses to mimic a filmic look and meet filmmaker and discerning audience expectations of aesthetically pleasing moving images. Digital Single Lens Reflex (DSLR) cameras that also provide HD video recording—introduced in 2009 with Nikon’s D-90, have brought optical cine-style lensing to digital recording including those implemented in consumer level cameras.

Lenses are also significant in that they occupy a privileged place in technologies of the moving image. They are neither mechanical, electronic analog nor

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digital. Although there are mechanical aspects of lenses in photography, as optical devices they merely transmit and diffract light. Lenses—particularly multi-element glass lenses for photographic purposes—have changed in design as new technologies have allowed for more exactitude in machining but the camera or projector lens is exempt from categorisation here. Lenses are one of many external technologies that moving images draw on and in a neat corollary, digital technologies are expanding previous notions of a corralled medium through the inclusion of technologies previously considered exclusive of the moving image.77

In an echo of the incremental introduction of digital post-production prior to camera recording, there was a veritable raft of digital post-production techniques to selectively re-establish shallow depth of field before cine-lenses were common in professional equipment. The aim was to mimic analog film and so offer a more perceptually authentic moving image experience. This strategy introduces the notion of digital technologies representing the ‘film’ of filmic reality rather than the depicted referent. This effect was achieved using computer software to selectively blur discrete parts of the image area. Similarly, software tools to introduce digital ‘grain’, motion blur and lens aberrations to images help achieve the ‘film-look’ many filmmakers are enamoured by (see fig. 35 and Gaut, 2010, p. 17).

77 For more on the significance of the lens to digital technologies and culture see Chapter One of Jay David Bolter’s (1984) Turing’s Man: Western Culture in the Computer Age and Allan Douglass Coleman’s (1998) essay Lentil Soup: A Meditation on Lens Culture (pp. 113-131).
Stu Maschwitz, co-founder of now defunct digital effects company *The Orphanage* and creative director of the *Magic Bullet* software suite, writes on the subjectivity of creating this analog film-look with digital tools wryly:

> Is it uncompressed 2K frames? Or is it soft, rolled-off highlights? Maybe it’s 35mm depth of field characteristics. Or maybe it’s just where you put the camera. Or maybe part of the new “film look” is “Look, I’m editing my film on my MacBook Air on the ride home from the shoot, because I shot to a mildly-compressed codec that’s compatible with my editing software.” (2012, unpaginated)

Babette Mangolte (2003) describes digital grain as ‘the grains of the silver image of the past… added on with a simple aftereffect algorithm [sic: most probably referring to the animation and VFX software *Adobe After Effects*]’ (p. 261).

For digital work being exported back to film, the careful selection of appropriate transfer film stocks can introduce perceptible analog grain at the end of the post-production stage. Film grain is added as an analog effect to mimic a film shooting-stock that was never part of the recording process. This
complex simulation and out-of-sequence use of analog moving images is an
important intention of those using digital (and analog) technologies to make
moving images that are indistinguishable from analog images. Despite
materially highlighting the apparatus, it is widely believed that digital
manipulation that simulates artefacts common to analog film including film
grain, halation, bokeh, scratches and shallow depth of field renders these
images more real.78

Deborah Tudor describes this effect as ‘cinematic technostalgia’ and
acknowledges that it stems from a realist claim regarding ‘the lack of shared
light bouncing between the object and the film plane, and the loss of image
information through sampling [as] differentiat[ing] digital recording from the
perceived holistic nature of analog recording’ (2010, unpaginated).

Tudor also writes of how full digital processes have led to new visual aesthetics
citing the filmmaker Michael Mann as a proponent of this approach that
avoids a yearning for analog film and replaces it with a use of digital
technologies that create images that are as ‘detailed, specific, and textured as
the reality they [the audience] see right now’ (ibid). Crucially, this was
achieved in Mann’s Public Enemies (2009) predominantly in-camera as part of
principle photography. This was made possible because the uptake of digital
technologies has permeated all technical aspects of moving image production
and the mutability of digital media no longer makes clear distinctions between
stages of production. The sequence of recording and representing reality is now
inexact. Cinematography can now take place in post-production as discussed
above and VFX, once reserved for post-production, can now be implemented
in-camera during earlier stages of production.

78 ‘Bokeh’ (ぼけ or ボケ or ボケ味) is the aesthetic quality of blur in out-of-focus areas of a
photographic image based on the depth of field within the image. The shape, brightness and
saturation of colour in these areas of the image have a causal relationship with the lens used to
record the image and mimic the aperture of the camera lens. Different lenses, depending on
the configuration of lens elements and shape of the aperture (more circular or polygonal) result
in different bokeh.
As part of a seemingly unrelated interest on first view, Dai Vaughan (1999) delves further into this phenomena: ‘every shot is a record of something—even, if you want to push it this far, the sequence of still drawings which constitute an animated cartoon’ (p. 153). Vaughan is writing broadly on documentary film and specifically here of 1940s Italian neorealism. He is considering the additional burden of materialism that is applied to documentary—as discussed in Chapter Two—but this notion can be successfully applied to the synthetic photorealism generated by digital imaging in addition to Vaughan’s distinction between studio and location shooting in Italian post-war cinema. The virtual camera is a record of something, but this thing is not from the same profilmic reality as appeared in front of the lens.

The combinative analog and digital reality offered by digital technologies in moving images discussed above is also a seamless record of at least two distinct realities. Vaughan’s description of a sector of Italian post-war cinema as an ‘attempt to graft the materialism of documentary onto the stem of fiction’ additionally seems particularly apt here as a descriptor of combinative analog and digital technologies and also referenced and fantastical realities (ibid, p. 151). This notion will be explored further for referenced and fantastical photorealism in the section on digitally mediated science fiction film below.

An additional link between digitally manipulated images and analog photography is the texturing of 3D digital models with optical photographs rather than digitally created images. In VFX terminology, wrapping digital 3D geometry with a photograph is known as ‘UV mapping’ or ‘UV wrapping’. This process can be thought of as unwrapping the 3D geometry into a flat sewing pattern for the photograph or ‘texture’ to be laid out on and then stitched to the 3D geometry. The resultant digital 3D object is then ‘dressed’ in a digitised analog photograph. A similar effect can be achieved through digital camera projection of a texture onto 3D geometry. In this process, a

79 ‘U’ and ‘V’ here are axes on a graph, analogous to the more commonly used X- and Y-axes. The objects are mapped along these axes so as to register their position.
A tracked 3D virtual camera is used to ‘project’ a photographic image—here a ‘texture’—onto 3D geometry.

Cubitt (2004) discusses UV mapping with reference to digital imaging being ‘increasingly dependent on photographic elements’ and in a later essay, refers to this process or the resultant objects as ‘sprites’, a term in 3D usually reserved for objects with no depth and often functioning as textured back-drops in a 3D scene (2004, pp. 262-3, 266; 2010, unpaginated). I believe Cubitt is here not referring to sprites as part of a digital 3D VFX lexicon but drawing on a broader definition of the term after Alvy Ray Smith (2011) who argues that ‘sprites are just shaped images. A sprite is as simple as a pixel with shape’. Smith speaks of the visual misrepresentation of pixels as rectangular or square and nominates the abstracted GUI of Adobe Photoshop with its rectilinear canvas containing an array displaying square or rectangular pixels—dependant on the file’s Pixel Aspect Ratio (PAR) settings—as a serial offender. In fact, pixels can be far more organic in shape as evidenced by vector and raster screens of the mid twentieth century including radar and early computing displays. Smith (1995) more formally refers to a pixel as ‘a point sample. It exists only at a point’ (p. 2). Bill Mitchell (1992) pictorially reiterates this stance on the book cover of *The Reconfigured Eye: Visual Truth in the Post-Photographic Era* featuring an image of a human eye wholly constructed from picture elements (pixels) of the same image at varying scales. Mitchell discusses this phenomena briefly in the text of the book describing the making ‘of an image out of smaller versions of itself, so that a kind of visual analepsis results’ (p. 77). The related technique of mosaic photographic rendering became popular with print designers in the late 1990s with promotional material for Peter Weir’s *The Truman Show* (1998) one of the most recognisable examples (fig. 36). This technique mirrors the montage and sequencing processes of filmmaking, employing still images that constitute cropped frames of the finished work as pixels to construct a representation of the entire work and at
the same time, make comment on the excess and pervasiveness of camera imagery thematic to the film.

Cubitt (2010) then, is perhaps referring to sprites as the non-rectilinear shapes that these textures wrap and also the resultant shape of the textures when covering shaped 3D geometry. Importantly, the combination of Cubitt’s specific observations regarding UV wrapping, coupled with Smith’s (2011 & 1995) position on variably shaped or point-based pixels, supports the argument that the digitisation of analog photographs does not necessarily reduce these
images to a uniform array of rectangular pixels despite the GUI’s visual presentation. Gaps then, between perception and materiality operate at several levels of digital image rendering. It is evident however, that digital moving image techniques can at times be considered to be combinative—blending analog processes with digital technologies—in addition to being mutable and autonomous in their presentation.

As noted above, part of the digital creation and recreation of referenced photorealism involves simulation. What is being simulated by digital technologies as photochemical film—the benchmark of reality—however, is the *photograph of reality*, not just the scene the reality depicts. Manovich (2001) takes up this point arguing that ‘what is faked is, of course, not reality but photographic reality, reality as seen by the camera lens. In other words, what computer graphics has (almost) achieved is not realism but only *photorealism*—the ability to fake not our perceptual and bodily experience of reality but only its photographic image’ (p. 200). This is part of Manovich’s larger argument that technology has only achieved simulation of ‘film-based’ reality rather than profilmic or afilmic reality.

This foregrounding of the apparatus is evidenced by the arguably digital creation of CG lens flares, film grain, motion blur and synthetic camera shake observable as visual elements in J J Abrams *Star Trek* (2009); all simulating the materiality of the cine-camera, in addition to the scene (fig. 37).

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80 Rodowick (2007) describes this impetus toward the an analog cinematographic aesthetic thus: ‘a certain cultural sense of the “cinematic” and an unreflective notion of “realism” remain in many ways the touchstones for valuing the aesthetic innovations of the digital’ (p. 11)
Abrams has stated in interview that he ‘wanted this movie to feel real… I’m not saying you can’t be real with digital. But with film, for me, there was such a familiarity and comfort to it, a real [sic] warmth. We wanted to avoid coldness and any unnatural sense of perfection’ (quoted in Goldman, 2009, pp. 18-9). Roger Guyett, the film’s Visual Effects Supervisor and 2nd Unit director expands:

We felt a degree of believability comes with the idiosyncrasies that we allowed onto the film—those aberrations on the lenses, flaring, and even a little misframing or accidents. Often, it’s accidents that go on to make up the great pieces of movie art. We felt that by allowing flares in, we would get an organic infringement into the sterile frame—adding a bit of imperfection, a degree of reality. (ibid, p. 19)

Digital lens flare is a marquee digital effect that can be traced back to the beginning of digital desktop computer imaging. It appeared early in the history of digital visual effects because of the simple optical principles used to calculate the resultant pseudo-optical evidence of reality and remains a popular visual aesthetic to create a visual sense of seemingly optical ‘realness’ across
professional and amateur photography—both still and motion.\textsuperscript{81} Regarding lens flares in \textit{Star Trek} (2009) Abrams says:

They [the lens flares] \textit{were all done live, they weren’t added later}. There are something about those flares, especially in a movie that can potentially be very sterile and CG and overly controlled. There is something incredibly unpredictable and gorgeous about them. It is a really fun thing. Our DP [Director of Photography] would be off camera with this incredibly powerful flashlight aiming it at the lens. It became an art because different lenses required angles, and different proximity to the lens. Sometimes, when we were outside we’d use mirrors. Certain sizes were too big... literally, it was ridiculous. It was like another actor in the scene.’ (Woerner, 2009, unpaginated, my emphasis)

Michael Goldman (2009) however, describes a distinctly different methodology used to achieve the flares, and quotes Guyett again:

But the flaring technique hardly stopped once the production left the set. Mindel’s [the Director of Photography] camera work served as the inspiration for the creation of artificial lens flares for many bits of hundreds of visual-effects shots. These flares were created using a proprietary system developed at ILM [Industrial Light and Magic] to match the specific aberrations of Mindel’s anamorphic lenses.

ILM Sequence Supervisor Todd Vaziri was responsible for developing the artificial lens-flare software system, which the company dubbed \textit{SunSpot}. The system essentially combines off-the-shelf software, certain

\textsuperscript{81} Ironically, the creation of digital lens flares has proven problematic for post-produced digital stereoscopic VFX. Lens flares have no scene depth in that they are a record of light scattering within the lens elements in the cine-camera. They are not part of the pro- or a-filmic scene being recording and have no depth cues to offer the viewer. This means they are not locatable within the scene and perceptually believable photorealistic lens flares in stereoscopic films are difficult to achieve. For an introduction to and snapshot of the progress of digital tools for generating lens flare see Hullin et al. (2011).
proprietary ILM tools, photographed elements, and several custom paint elements to painstakingly match the flares captured on the negative.

“The technique gives compositors instant, highly realistic anamorphic lens flares for our all-CG shots that are indistinguishable from real, practical flares shots by the first unit,” Guyett says. “We used it to create flares for a variety of purposes such as spotlights on the exterior of the Enterprise, lights on synthetic set extensions, the Vulcan sun, and a dwarf star featured in the film’s prologue.” (p. 20)

Clearly then, despite Abrams’ advocating for the ‘realness’ of analog processes, there is a mélange of analog and digital flares depicted in Star Trek (2009). Importantly, at the service of verisimilitude, the digital flares use analog photographs directly and also draw on data captured at the time of analog shooting to reproduce ‘like’ flares in digital post-production. These are not generic flares drawn from a stock library of digital assets but ones matched to the camera lenses and lighting design employed for this particular production increasing their mimetic authenticity but bringing them no closer to material indexicality.

The Presentation of Representation

There is a parallel between this simulation of a photograph of reality and the integration of the depicted scene in Bruce Isaacs’ (2007) argument regarding deep focus techniques in Welles’ Citizen Kane (1941), a film whose deep focus and its implications for recreating the real is discussed in Chapter Two. Isaacs comments on Citizen Kane’s place in a chronological history following Classic Hollywood Cinema of the 1930s and 40s and its role in exploring ‘the boundaries of what Hitchcock called “pure cinema”’ (p. 115). Isaacs does not expand on his use of this term but I take this to mean a broadly—but not exclusively—anti-narrative approach that in Citizen Kane leverages technology—particularly advances in cinematography lensing—to create a
more affecting experience rather than using story, narrative or characters to connect with viewers. Isaacs argues that ‘the purity of the image achieves its resonance as a photographed (and thus reproduced) reality; deep focus allows the photograph to draw the entirety of the Real into its construction’ (ibid). The camera in *Citizen Kane* is formally foregrounded through new technique but also invisible in attempting to mimic the profilmic vista a spectator would have of this scene. In seeking to preserve the mode of naturalistic viewing through technology, the camera is at once highlighting a novel mode of depiction and also seeking to minimise the role of representation it is required to perform.

As digital motion picture technologies mature and establish new visual aesthetics, there is an increasing focus on incrementality with regard to photorealism, manifested here as the reproduction of photography in addition to the representation of reality particularly for instances of referenced photorealism. The depicted scene is subsumed and given additional mimetic verisimilitude within this focus on replicating the apparatus that further presumes the reality of a synthetic scene. Cubitt (2004) is a theorist notably preoccupied with a distinction between representation and display. He argues for event cinema that ‘the emphasis is on believability, not verisimilitude’ (p. 249). Manovich (2001) also shares this view, noting that a digital ‘illusionistic image is no longer something a subject simply looks at, comparing it with memories of represented reality to judge its reality effect’ (p. 183). Ron Burnett (2004) writes of the collapsing distinctions between naturalness and artifice and picks up on this thread concerning simulations of photographic representations of reality rather than of reality:

> The trees on the horizon and the stars in the sky no longer come to viewers through a purity of process and vision divorced from the *images* they have seen of trees and stars. Over the last two centuries, Western societies have built physical and psychological infrastructures that are dependant upon images of what I call image-worlds. This pulls trees
from their natural location into a more complex mediated space that is inscribed rather than natural. The images viewers watch are no longer just images. (p. 6)

Former ILM animation director Phil Tippett sounds a cautionary note alongside his active involvement with digital moving image technologies from their inception:

The computer demands that you be very procedural and use specific language to communicate and control it. It’s not the same thing at all as having a relationship with materials. My concern is that in the technical realm, things can be very monolithic and one can tend to lose touch and sight of the real physical world. (quoted in Vaz & Duignan, 1996, p. 231).

Both Cubitt (2004 & 1999) and Bukatman (1995) argue that the on-screen experience is sealed from reality ‘into miniaturized infinities bracketed off from the world’ (Cubitt 2004, p. 247). The requirement for referencing reality is less important than the communication of and ‘delight in the illusory perception of illusion’ (ibid, p. 256). In other words it is ‘defined by the frame of the screen, the world produced is a universe, and its principle of coherence made universal within that world’ (Cubitt, 2010, unpaginated). Prince (1996), in an earlier paper, argues that ‘perceptual realism, therefore, designates a relationship between the image on film and the spectator, and it can encompass both unreal images and those that are referentially realistic. Because of this, unreal images may be referentially fictional but perceptually realistic’ (p. 32). Prince importantly identifies a paradigm shift from the relationship between image and referent to one between image and viewer. It is this that allows a blend of referenced and fantastical photorealism.

Julia Moszkowicz (2002) is suspicious of this McLuhan-like stance. She reads these arguments as further distancing the technological from the social and as privileging technological determinism: ‘the ascendant discourse within CGI is
one which locates social agency, in all its forms, at the margins of the graphical interface’ (p. 307). Moszkowicz agrees that digital imaging ‘seems to have no need to refer back to “the real” because it has an integrity of its own’ but views this as a worrying reification of the computer, going so far to claim that this ‘position within CGI discourse secures a degree of autonomy for the computer which is tantamount to ascribing it a life of its own (p. 305). Burnett (2004) agrees that there is an increase in autonomy but reads this as an opportunity for partnership. Computers ‘become part of a dialogue about achieving particular goals and results (p. 97). Burnett does though, go on to argue for a cautionary approach to the cultural and societal transformations afforded by digital technologies. ‘Meaning’ for Burnett can never be excluded from the relationship between images and the viewer:

   The notion that information can be disembodied and can function in a dematerialised way is a trope of tremendous power. It makes it seem as if meaning were merely an add-on to technology…There is a danger that the human subject will become an add-on to what digital technologies provide and that human beings will end up as translators of information, the navigators rather than the creators. (p. 200)

As introduced above, yet another way of describing this insularity made possible by digital technologies is that the representational imperative of analog moving images excises the prefix of representation and in the digital realm becomes a presentation only, because of its inherent essentialism. As early as 1985 La Valley noted that ‘the dimension of analogue has virtually disappeared. Instead we are left yearning for greater and greater special effects, more convincing illusions’ (p. 157). A digital presentation can equally offer moving images both of reality and of synthetic origin and perceptual photorealism is core to the success of this (im)material enterprise. Perception, previously problematic in discerning the ontology of moving images because of disengagement between phenomenology and ontology, is now central to the
working apparatus of digitality. The insular mode of presentationism promotes apprehension to the essential mechanism of digital moving images.

This new mode of presentation that eschews indexical relationships with reality in display, has archaeological links to Peircian iconic (rather than indexical) pre-digital image making in its process. The presentation of recognition rather than simulation is similar to the contrast between photo- and hyper-realism in the 1960s and 70s paintings of Chuck Close, Don Eddy, Robert Cottingham, and Richard Estes; figurative painting beginning with cubism for which the representation of reality does not necessarily include likeness; and action or post-action paintings by Jackson Pollock, emblematic of artists for whom it can be argued made paintings without painting. Stanley Cavell (1979) links Pollock’s painting practice to automatism as implicit in photography. He argues that photography overcomes the subjectivity of painting through automatism. In contrasting photography with painting Cavell argues that painting’s ‘presentness’ is not evidence of ‘the world’s presence to us, but of out presence to it’ (p. 22):

One could accordingly say that photography was never in competition with painting. What happened was that at some point the quest for visual reality, or the “memory of the present” (as Baudelaire put it), split apart. To maintain conviction in our connection with reality, to maintain our presentness, painting accepts the recession of the world. Photography maintains the presentness of the world by accepting our absence from it. The reality in a photograph is present to me while I am not present to it; and a world I know, and see, but to which I am nevertheless not present (through no fault of my subjectivity), is a world past. (p. 23)
Digital Dissention

The field of moving images is so broad and voluminous that unsurprisingly, there are alternatives to the dominant trajectory. This is similar to those alternatives described in earlier chapters discussing the split between realists and formalists throughout the short history of the moving image. There are many filmmakers and theorists that have embraced new digital paradigms, at times uncritically arguing that ‘the difference between “real” and “screen” is not clear in digital viewing, that much is certain’ (Mangolte, 2003, p. 266) but there are also several high profile contemporary filmmakers including David Lynch, George Lucas, Quentin Tarantino and Steven Spielberg who to some degree shun the inroads that digital technologies have made into film production and reception. Examining these claims closely however, reveals a complex regard for the role of ever increasingly pervasive digital technologies. Many of these comments relate to content and not to the materiality of moving images and others comment on the nature of spectatorial engagement particularly as it relates to the dissipation of viewing contexts as noted at the opening of this chapter. This elusiveness is similar to the conflation between moving images and the experience of moving images highlighted in earlier chapters of this thesis.

Painter, writer and film director David Lynch (2005a), best known for his surrealist influenced arthouse feature films, speaks as a faux Luddite regarding the non-filmic experience of watching films on handheld digital devices:

If you are playing the movie on a telephone, you will never in a trillion years experience the film. You’ll think you have experienced it, but you’ll be cheated. It’s such a sadness that you think you’ve seen a film on your fucking telephone—get real!
Lynch’s most recent feature film is *Inland Empire* (2006), shot on prosumer
digital video and post-produced digitally. Since 2002 he has created a large
body of digital moving image work including episodic absurdist shorts and
online documentary works exclusively for release via the www and later released
on DVD. These works were designed to be experienced on the kinds of
‘telephone’ and computer screens that Lynch claims cannot show ‘films’. As an
advocate for the use of digital technologies in creating moving images, Lynch
distinguishes between the materiality of film and digital video and also the
medium of film and other moving images. He has often resisted in interviews
discussion of the meaning of his work and also how different media change the
approach and outcomes of his moving image work (Rodley, 2005, pp. vii; 187).
There are however, clues in the work itself. A number of Lynch DVD titles do
not have customary chapter breaks. As Samardzija (2010) notes, the DVD of
Lynch’s *The Straight Story* (2000) has a note from Lynch in the accompanying
printed matter—‘I know most DVDs have chapter stops. It is my opinion that
a film is not like a book—it should not be broken up. It is a continuum and
should be seen as such. Thank you for your understanding’. This supports an
argument that a Lynch narrative is linear even in its celebrated non-linear
offers the following observation regarding the materiality of consumer grade
digital video:

> The quality is pretty terrible, but I like that. It reminds me of the early
days of 35mm [film], when there wasn’t so much information in the
frame or emulsion. But the human being is a beautiful creature, you act
and react, and the medium starts talking to you. So I love working in
digital video. High-def is a little bit too much information. (quoted in
Samardzija, 2010, unpaginated)

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82 *Inland Empire* (2006) was photographed on Sony’s DSR-PD150 video camera recording in
DVCAM mode.
A recurring pattern from industry practitioners further illustrated in the text below, is one in which digital moving images are compared to analog images. Attempts are made literally or symbolically to visually replicate visual qualities of analog images but also a counter intention to create a diversity of new visual aesthetics reflecting emerging technologies. In the case of the enigmatic Lynch, production methods are found that do not play to one of the strengths of digital imaging—increased visual clarity—but this is not merely an attempt to make the digital appear analog. Lynch’s video works do not present as such; rather they conjure a visual abstraction that highlights the increasingly immaterial spectre of digital technologies, even while presenting figurative material. There are explicit hallmarks of the visual texture associated with consumer digital video in Lynch’s video works including a distinct lack of shadow detail, digital visual noise, highlight blowouts, and a visual softness to the images (see figs. 38-40).
A far more tempered and resigned view from one of the founders of the digital vanguard, George Lucas, also acknowledges the difference in watching a film on a 'phone' and on the 'big screen':
I am a giant proponent of giant screens. But I accept the fact that most of my movies are going to be seen on phones. Because that’s what’s going to happen. People can get whatever they want out of it on a phone. If they do, then that’s great. I don’t recommend it, but I certainly don’t say don’t do that. Because people have a right to do whatever they want to do, and see it under whatever conditions. But if you really love films, and you really want to get the full impact, there’s a huge difference between watching something on a small screen with a mediocre sound system and watching it on a giant screen in a giant theater with a huge beautiful sound system. I mean the difference is electric. (quoted in Corliss, 2006, p. 46)

However, Lucas is careful to contain his remarks to scale rather than comment on technology directly. He is aware of distinctions between perceptual discernment and materiality noting that: ‘I think it is very hard to tell a film that is projected digitally from a film that is projected on film’ (quoted in McKernan, 2005, p. 31). Lucas in his comments on both dissipated viewing contexts and perceptual verisimilitude clearly acknowledges the mutability of digital media.

Well known as a purist continuing to work with analog processes as his contemporaries increase their use of digital effects, Quentin Tarantino in an interview with Empire Magazine (2003) disingenuously rails against the use of CGI in contemporary film as he continues to employ digital technologies to create the visually spectacular fight scenes and gore that he is celebrated for. He describes a private preview screening of Kill Bill Vol. 2 (2004):

I watched Keanu [Reeves] watching and I suddenly felt it. You know, my guys are all real. There’s no computer fucking around. I’m sick to death of all that shit. This is old school with fucking cameras. If I’d wanted all that computer game bullshit, I’d have gone home and stuck my dick in my Nintendo… This CGI bullshit is the death knell of cinema. Movies
are far too fucking expensive at the moment and it’s killing the fucking art form. The way it’s going, in ten year’s time it will officially be killed [sic]. (Cinema Eye, 2003, unpaginated)

Tarantino creates forms of spectacle cinema and continues to exploit digital processes in instances where their use is not visually overt. This approach is most obvious in his 2007 film Death Proof that was both shot and post-produced digitally but visually treated to look like 1970s grindhouse cinema. Digital technologies were considered by Tarantino as the best way to achieve the visual aesthetic that he required—one that is extremely different from the default of seamless clarity that digital processes afford but makes extensive use of the mutability of digital media.

Steven Spielberg has been quoted as saying that ‘he will always edit his films on film’ (Prince, 2004, p. 26). I take this to mean he will always edit linearly with a positive film ‘work print’ of the camera negative print, physically cutting and splicing the sections of film together to make the finished sequence that becomes the final film. This reads in conflict to the spectacular digital cinema he is best known for even when only considering his role as a director. These films include the technically ground-breaking and heavily digitally produced and/or post-produced films The Adventures of Tintin (2011), Indiana Jones and the Kingdom of the Crystal Skull (2008), War of the Worlds (2005), Minority Report (2002), Artificial Intelligence: AI (A.I. Artificial Intelligence, 2001), The Lost World: Jurassic Park (1997), Jurassic Park (1993), and Hook (1991). The role of picture editing as one of the central story-telling methods of filmmaking is here being relegated to the sidelines as other digital post-production montage techniques step in.

What is common in these accomplished filmmakers’ positions opposing digital technologies that also goes some way toward minimising the conflict between their comments and their combined impressive body of digitally manipulated work, is that they are speaking of rejecting isolated segments of the digital filmmaking process while overtly engaging with other parts of this same digital
process. Putting aside guile and a welcoming of controversy palpable from three of the four interviewees, for Lynch this rejection is digital delivery on non-traditional screens; for Tarantino it is visual spectacle and virtual actors created through baroque digital visual effects; and for Spielberg it is the diminishing role of the non-linear digital picture-editing component of post-production. Other segments of these directors’ filmmaking processes unapologetically use digital technologies evidencing the increasing ubiquity of these techniques within moving image technologies.

Verisimilitude and Digital 3-D Cinema

An example of Tippett’s ‘losing touch and sight of the real physical world’ quoted above can be seen in ‘this new round of stereoscopy—arriving right on schedule, at the standard generational interval of 30 years’ (Kehr, 2010, p. 60). Digital 3-D cinema has been aggressively marketed by industry but also aggressively condemned by critics and theorists predominantly on the basis of valuing box office gross over quality.83 Roger Ebert’s (2010) Newsweek article “Why I Hate 3-D (And You Should Too)” capably sums up the dissenting position thus:

3-D is a waste of a perfectly good dimension. Hollywood’s current crazy stampede toward it is suicidal. It adds nothing essential to the moviegoing experience. For some, it is an annoying distraction. For others, it creates nausea and headaches. It is driven largely to sell expensive projection equipment and add a $5 to $7.50 surcharge on already expensive movie tickets. Its image is noticeably darker than standard 2-D. It is unsuitable for grown-up films of any seriousness. It limits the freedom of directors to make films as they choose. For

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83 For an excellent summary of the state of play between industry and critics with regard to stereoscopic cinema see Kirstin Thompson’s (2011, 2011a & 2011b) series of blog posts; Has 3D already failed?; The Sequel Part One: RealDlighted; Part Two: RealDgusted; and As the summer winds down, is 3D doing the same?.
moviegoers in the PG-13 and R ranges, it only rarely provides an experience worth paying a premium for.

The relevance of digital stereoscopic moving images here is two-fold. First, there is the increased verisimilitude made possible by added depth achieving increased photorealism with less of the visual aberrations associated with the previous incarnations of motion stereoscopy. Akira Lippit (1999) argues that ‘the impulse toward stereoscopic cinema is sustained by a fundamental cinematic desire to eliminate the last vestige of the apparatus from the field of representation, the film screen’ (p. 214). Kehr (2010) argues ‘if this effect can be carried over to live-action stereoscopy, Hollywood may finally have found its way of normalizing 3-D, of bringing it into line with color and sound as technologies that contribute to the suspension of disbelief crucial to Hollywood realism, rather than distracting from it’ (p. 67). This is a well-argued response to the outspoken opposition to digital effects presenting spectacle cinema at the cost of narrative and Kehr’s argument at its core, considers digital stereoscopy for moving images as a set of enabling technologies rather than being solely self-reflexive. Kehr, referring to the stereoscopy offered by Cameron’s Avatar (2010) argues that well rendered digital 3-D imagery is

an effect that overcomes that toy-theater sense of a series of flat planes grouped together and instead creates something continuous and perceptually whole. With this viscous space, Cameron has brought an entirely new element to the game. The contrast between foreground and background no longer seems quite as harsh and conspicuous as it did in the 3-D of the Fifties; it has all become mid-ground, a continuum closer to the way we actually perceive the world. (p. 67)

This observation prompts a revision of the discussion of Krauss (1982), Schiavo, (2003), Fowles (1994), Cowie (1999), Panofsky (1997) and Crary regarding stereoscopy (1990) in Chapter Two. In that discussion of analog stereoscopy there is a general accord that stereoscopic images offer a series of
planes with an absence in between these planes. ‘We are given an insistent sense of “in front of” and “in back of” that seems to organize the image as a sequence of receding planes. And in fact the fundamental organization of the stereoscopic image is planar’ (Crary, 1990, p. 125). The fine granularity of digital stereoscopic images however, offers the possibility of populating these breaches and so can present a lush cohesive vision of a deep synthetic space, ‘filling the gaps between objects with a continuous field of moving particles—dust mites, tiny insects, mist—that give a visual density to the ostensibly empty space. Everything seems to be swimming in the same, three-dimensional ether’ (Kehr, 2010, p. 67).

Secondly, there are broadly two modes of digital 3-D production, the first and less pilloried production method is shooting left and right eye views in-camera. Crary’s (1990) description of nineteenth century stereoscopy holds true here because the optical relationship is constant: ‘what appears is the technical reconstitution of an already reproduced world fragmented into two non-identical models, models that precede any experience of their subsequent perception as unified or tangible’ (p. 128). The second mode is shooting in 2-D and undertaking a post-production conversion to 3-D, increasingly outsourced to India and Eastern Europe due to costs associated with the labour intensive process of manually isolating and separating multiple depth cues for each shot within the film. The caveat emptor adage combined with a ‘results may vary’ process added to tight studio deadlines for public releases has resulted in many big-budget poor post-production conversions. In 2010 alone these included the widely derided stereoscopic results of films including Resident Evil: Afterlife, Piranha, Saw 3D, Wes Craven’s My Soul to Take and Cats & Dogs: The Revenge of Kitty Galore.

Materially this distinction is important. In-camera stereographic capture optically represents pro- or a-filmic events but in a synthetic space perceptually identical to analog stereoscopy that in Crary’s (1990) words: ‘shatter[s] the scenic relationship between viewer and object that was intrinsic to the
fundamentally theatrical setup of the camera obscura’ (p. 127). In contrast, post-produced 3-D creates and delivers at least one eye’s view as a wholly digital recreation of the camera capture, not only extinguishing any claim to indexicality, but doing so through different and more contemporary technological means.

Linking these two points is Bazin’s total cinema—perfect mimesis—and so the realisation of anti-cinema. Lippit (1999) describes the historical push for 3-D cinema as ‘cinema need[ing] to surpass, at some moment, the limitations of the basic apparatus—screen and projector—and provide a synthetic experience of the world, not just its reproduction’ (p 213). Lippit argues that the externalisation of the depth cues already present in ‘flat’ moving images via stereoscopic projection problematises the relationship between cinema and reality. I argue that there is then an absence of the screen—a defining characteristic of cinema. With no delineation between spectator and screen, digital 3-D cinema literally immerses the spectator in the spectacle of the image. Acknowledging the staged subjectivity inherent in moving images, Lippit describes 3-D cinema as a ‘kind of tangible phantasy’ (p. 214).

However, materially this is still a two-dimensional projection and the gap between perceptual experience and the technology of the apparatus is brought into stark relief. Recalling Lippit’s (1999) reference to Bertram Lewin’s ‘dream screen’ alongside the (fictional) presentation of augmented reality by Wim Wender’s dream-recording machine in Bis ans Ende der Welt (Until the End of the World, 1991) noted below, the pragmatic function of the apparatus is subsumed within the experience of immersive viewing, set apart from the mechanics of image production, but simultaneously acknowledging its entirely synthetic representation. The reality of 3-D cinema however, is that most current stereoscopic moving images are foregrounded as apparatus and the wonder of the image is presented as a triumph of digital technology. Lippit argues that 3-D cinema has promoted a shift from reproduction to mimesis, or duplication. I argue that this shift eclipses mimesis, moves towards and then
eclipses simulation, becomes unanchored within the digital realm and finally emerges as an insular presentation.

The twenty-first century wave of stereoscopic moving images follows 3-D film production and exhibition discussed in previous chapters and demonstrates an ongoing investigation into stereoscopic moving images in addition to the major waves of production and distribution in the 1950s and 1980s. Recalling my argument in previous chapters regarding parallel developments of technology and also their cultural and societal impetus, it is salient to acknowledge that there is more to the history of stereoscopy than an increasing drive towards verisimilitude. However Lippit (1999) accurately describes the cyclical history of 3-D production as ‘invariably erupt[ing] as amnesic stutters and lapses’ (p. 216).

As discussed above with regard to the elevation of apprehension in digital screening, the eye becomes enmeshed in the process of creating synthetic images. Crary (1990) describes stereoscopy of the nineteenth century as holding a particular place in the shift from the ‘ideal eye’ to one of ‘metonymy’ (p. 129). He argues that ‘no other form of representation in the nineteenth century has so conflated the real with the optical’ (p. 124). It appears that digital moving images continue, rather than announce this particular stereo viewing mode. Mid-nineteenth century experiments led to the stereoscopic work of the Lumiérès and Grivolas in the 1890s; William E. Waddell’s and Edwin S Porters’ anaglyph documentary rushes screened at the Astor Theatre in New York in 1915; Harry K. Fairall’s 3-D film The Power of Love screened in 1922; and William Van Doren Kelley’s Plasticon process resulting in Movies of the Future the same year. William F. Cassidy and Laurens Hammonds’ Teleview system which departed from the then dominant anaglyph model in favour of alternating images for the left and right eye was not successful in the 1920s but is the basis for early IMAX 3-D before more ergonomic polarising glasses took over and is also the core technology for shuttered glasses for current home stereoscopic viewing on 3-D televisions. Other innovations of
the 1920s include Frederick Eugene Ives’ and Jacob Leventhal’s *Stereoscopiks* technology with at least four feature titles released and the stereoscopic sequences within Gance’s *Napoléon* (1927) discussed in Chapter Two (Kehr, 2010, p. 62).

Stereo films via polarised light and parallax stereograms were prominent in the mid-1930s but it was the anaglyph 3-D films of the early 1950s that represent the first acknowledged widespread stereoscopic screenings, as discussed in Chapter Three (Zone, 2004). Minor 3-D productions in the 60s and 70s can be aligned with the release of exploitation films including *Adam and Six Eves* (1962), Francis Ford Coppola’s *The Bellboy and the Playgirls* (1962), *The Stewardesses* (1969) and the development of new technologies that became prominent in 3-D cinema’s revival in the first half of the 1980s, many employing dual 70mm projection. The second half of the 1980s introduced IMAX 3-D that began with anaglyph projection and more recently employs polarised glasses to achieve 3-D depth perception.\(^84\) IMAX offered a dedicated projection format that improved the image quality through the 1990s and solved many of the previous perceptual issues with 3-D projection. From 2002-2006, IMAX and digital 3-D formats shared feature film screenings with digital projection becoming the dominant form of stereoscopic projection and substantially increasing the number of releases from 2007 onwards.\(^85\)

Swimming against the tide of big-budget effects-driven cinematography, two contemporary relatively low-budget commercial feature film productions by veteran filmmakers shooting 3-D are Werner Herzog’s documentary *Cave of Forgotten Dreams* (2010) and Wim Wenders’ performance film, *Pina* (2011). Herzog’s film exclusively shows audiences one of the largest and oldest set of prehistoric paintings in the Chauvet caves in Southern France. The Chauvet-

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\(^84\) An extensive filmography of stereoscopic film up to 2004 with notes can be found in Palmer (2004). See also Mitchell (2004) for 3-D studio films of the 1950s and Zone (2007 & 2004).

\(^85\) See Sony UK’s (2010) Professional Education and Knowledge (SPEAK) infographic ‘Timeline of 3D Movies’ that details the majority of 3-D productions from the beginning of cinema along with the production technologies used in creating them.
Pont-d’Arc cave art is inaccessible to the public and has extremely restricted access for even scientists. Similarly, Wenders’ approach to shooting 3-D for *Pina* (2011) ‘eschewed the effects-driven “fairground trash” 3D favoured by fantasy films and blockbusters’ to create a dance performance film in which ‘the crisp images give a depth and sculptural quality to the dancers that would be unimaginable in two-dimensional cinema (Shineberg, 2011, p. 19).

These productions embody Kehr’s (2010) argument regarding the normalisation of 3-D moving images but here are considered against particular subjects. The 3-D release of Scorsese’s big-budget *Hugo* (2011) is perhaps a film that in its embrace of historicity and fictional narrative will create confidence in mainstream stereo film beyond epic spectacle. These films offer moving images containing stereography that is engaged as an enabling technology without a particular visual aesthetic. Herzog has stated that he would not necessarily shoot stereoscopically again. He considers 3-D the best way to tell the story of *Cave of Forgotten Dreams* (2010) but says: ‘I’ve never used the process in the 58 films I made before and I have no plans to do it ever again’ (Goldstein & Rainey, 2010). Conversely, Wenders considers 3-D a new ‘medium’ to work with and plans to complete future documentaries with digital stereoscopic technology (Shineberg, 2011). Looking to the future, vanguard technologist and inventor Douglas Trumbull signals his intent to venture beyond 3-D to even more immersive cinema experiences:

I've invested a lot of my time and energy in trying to make the medium better than it has been,” he says…. I think I’m about to make some major breakthroughs in that area, and I’m looking forward to the next year or two of my life. Not only to direct a movie or two, but also to bring new technologies I think will be even better than 3-D, making the movie experience immersive. If I can do what I really want to do, we'll be able to make an experience that’s indistinguishable from reality. (quoted in Juddery, 2011, unpaginated)
Referenced and Fantastical Photorealism in Contemporary Science Fiction Film

Alongside a synthesis of analog and digital technologies in the creation of digital cinema discussed above, specific genres have sought to foreground the materiality of digital technologies. Science fiction film pointedly offers further amalgamation to the application of hybrid moving image technologies. This is one of referenced photorealistic moving images—those that audiences recognise—having seen their real world counterparts or analog photo references—alongside fantastical photorealistic moving images; those with no real world referents. This kind of self-reflexive cinematic depiction challenges long held assumptions about realism in moving images and also the filmic reality that is ‘embodied in film theory’ (Prince, 1996, p. 28).

In its most basic form and in a reflection of its ontological status, La Valley (1985) defines science fiction film as ‘fantasy as a form of technological speculation’ (p. 144). Bukatman argues that ‘the variable distance between the language of the text and the reader’s lived experience can be seen as the genre’s ultimate object’. He goes on to cite Fredric Jameson on science fiction as a genre offering ‘the estrangement and renewal of our own reading present’ (Bukatman, 1998, p. 253; Jameson, 1991, p. 285). Science fiction film audiences accept that they are no longer looking at a recording of a profilmic event. An acceptance of the genre is an acceptance that what is presented is not entirely of reality. La Valley (1985) refers to this particular effect of science fiction film as showing us things that which we immediately know to be untrue but show[ing] them to us with such conviction that we believe them to be real… Yet because of the notion of impossibility, disavowal comes before avowal or

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86 In addition to these definitions, see Aylish Wood’s (2002) Technoscience in Contemporary American Film: Beyond Science Fiction for an expansive definition of science fiction film that considers films including Tim Burton’s Edward Scissorhands (1990) George Miller’s Lorenzo’s OIl (1992), Ron Howard’s Apollo 13 (1995), and Steven Soderbergh’s sex, lies, and videotape (1989) under the banner of science fiction.
at least directly with it in science fiction films. Because of this, we simultaneously revel in the machinery that gives us this deception. (p. 144).

In a correspondence model as used by Prince (1996) between moving images and reality, referenced photorealism in this thesis is what Prince (1996) refers to as ‘referentially realistic images’ and my term fantastical photorealism is what Prince refers to as ‘perceptually realistic images’ (p. 32). Prince’s latter term is problematic in that referenced photorealism can also be perceptually realistic. This then presents images that meet Prince’s definition for fantastical photorealism in that they ‘structurally correspond to the viewer’s audiovisual experience of three-dimensional space’ (ibid). I do not believe that Prince’s term is sufficiently distinguished from referenced photorealism to be useful here. The analogous terms offered by Michele Pierson (1999a) are a ‘simulationist aesthetic… entirely geared toward reproducing the photographic realism of the cinematographic image’ and ‘techno-futurism [which] describes a hyperreal, electronic aesthetic that is not entirely commensurate with this photorealism project. Techno-futurism also describes an aesthetic which, in cinematic terms, can barely be imagined outside of science fiction cinema’ (p. 35, my emphasis).

It is important to note that a secondary relationship, identified above by Prince (1996) is established in this correspondence model. It is that between the filmic image and spectator—mediated by perception—in addition to the relationship between the image and its Peircian Object. This means that broadly, fantastical photorealism realised through digital technologies can be seen to reposition the relationship between image and reality to one now between image and viewer as nominated in the Introduction to this chapter. This resonates with the arguments of Cubitt (2010 & 2004) and Bukatman (1995) noted above regarding the insular essentialism of digital moving images. Bukatman (1998), in a later text, further argues that ‘the experience produced by many effect sequences in science fiction cinema is one of hallucinatory excess as the
narrative yields to an abstract, kinetic spectatorial experience that exists apart from its representational function’ (p. 255). An earlier articulation of this position can be found in Cubitt’s criticism of Baudrillard’s (1983) position on simulacra: ‘yet the disappearance of truth in signification, which he [Baudrillard] equates with the loss of reality, concerns only one aspect of the sign: its reference. What remains is the communicative’ (Cubitt, 1999, p. 124). Cubitt advances this argument through an examination of the writing of Paul Virilio, Gianni Vattimo, and Dudley Andrews’ ‘expression,’ concluding that ‘in the cinema of special effects, the matter of the communication is then not an external referent but the relationship instigated between the film and the viewer’ (ibid, p. 126).

It must also be noted that the combinative techniques that blend analog profilmic and digital images discussed above, do not detract from my broader argument in that these analog assets are digitised as part of these processes and so the result—even if an analog film print—is one that has been rendered digitally.

Pierson (1999a) argues that:

In the early part of this decade [1990s], it was… science fiction cinema which made the public and social screening of the computer-generated image an occasion for speculation about the future of cinema itself. Much of this speculation focused on the question of how long it would be before digital imaging technologies had totally replaced physical and mechanical effects. (p. 29)

Additionally, the self-reflexive nature of science fiction film makes it an ideal candidate for the exploration of the shared roles of technology and the real, as it achieves this through examining utopian, dystopian, and other alternate realities mediated through technology as part of its remit. Pierson (1999a) describes particularly early digital science fiction as cinema that ‘shimmered with a special reflexivity’ (p. 36). Landon’s (1992) overarching argument, in
the second part of his book *The Aesthetics of Ambivalence: Rethinking Science Fiction Film in the Age of Electronic (Re)Production*, is that digital technologies are transforming science fiction film and also our relationship to science fiction. The story of technology and more specifically, motion picture technologies is more compelling than the stories that it presents. Bukatman (1990) writing of the legacy of science fiction texts argues that:

 Representation and textuality become the explicit subjects of the text; discourse will comprise the content as well as determine textual form. The inherent rhetoricity of the genre is extended as the text turns in upon its own production and status. The science fiction of the spectacle often demands the recognition of its own imbrication in the implosion of the real. (p. 200)

As La Valley (1985) notes after Steve Neale (1980), the ‘principle aim of science fiction movies is to illustrate the “state of the art”, to be in essence an advertisement by cinema for itself’ (p. 148). This view pre-empts a broader argument offered by David Rodowick (2007) that ‘films themselves tend to stage its [film theory’s] primary question: What is cinema?’ (p. 9). Bukatman similarly (1998) describes this concern as: ‘the meaning of science fiction films is often to be found in their visual organisation and in their inevitable attention to the act of seeing, and this is where special effects begin to take on a particular importance’ (p. 250). He also contextualises this view, anticipating Rodowick’s observation, in noting that:

 The special effects of contemporary cinema are a recent version of centuries-old spectacular technologies that moved towards immersive and apparently immediate sensory experiences, such as monocular and elevated perspectives, panoramas, large-scale landscape paintings, kaleidoscopes, dioramas, and the early “cinema of attractions”. (ibid)

As part of a partially dissenting position, Pierson (1999) argues that this reflexivity has early digital VFX in science fiction film ‘pulled, on the one hand,
towards photographic realism, and, on the other, towards a synthetic hyperrealism, the computer generated imagery in this cinema exhibits an aesthetic that plays across these two poles’ (p. 172). Pierson (1999, 1999a & 2002) argues that it is the ‘electronic reconfiguring of the cinematographic image which gives key CGI effects in these films their special reflexivity’ (1999, ibid). This is evidence of an emerging electronic aesthetic that is not aimed at representing reality. Significantly, Pierson transposes the emphasis of her argument from a broadly accepted position that considers the genre of science fiction cinema as self reflexive to one in which this self reflexivity belongs to the VFX within digitally realised science fiction film. Pierson (1999) and Hayward & Wollen (1993) nominate this as a ‘techno-futurist’ aesthetic that highlights the synthetic in early digital VFX and offers a ‘presentationist’ style (Pierson, 1999, p. 158; 1999a, p. 36).

**Historical Fantastical (Photo)Realism**

As noted above for the manipulation of moving images, fantastical realism correspondingly does not begin with digital technologies. Celebrated early films including Méliès’ *Le Voyage dans La Lune (A Trip to the Moon, 1902)*, Fritz Lang’s *Metropolis* (1927) and *Frau im Mond (Woman in the Moon, 1929)* present fantastical realism—although notably not photorealism in that the fantastical is clearly synthetic. Low budget B-grade ‘monster movies’ and similar larger budget 3-D and large screen spectacle cinema science fiction films of the 1950s explore, among other themes, the mutating effects of the atomic age often featuring scientists in technical settings and offer an increased fantastical realism when compared to their predecessors (Neale, 2000, p. 240; 87)

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87 In support of the argument regarding the mutability of digital media, Pierson (2002) in her subsequent book, *Special Effects: Still in Search of Wonder*, refers to this same pull as being between photographic realism and ‘synthetic plasticity’ (p. 128).
La Valley, 1985, pp. 145-54). Japan’s *daikaiju eiga* (giant monster films) are emblematic of these themes and as McRoy (2008) notes, they provide the perfect arena for addressing numerous social anxieties, not the least of which constellate around the dread of mass destruction, biological mutation, and the environmental impact of pollution resulting from rapid industrialization… *daikaiju eiga* remain creative forums through which very human fears over the manipulation of science and technology are projected onto fantastical physiognomies that engage in battle but rarely perish. (pp. 138-9)

Kubrick’s *2001: A Space Odyssey* (1968) as discussed above, presents a huge leap forward in realism. It is important to note however that “the photographic realism of any age assumes quaintness or distance as soon as “improvements” achieve fresh immediacy: our notions of the “real” are changed by the “realisms” which supersede each other to represent it’ (Hayward & Wollen, 1993, p. 2). In homage, *2001: A Space Odyssey* references the setting of Lang’s *Metropolis* (1926/7) and shares with Lang’s *Frau im Mond* (1929) a fastidious attention to detail. *Frau im Mond* presents an almost documentary rendition of then current state of rocket technology through data visualisation, physics diagrams and industrial film footage before segueing to fiction and leaving behind scientific fact as it tackles the moon voyage. *2001: A Space Odyssey* ushers the way for dystopian views of a technological future as part of a technoir genre that followed this. It is exemplified by films that often reprise the environmental concerns of *daikaiju eiga* including *THX1138* (1970), *Silent Running* (1972), *Soylent Green* (1973), *Westworld* (1973), *Logan’s Run* (1976), *The Man Who Fell to Earth* (1976), *Alien* (1979), *The Terminator* (1984) and *Terminator 2: Judgement Day* (1991), *Blade Runner* (1995), and Kathryn Bigelow’s *Strange Days* (1995).

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88 For a broader view of this theme see Mick Broderick’s (1996) chronological anthology: *Hibakusha Cinema: Hiroshima, Nagasaki and the Nuclear Image in Japanese Film*, particularly the contributions of Susan Sontag and Chon Noriega.
A concentrated exploration of alternate realities, often through VR, characterised a substantial offering in science fiction films of the 1980s that continues into the 2000s. This theme parallels the introduction of digital technologies to filmmaking processes as discussed above. These enhanced realities do not subscribe to other models of simulation argues Cubitt (2004); they are no longer ‘caught in the matrix of simulation, the theoretical end-stop to the old paradox of representation’ (p. 258). Significant films that explore these alternate—often augmented realities—almost all through a blending of analog and digital technologies include *Tron* (1982), Trumbull’s *Brainstorm* (1983), *Videodrome* (1983), the dream capturing machine in Wim Wenders’ *Until the End of the World* (1991) noted above, *The Lawnmower Man* (1992), *Virtuosity* (1995), David Cronenberg’s *eXistenZ* (1999), *The Matrix* franchise of films (1999 & 2003), Mamoru Oshii’s *Avalon* (2001), Gaspar Noé’s overtly materialist *Enter the Void* (2010), Paul Verhoeven’s (1990) and Len Wiseman’s (2012) *Total Recall* as noted in Chapter Two, the Holodeck in ongoing film and television representations of *Star Trek*—most recently in Abrams’ 2009 film discussed above, *Strange Days* (1995) also noted above, and Cameron’s 3-D epic *Avatar* (2009).\(^9\)

Cubitt (2004) argues for distinctions between CGI and compositing in citing Bukatman (1999) and Michele Pierson’s (1999 & 1999a) call to consider the synthetic properties of ‘electronic imagery’ alongside the ‘aesthetic project’ that is ‘geared towards simulation’ (Pierson, p. 158). Problematic now, given contemporary compositing, Cubitt argues for an ‘ethical dimension to the choice’ to use miniatures for example, rather than CGI. The distinction is that these miniatures can then be composited with other optical footage to create a seamless vista. Cubitt argues that this move to VFX ‘corresponds to a shift away from spectacle toward simulation of reality’ (p. 258). However, in recent compositing practice, a substantial proportion of the work of spectacle is in blending multiple CG images, not analog with digital assets. The practice of

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\(^9\) See Bolter (2005a) for further discussion of VR in the context of digital cinema technologies.
digital compositing as defined in Chapter Two—particularly in marquee Hollywood feature films—is now oriented toward synthesising a disparate group of analog and increasingly now, exclusively digital image assets. The in-principle notion of combining optical footage shot on film with a digital backdrop or even as Cubitt notes, enhancing profilmic footage with digital tools is no longer the dominant model that it was when Cubitt wrote this. Digitised analog images are spatially manipulated, colour corrected and otherwise tweaked in preparation for compositing in similar ways that complementary digital assets are. Compositing is certainly a distinct art within CGI VFX processes, perhaps even more so now than in 2004 but it has not continued to respect a focus toward simulation over spectacle. The focus is on synthesis, as it had been previously, but now this synthesis is concerned with bringing together a concoction of disparate 2D planes while preserving perceptual depth, not in blending the digital with an analog truth.

**Insularity, Doppelgangers and Inverse Depth in *Tron and Tron: Legacy***

Writer/Director Steven Lisberger’s *Tron* (1982) and Joseph Kosinski’s *Tron: Legacy* (2010) are an intertwined pair of science fiction films that offer a compelling illustration of the successive technological shifts of imaging technology in their depiction of a virtual diegetic environment through predominantly analog and digital technologies respectively. Alongside this lineage however, there is an important break in aesthetic that speaks to the new nature of digital images and highlights the implications of incremental photorealism and densely layered referentiality.

In a material layering of visual illusion and immediacy *Tron: Legacy* (2010) is a film that conjures a new *trucage* beyond the spectacle of nineteenth century trick-films and Gunning’s ‘aesthetic of astonishment’. La Valley (1985) describes the effect of the *old* trick as the audience
see[ing] something we know cannot happen, we know it is a lie and a trick, but we delight in the illusion, even giving it some credence—certainly within the narrative. But finally we give as much or more wonder to the machine which can produce this illusion and of which we are highly conscious. (p. 147)

Almost twenty years later however, Cubitt (2004), regarding science fiction film and Bolter And Grusins’ (1999) ‘hypermediacy’, offers a new iteration: ‘this is magical, but it is neither the magic of the illusion of life, nor of the awareness of trickality, nor yet of the endlessness of the graphical vector: rather it is the delight in the illusory perception of illusion’ (p. 256). With reference to Pierson’s (1999) quote at the opening of this chapter, it is clear that in contemporary CGI, the new tricks of VFX are no longer ‘bracketed off’ and are increasingly either invisible or alternately imbricated and enmeshed in ways that promote Cubitt’s and Bukatman’s (1995) views of insular essentialism (p. 173). Pierson nominates this as ‘a hyperreal electronic aesthetic that takes the cinematographic image as its point of departure’ (p. 171). Also in support of an unanchored presentation, and particularly fitting for the diegisis of science fiction film, Mulvey (2004) argues that occluding the profilmic event is essential for the success of narrative film:

The autonomy and credibility of a narrative world, its diegesis, depends on a successful representation of its story-time which, in turn, depends on the suppression of the moment of inscription, the presence of the past moment at which the film image was registered. (p. 145)

Tron (1982) charts the journey of Kevin Flynn; performed by the actor Jeff Bridges, as he is digitised and forced to defend himself in a virtual world—the grid—as part of a series of gladiatorial contests engineered by a malevolent master program. The reward for succeeding in these games is an opportunity to

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90 Cubitt’s reference to ‘trickality’ here is likely employed after André Gaudreault’s (1987) use of the term in his essay on the unacknowledged specificity of Méliès’ work.
outwit the program and return to the real world. The film presents a self-reflexive visual aesthetic that interacts with the then vanguard potential of CGI for moving images, in part through depictions of virtual CG environments comprising the diegetic world of Tron. Vivian Sobchack (1988) writing of the film, nominates

the “deep” and indexical space of cinematographic representation [as] deflated—punctured and punctuated by the superficial and iconic space of electronic simulation. This deflation of deep space, however, is presented not as a loss of dimension, but rather as an excess of surface. The hyperspace of these films is proudly two-dimensional—even in its depiction of three-dimensionality... It thus presents itself as “more visible” than the cinematographic image, less clouded by atmosphere. (p. 256)

Twenty-eight years on, Tron: Legacy (2010) focuses on believable and recognisable moving images rather than just the conundrum of simulating virtual reality—and does this in stereo. The recognition is to both referenced and fantastical photorealism but also to the earlier Tron (1982) film. Both films offer computer-simulated environments that are cast against the ‘real world’ but the later film adds an insular essentialism through a complex layering of visual representation and full digital production.91

The earlier Tron (1982) employs markedly different looks for the two environments—real and virtual—through contrasting practical art department looks for the real world with predominantly cel-animation techniques for the virtual digital environments. Sobchack (1988) argues that the ‘hyperreality of electric simulation’ in Tron visually depicted as a space in which depth is collapsed, functions to attest to its distinction from the ‘older model of “deep”

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91 Tron: Legacy (2010) was shot on two models of digital camera rigs: the Phantom HD Camera, and the Sony CineAlta F35 recording to HDCAM/HDCAM SR digital formats. The production was mastered digitally in 2K and then distributed digitally for D-Cinema projection, as anamorphic 35mm film in 2D and 3-D, and as 70mm dual strip 3-D.
space, affirming the latter’s contours, texture, and thickness as the primary ground for human movement and existence’ (p. 261). Conspicuously, *Tron: Legacy* (2010) reverses this relationship in rendering these different realities. Real world scenes in *Tron: Legacy* were photographed and are presented ‘flat’—in 2D, whereas the virtual world of the grid is presented stereoscopically throughout the film.\(^92\) Rather than the breadth of excess surface to depict digitality cited by Sobchack for the earlier film, *Tron: Legacy* presents in its place, depth—achieved through stereoscopic photography and projection—and in doing so relegates the real world to a deprived perceptual flatness in 2D. This separation of 2D and 3-D presentations via the addition of selected stereoscopic camera rigs in production, 3-D VFX in post-production and stereo projection in theatres, styles the diegetic virtual computer generated world as an inversion of Sobchack’s argument describing the deflated and so flattened electronic space in *Tron*.

Whereas the virtual and occasionally digital produced realm in *Tron* (1982) is notable for its distinction from verisimilitudinous cinematographic representation, *Tron: Legacy* (2010) revels in a set of techniques that recall the Technicolour representation of the Land of Oz following the sepia-toned Kansas in Victor Fleming’s *The Wizard of Oz* (1939) and also, as Cubitt (1999a) describes for the Wachowski’s *The Matrix* (1999): ‘the everyday material world becom[ing] banal and simulacral, the object of a subject whose subjectivity is lifted ... far above it’ (p. 116). This foregrounding of the new as discussed in Chapter Three blurs the boundaries of moving image technologies and diegesis. Not only does *Tron: Legacy* render the real world perceptually impoverished, the new technology foregrounded is both within and outside of the diegesis, an extensively developed tactic that is discussed below. *Tron: Legacy*’s promotion of a separation achieved through privileging excessive

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92 The exception to this approach is a flashback sequence on the grid showing the construction of the film’s virtual world and then the destruction of the Iso towers that prevent Flynn from returning to the real world. This is stylistically set apart from the other grid environments to foreground that it is of a time past and is created as a flat CGI sequence in 2D. This sequence is selectively seen as a 2D image inside 3-D rendered space.
perceptual depth for the grid when compared to the flat ‘real world’, is in Sobchack’s terms—an ‘inflation’—but here an inflation of medium in addition to Sobchack’s (1988) ‘excess scenography’ as visible in, for instance, Blade Runner (1982, pp. 261-2).

In a precise allegory to the increasingly insular and ever more photorealistic evolution of digital VFX in the twenty-eight years between production of the two films, Kosinski describes his director’s vision of the grid in Tron: Legacy (2010) as having

been sealed off on a [computer] server 28 years ago, disconnected from the internet, and, like the Galápagos Islands, it continued to evolve in a closed system. That world continued to be refined for the equivalent of thousands of years in the computer, as opposed to the 28 years in the real world; and as it evolved, the simulations became more realistic, more visceral, and more physical. (quoted in Duncan, 2011, p. 33)

Sobchack (1988) considers the virtual world of the grid, and particularly its inhabitants—referencing only the earlier film but proving a valid observation for both works—after Bukatman’s ‘terminal identity’—the subject as the terminal of multiple visual and digital information networks and also as bearing a new identity in the information age: ‘for most of the film, almost everything and everyone have mutated into a simulation, and the category of the “real”… is short-circuited and loses power. Simulation seems the only mode and space of being’ (p. 257).93 The simulation that gives way to presentationism in Tron: Legacy (2010) amplifies Sobchack’s ‘effect’. It is one that presents as part of a hierarchy that begins with the simulation of the diegetic worlds of Tron; supported by the digital simulation of environments and actors; which are in turn, supported by the simulation of stereoscopic

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93 Bukatman’s ‘terminal identity… refers both to the end of the traditional self and the emergence of a new self-definition constructed at the computer station or television screen’ (Bukatman, 1998, p. 253). It, in turn, follows William Burroughs’ (1964) use of the term in his cut-up novel Nova Express, and is attributed to Burroughs by Beat scholar Eric Mottram (1978).
space on a 2-D plane; simulating unreferenced reality. These layers of simulation and their referents promote simultaneously a complex perceptual mimetic model and in resolution, an insular essentialism in an arrangement that recalls Bukatman’s (1990) description of Philip K Dicks’ novel *Ubik* (1969) in which ‘the reification of the real is replaced by a recursive structure of infinite regression’ (pp. 208-9).94 This arrangement also recalls and offers an incremental increase to Bill Mitchell’s (1992) argument of interpictoriality:

The digital structures that are produced and consumed do not just refer to each other, they are actually made from each other, so that they form mirror mazes of interpictoriality hooked to the external physical world (at relatively few points) by moments of image capture. Images do not just mirror the world directly, as they once seemed to do, but reflect traces (perhaps tinted or distorted) of other images. (p. 52)

Mitchell’s ‘moment of image capture’ in *Tron: Legacy* (2010) is done away with and the ‘traces of other images’ are now recognitions, not referents (ibid). It can then be seen how Comolli’s and Cubitt’s *mise en abyme* discussed in the previous chapter is front and centre in the appositely named *Tron: Legacy*.

The reduplication presented is one that breaks the bounds of the fictional narrative and interrogates the mimetic representation of a specific actor across the two films. *Tron: Legacy* (2010) again features Jeff Bridges whose profilmic performance is recorded on digital film and then digitally manipulated but also a representation of his character’s (and actor’s) younger self as a CGI head atop another actor’s body as the virtual character Clu. The film presents both a CGI character driven by the actor Jeff Bridges—Clu, who is a digital doppelganger for the younger Kevin Flynn, and also a digital doppelganger for Jeff Bridges from *Tron* (1982; see figs. 41 & 42 respectively).

94 Incidentally, Dick’s novel *Ubik* (1969) is, after several attempts, currently in development to be realised as a feature film directed by Michel Gondry and produced by Film Rites (Jagernauth, 2011).
The audience is offered a 2010 manipulated digital representation of Jeff Bridges and also a 1982 version that blends profilmic and digital images of the actor. The mimetic believability of this character represented by two figures, one visibly twenty-eight years older than the other, is achieved by making the recognisable face of a marquee actor appear as he did in the same environment at thirty-five years old, alongside, and in a critical scene, against his performance as a sixty-three year old in the more recent film (fig. 45).95

95 The triad of Kevin Flynn, his nemesis Clu, and Kevin’s son Sam, played by Garrett Hedlund in Tron: Legacy (2010) is also evident in the framing and sequencing of the shots in this scene particularly. This scene overtly comments on a generational relationship between the biological and the synthetic and also the ‘legacy’ of representation alongside reproduction.
The VFX work for these sequences was undertaken at Digital Domain, and by the same team as responsible for the VFX work instrumental in creating the ever-more-youthful Benjamin Button as played by Brad Pitt in Fincher’s *The Curious Case of Benjamin Button* (2008). In that film, more than half of the depictions of the titular Benjamin were CGI heads as the film charted the gradual inverse aging—or ‘youthenizing’ as the production team dubbed it—of the character. For example, all images of Benjamin in the first fifty-two minutes of the film use CG heads to represent that character (‘The Science Behind…’, 2009). The technology was tested through earlier and smaller productions in the form of advertisements for North American Popcorn brand *Orville Redenbacher* in 2007 by the same team headed up by Eric Barba. ‘Orville was famous for his direct to camera promotional spots that aired on US television in the 70s and 80s. After his death, Fincher used CGI techniques to bring him back for a spot in 2007’ (Seymour, 2009).

Unlike *The Curious Case of Benjamin Button* (2008) however, *Tron: Legacy* (2010), presents a frame that is shared by visual representations of the character Kevin Flynn both as he appears in *Tron* (1982) and *Tron: Legacy* (2010). The mimesis is not only against other visual representations of the character within the same work but against the earlier *Tron* film and more importantly within a context of degrees of reality, the same actor as he appeared twenty-eight years earlier. For *The Curious Case of Benjamin Button*, Barba describes the goal as ‘not to create Benjamin’s performance in animation, but rather to “xerox” Brad Pitt’s performance onto this CG head’ (ibid). For *Tron: Legacy* the team needed to visually create a digital doppelganger of the actor as he had appeared in 1982 to play opposite himself in the late 2000s (figs. 43-5). As Duncan notes:

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96 Some scenes in *Tron: Legacy* (2010) feature a CGI head atop another actor’s body and others are full CGI creations known as ‘synthespians’ or ‘vactors’. For more on the history of synthetic actors see Notaro (2009) and Causey (1999).
As challenging as the *Benjamin Button* [2008] effects had been, the effects artists had benefited from the fact that nobody knew what an 85-year-old Brad Pitt would look like. In contrast, *everyone* knew what a 35-year-old Jeff Bridges looked like, which meant that audiences would recognize immediately if the digital character failed to re-create the actor in every detail. (2011, p. 30)
In an acknowledgment that the digital Clu was a representation of Jeff Bridges rather than solely the character Kevin Flynn, Digital Domain Animation supervisor on *Tron: Legacy* (2010) adds: ‘not only has everyone seen a young Jeff Bridges… but everyone has a different recollection of what he looked like. Some remember him best from *Starman* [1984], others remember him in *Against All Odds* [1984], others remember him in *Tron* [1982]—and he looks different in each movie!’ (ibid, pp. 33-4).97

Recognition here is more important than mimesis, representation becomes simply presentation, even through a tangle of visual references that are necessary to create it. This in turn, recalls Bertrand Russell’s (1921) observations on sensation and perception:

> When we perceive any object of a familiar kind, much of what appears subjectively to be immediately given is really derived from past experience. When we see an object, say a penny, we seem to be aware of its “real” shape we have the impression of something circular, not of something elliptical. In learning to draw, it is necessary to acquire the art of representing things according to the sensation, not according to the perception. And the visual appearance is filled out with feeling of what the object would be like to touch, and so on. This filling out and supplying of the “real” shape and so on consists of the most usual correlates of the sensational core in our perception. It may happen that, in the particular case, the real correlates are unusual; for example, if what we are seeing is a carpet made to look like tiles. If so, the non-sensational part of our perception will be illusory, i.e. it will supply qualities which the object in question does not in fact have. (p. 32)

Temenuga Trifonova (2006) indirectly takes up this point in her re-reading of Kracauer’s ideas of cinematic realism: ‘insofar as the task of cinematic realism is

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97 A note bridging Flynn and Duncan’s observations on subjectivity is made by Julia Moszkowicz (2002) regarding the rendering of Princess Fiona in *Shrek* (2001): ‘no one knows precisely how dinosaurs moved, but everyone knows what a princess looks like’ (p. 295).
the transformation of conventional reality, the fantastic object meets the demands of camera-reality more easily, or to a greater degree, than the real object (p. 57). Trifonova argues that the image releases an object from its referent, creates a ‘self-sufficient and self-referential’ reality that increases its photogenic qualities—after the mysticism of photogénie noted in Chapter Two (ibid, p. 67).

Despite Pierson’s argument that the ‘charismatic state of grace’ regarding a focus on materiality ended in the mid 1990s, this choice to present Bridges playing opposite his younger self resonates with Pierson’s argument regarding pre-1995 digital science fiction VFX, now updated to reflect 2010 technological possibilities:

But in all of the films of this period, the presentation of key computer-generated images was geared towards suspending spectators’ willed immersion in the action long enough to direct their attention to the display of a new kind of artifact. (p. 37)

Interviewed by fan magazine Starlog in 1982, co-supervisor of visual effects on Tron (1982) Richard Taylor, espouses the wonder of digital graphics as simulation and as non-combinative. He also describes aspects of working with 3-D digital computer graphics to create ‘digital scene simulations’ that read equally well when considering contemporary CGI:

In computer animation… the object the computer creates (lightcycles, people, flowerpots etc.) are totally three dimensional and totally true to their reality—they have perfect perspective, they move accurately in space and there are no matte lines… in fact, there are no such thing as mattes. There are no limits to the physical objects which the computer creates. They can pass right through each other, they can metamorphase [sic], they can be transparent one minute, opaque the next. Also there is no limit to the point of view of the camera. You can be inside an object
looking out, zoom out 100 miles in a flash or coast an inch above or an inch below the surface of the object. Anything you wish. (pp. 75-6)

**Insularity and Referenced Photorealism**

Images belonging to the category of fantastical photorealism then, can be seen in much digitally produced science fiction film. I argue though, that much of this seemingly non-referenced imagery extensively employs extrapolation techniques to offer more realistic depictions of fantastical images. It is recognition as phenomena that privileges perceptual realism without indexicality; that promotes photorealism without referent. It is recognition that allows perceptual realism to operate as an essential component of the materiality of digital moving images. This preserves the insularity of these images and simultaneously renders their transubstantiation.

These fantastical images extrapolate from the real—particularly algorithms drawing on the laws of physics—to construct images that rely on, but do not present, the physicality of real world referents. The digitally created pseudopod morphing water creature from Cameron’s *The Abyss* (1989) moves and interacts with Mary Elizabeth Mastrantonio’s character, Lindsey Brigman, according to algorithms that describe the behaviour of water across twenty shots and a total of seventy-five seconds of screen time. The molten-metal Terminator in Cameron’s *Terminator 2: Judgement Day* (1991) and the sandstorms of Stephen Sommers’ *The Mummy* (1999) respect the laws of physics in their morphing abilities and behaviour alongside an extension and maturation of the digital morphing technology used in *The Abyss*. As Lincoln Hu from the *Human Motion Group* at ILM that worked on *Terminator 2: Judgement Day* observes: ‘you have to follow the laws of physics. A walking chrome creature, even though it’s an abstraction, needs to reflect and move correctly, or it’ll look phony to the audience’ (quoted in Vaz & Diugnan, 1996, p. 204). It is virtual physics, via algorithmic engines, that are harnessed in
computer programs generating these simulations. They are first accurate simulations of real world behaviours and then extrapolations of these rules when digital images depict fantastical events. In Cameron’s *The Abyss* and *Terminator 2: Judgement Day*, these are notably visual morphing behaviours.

Following Sobchack’s (1988 & 2000) influential arguments regarding the flattening of space in the digital virtuality of *Tron* (1982) and Cubitt’s (1999) digital ‘spatial effects’—both viewed alongside a broader postmodernist view of the spatialisation of time or the domination of space to the detriment of duration—these examples of morphing in early digital science fiction film are predominantly spatial rather than temporal. More recent science fiction film additionally features temporal morphing, most notably *The Matrix* trilogy’s ‘bullet-time’ (1999 & 2003). Additionally, Wood (2002) outlines a third term—‘timespace’, which encompasses and ties together the modes of spectacle and narrative, operating not unlike Deleuze’s action-image to integrate VFX within spectacle cinema. Wood argues that in this model VFX as ‘mobile agents… have the potential to introduce a dynamism to narrative space, one which can be addressed by a reconfiguration of ideas about the relationship between time and space in the cinema through the idea of timespace (pp. 376-7). Pierson (1999) argues that there has been more recently a shift away from the ‘simulationist aesthetic’ of early digital moving images toward an ‘assimilationist aesthetic that, instead of presenting the computer-generated image as an aesthetic object, is directed towards integrating the special effect into the action’ (p. 175).

The morph is representative of both the non-linearity and the mutability of an arguably rectilinear array of pixels in digital moving images. The digital image is inherently manipulable and photorealistic transformation from one seamless figural reading to another is clearly a digital trope: ‘the morph literally and visually exposes the dissolving of difference as a crucial characteristic of the digital’ (Spielmann, 1999a, p. 145).
In addition to mimicking the behaviour of water movement, the pseudopod also morphs into facial likenesses of *The Abyss* (1989) characters Bud and Lindsey, and by extension, these actors’ faces. (fig. 46).

Figure 46 From Cameron, J. (1989) *The Abyss* [Motion Picture, DVD frame grab]

Vaz and Duignan (19996) note that:

> Unlike the [Pixar] laser scanner used to create physical sculptures of the Starship *Enterprise* crew in *Star Trek IV: The Voyage Home, 1986*, the new generation Cyberware scanning equipment (owned and made available by Disney Imagineering, the R and D arm of the company’s theme park division) recorded raw numbers that could be inputted into ILM’s CG system and then manipulated. (p. 198)

Disregarding the conflicting statement from the same authors citing the ‘range of laser-scanned expressions’ the production had to draw on, it is clear that the celebrated morphing of the pseudopod creature refers not only to its accurate water-like behaviour but also its diegetic simulation of the human cast of *The Abyss* (1989; ibid). This layering of simulation, moving from diegetic to production and from character to actor is another example of the presentationist discussion considering recognition and mimesis in *Tron: Legacy* (2009) above. It further reinforces the cloudy distinction between referenced and fantastical photorealism particularly when both production and reception are considered.
Simulation is foregrounded here in that to be believable, the morph must reference reality. Cameron interviewed regarding the creation of the pseudopod observes that 'what finally worked was a blend of things. Playing with the scale and speed of the ripples, determining the right mix of reflection and refraction. If the ripples weren’t the right scale and speed, the surface looked like jello or molten glass. With too much reflection, it looked like chrome' (quoted in Baker, 1993, p. 40). Further, the visual images that represent the spatial morph between the start and end frames are examples of an insular essentialism. These images employ simulatory real-world referents and exist only in the diegetic space of the shot. The digital morph, within a single shot, presents simulation in the start and end frames and insular fantasy in the intervening frames. The morphing effect can be viewed as reflective of presentationism argued for in this chapter. The digital morph at once offers both fantastical and referenced photorealism—insularity and simulation.

With respect to both spectacle and the material aspects of image, *The Abyss* (1989) offers a new arrangement of new technology in a new mode. Cameron observes of the film: ‘we were trying to create something that had never been seen before’ (Baker, 1993, p. 39). This is an early example of digital imagery that continues to reference real world phenomena through simulation and algorithm despite casting aside profilmic capture.

**Jurassic Park’s Dinosaurs: Illusion and Allusion**

Spielberg’s *Jurassic Park* (1993) is significant in ‘cementing a shift in cinematic special effects away from photographically conceived effects toward digitally conceived images that have their origin in computer reality which have become integral to late-twentieth- and early-twenty-first-century spectacle’ (Ndalianis, 2004, p. 185). The dinosaurs of *Jurassic Park* are correspondingly significant. These digital creations from the advent of emerging digital moving images are simultaneously of a referenced afilmic world and fantastical. Dennis Muren,
Industrial Light and Magic’s (ILM) VFX supervisor on *Jurassic Park* enthuses: ‘no longer were computer-generated images just a background distraction. They were the actual dinosaurs—living, breathing, totally real. You couldn’t believe a computer had done this’ (quoted in Kaplan, 1993, p. 60).

Similar to the illustrative potency of *Tron* (1982) and *Tron: Legacy* (2010) discussed above, *Jurassic Park* (1993) offers a distinct rendering of reality that bears particular scrutiny in terms of representation, simulation and verisimilitude. The film unmistakably demonstrates the digital moving image component of allusion. *Jurassic Park*’s CGI dinosaurs are filmic representations of the real (prehistoric) world but hitherto unseen as part of a filmic reality or representations of profilmic reality. They blend the fantastical and the referenced in equal measure. This photorealism prompts, and in fact requires, recognition not of the referent but its depiction. This tiered structure of recognition perched atop simulation, in turn buoyed by representation, is in its delivery a relationship between image and viewer, not image and referent. Recognition here is not from a- or profilmic reality but from allusion—other representations of dinosaurs and a knowledge that they did exist. It is this that leads the digital image materially to its insular essentialism, standing in for prior representation and no longer requiring a direct real world referent. Digital images such as *Jurassic Park*’s dinosaurs are allusion and illusion combined.

*Jurassic Park* (1993) employs both profilmic dinosaur models and miniatures in addition to the digital dinosaurs—described in the film credits as ‘full-motion dinosaurs’—often associated with the film (Elsaesser & Buckland, 2002, p. 211; Vaz & Duignan, 1996, p. 218). This discussion will refer to only the digital creations of *Jurassic Park* but can also be applied to the dinosaurs of Spielberg’s sequel, *The Lost World: Jurassic Park* (1997) and to a lesser extent, Joe Johnson’s *Jurassic Park III* (2001). The films extrapolate the possibilities of extracting dinosaur DNA (deoxyribonucleic acid) from insects fossilised in
amber in parallel with the digital moving image rendering of dinosaurs based on existing knowledge of what dinosaurs might have looked like.

Buckland (1999) and Elsaesser & Buckland (2002) describe this approach to story as ‘what [analytic] philosophers of modal logic call a “possible world” (Buckland, 1999, p. 177).’ Buckland’s and Elsaesser & Buckland’s overarching argument is that *Jurassic Park* can be viewed as more than spectacle cinema and instead, the representation of a possible, rather than actual, world can be argued as motivating the ‘special effects and action sequences’ (ibid, p. 180). *Jurassic Park* then, contains fictional and non-fictional dimensions because the digital dinosaurs as fantastical depictions did exist. As for select other science fiction film, *Jurassic Park* begins with fact but instead of extrapolating toward the fantastical, it consciously extends these facts only to the limits of possibility. The combination of these known and possible facts are realised through digital moving images and so the diegetic world of the film is at once referenced and fantastical—as are the dinosaurs.

This is further enhanced by then vanguard use of post-production techniques of digital motion-blur and match-moving in which optical footage and post-produced digital shots can be spatially registered with each other using motion-control hardware, even when the camera is moving. First seen by public audiences in Zemeckis’ *Who Framed Roger Rabbit?* (1988), the optical camera movement is recorded and input into a digital production environment for replication with digital assets in conjunction with camera lensing information. This offers increased verisimilitude and appears more ‘natural’ and so more convincing to the viewer.

Elsaesser & Buckland’s (2002) and Buckland’s (1999) arguments are not

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98 ‘A possible world is a modal extension of the “actual world”. Fiction, on the other hand, we can think of as a purely imaginary world that runs parallel to, but is autonomous from, the actual world’ (Buckland, 1999, p. 177).

99 Curiously, just after the commencement of production on *Jurassic Park* it was announced that scientists had ‘extracted the DNA of an extinct bee that that had been preserved in amber for 25 million years’ (Vaz & Duignan, 1996, p. 214).
representative of broader theoretical views of *Jurassic Park* (1993). Pierson (1999), more agreeable to a dominant position regarding early digital science fiction film as spectacle argues that the film is an ideal candidate to valorise Landon’s (1992) ‘dream of simulation’ in which ‘*Jurassic Park* was widely billed as a cinematic event which would reveal special-effects imagery that was yet one step closer to realizing the science-fictional dream of total computer-generated simulation’ (Pierson, 1999, p. 167). Pierson notes that:

In the build-up to *Jurassic Park*’s release, speculation about the film’s computer-generated dinosaurs generated by far and away the most publicity for the film. In fact, no other film so perfectly exemplifies certain aspects of Landon’s description of the way that special-effects imagery functions in the contemporary science-fiction film. In the first scene in which one of the much-anticipated computer-generated dinosaurs is finally unveiled—both to the characters in the film and to the audience in the cinema—the narrative all but comes to halt, the music gradually builds, and shots of characters reacting to the appearance of the dinosaur with wonder and amazement are interspersed with long takes displaying the computer-generated brachiosaur centre-screen. (pp. 166–7)

Similarly, Angela Ndalianis (2004) argues that the digital technology rendering the dinosaurs is the ‘primary attraction’ of *Jurassic Park* (1993): ‘engaging the spectator in a game of perception that is also about an understood deception: a revelation of chimeras’ (p. 166). Her position picks up on La Valley’s (1985) ‘technological speculation’ and Neale’s (1980) discussion of the function of science fiction film in arguing that:

*Jurassic Park* [1993], in fact, has a great deal to inform the audience about in terms of the way contemporary culture is grappling with the issue of changing realities. This concern about changing realities is evident both within the diegetic space (in the plot’s concerns with the implications of genetic engineering, computer technology, and the
simulated experience of high-tech theme parks), as well as in the film’s employment of special effects (which reveal a level of technological advancement that allows for the construction of illusionistically convincing depictions of a new dinosaur age). (p. 180)

*Jurassic Park*’s (1993) dinosaurs prompt a response of heightened perceptual realism not only at the service of a simulatory real but as an essential part of the materiality of these images. Without visual recognition of the movement, skin texture, and colour of these never seen creatures, the claims of these dinosaurs’ verisimilitude would be lost.

Manovich (2001) describes the ‘degradation’ of the ‘perfection’ represented by CGI in *Jurassic Park* (1993) as motivated by a desire to perceptually match the ‘imperfection of the film’s graininess’ (p. 202). Manovich unnecessarily characterises this process as making the pure digital image impoverished to fit the analog filmic image. This reads against his argument that ‘the synthetic image is free of the limitations of both human and camera vision. It can have an unlimited resolution and an unlimited level of detail’ (p. 202). It does however, reinforce his view—discussed above—regarding the distinction between simulating the filmic image rather than pro- or a-filmic reality.

In addition to my argument regarding recognition, my alternate reading of this point is that the creation of images via film cameras composited with CGI produces different raw visual aesthetics and the mutability of the digital image straightforwardly lends itself to an imbrication with filmic imagery at the service of a cohesive photorealistic image. This is in opposition to Manovich’s arguing for CGI ‘bend[ing] down before the film image’ (p. 204). And clearly the synthetic image is not unlimited in resolution or detail in practice. Current technology—whenever that time may be considered—dictates an empirical limit to the extent of resolution and detail achievable by digital imaging tools.
Conclusion

I argue that in the decade since Manovich’s (2001) text, the integration of CGI with analog film sources and also the exclusive use of digital moving images in filmic works has offered an array of combinative, continuous, simulative, representative, insular, allusory, and assimilative visual aesthetics as discussed above. All of these are predominantly enabled by the transubstantiation of images through the photorealism offered by digital technologies and its ability to prompt recognition without direct referent. I argue that this new image-making and reception is an essentialist endeavour; that simulation offers a presentationist mode as the image/referent relationship is co-opted by an image/spectator dynamic. This mode at its core is insular and necessarily internal to the diegesis despite complex layered and incremental referentiality.

Echoing and extending Burnett’s (2004) argument on the independence of digital images discussed above in which ‘truth has become an increasingly relative concept, based more on context than on anything absolute’, this trajectory is toward autopoiesis, away from any external reference, and certainly away from a causal relationship with pro- or a-filmic reality (p. 206). Rather than subscribing to Rodowick’s (2007) view that ‘the digital arts render all expressions as identical since they are all ultimately reducible to the same computational notation’, I argue that the presentation of digital moving images has evolved from rendering images that mimic reality to now additionally encompassing the creation of perceptually authentic self-contained realities (p. 10). There is no requirement for such images to engage with an indexical relationship with reality as the relationship is now, in an insular fashion, between image and viewer, no longer between image and reality. Despite similarity often being evident, any requirement for indexical resemblance is extinguished by the essentialist nature of digital moving images.

As inscriptive components of a new synthetic naturalism, the two categories discussed above—referenced photorealism and fantastical photorealism—each employ distinct modes of construction but share a common mode of
presentation. For the referenced category, this construction is clearly simulatory, and for the fantastical category the construction is an indirect allusion, often drawing on algorithmic reality and/or the extrapolation of pro- and a-filmic reality. Regardless as to whether these images are fashioned through the use of composited analog filmic representing reality with CGI assets or through the extrapolation of real world referents to create fantastical realism; they are rendered and viewed cinematographically in an insular fashion. The re-emergence of the directness of ‘showing’ in early digital moving images after a century of indirectly ‘telling’ ultimately combine in contemporary digital moving images as ‘being’.

Cavell’s (1979) writing on the naturalness of automatism in painting can be equally applied to the reality status of digital moving images in that both achieve ‘an old wish of romanticism—to imitate not the look of nature, but its conditions, the possibilities of knowing nature at all and of locating ourselves in a world… the conditions present themselves as nature’s autonomy, self-sufficiency, laws unto themselves. Not how the world is, but that it is’ (p. 113).
CONCLUSION

This thesis has presented an account of Peircian indexicality as it may be applied to distinct technologies of moving images. It has argued that an indexical rupture for moving images most commonly located as part of the conversion of continuous reality to discretised digital data in fact occurs in the transformation from mechanical to analog electronic moving images. Key to this argument is an often-cited distinction between continuous analog and discrete digital signals. I accept that arguments describing digital moving images as discrete are not contentious but have argued that analog electronic images—represented by television and video—are also discretised. This is at odds with a commonly accepted view of such images as continuous, based on their analog status. In this, the thesis departs from a customary dichotomy between analog and digital to describe indexicality and instead, argues for a more nuanced appraisal of the indexicality of automated moving images that includes distinctions between mechanical and electronic technologies within the analog realm. I argue that analog electronic moving images are materially more closely aligned with digital images than with mechanical filmic images and can be seen, as part of this affiliation, to offer rehearsals for many digital moving image tropes.

The aim of this project was to historiographically chart Peirce’s notion of indexicality across three defined eras of technologically mediated moving images; mechanical, analog electronic and digital. This was in order to determine to which of these categories of moving images Peircian indexicality could be attributed. To achieve this, the thesis undertook to apply empirical data in the form of SMPTE standards describing the material properties of moving images to these three categories.

The primary finding to emerge from this thesis as argued in Chapter One is that Peircian indexicality has previously been erroneously attributed to analog electronic images when in fact this indexicality is extinguished alongside the
transition from mechanical imaging to electronic technologies. Secondary findings include the clearly indexical nature of mechanical moving images promoting apprehension as the principal measure of indexicality rather than a consideration of materiality. That thread developed in Chapter Two is picked up in the opening of Chapter Four on digital moving images. In this chapter the elusive nature of digital materiality can be readily contrasted with the clearly visible filmic object of the twentieth century. The diminishing grasp we have on the object of digital moving images has promoted a return to a focus on the materiality of moving images and the relationship with pro- and a-filmic reality that this novel form of materiality presents.

Cushioned between these two chapters dealing on one side with clearly indexical mechanical moving images and on the other, just as clearly Peircian iconic digital moving images, is an examination of the marginalised role of analog video. A close material examination of these electronic analog moving images is crucial to better understandings of indexicality as applied to moving images. A newly defined technologically mediated lineage is highlighted by this historiographical investigation.

As stated above, this thesis argues that the transposition of an indexical severance as part of a shift from analog to digital technologies needs to be located at the cusp of mechanical to electronic imaging. This recasts the indexical status of moving images for that period between the invention of television in the late 1920s and the introduction of digital moving image technologies in the early 1980s. One of the unexpected discoveries that emerged from this argument is a departure from a sustained interest in the development and progression of 1920s moving image technologies that are in-part responsible for television and video and represent the proving ground for this breach of Peircian indexicality. Another focus emerged as a primary site of investigation. This was late twentieth century analog electronic moving images—specifically analog video—that both embodies and illuminates the
crux of the central argument of the thesis, occurring just prior to the imaging revolution led by digital technologies.

It is the key attribute of continuity, in opposition to discretisation, that lead to the technology of analog video becoming the nexus of my historical interrogation. There are a number of analog electronic moving image traits that position it as an outlier and this role is significantly one that helps to define views of the materiality of moving images that come before and after it. These traits can be expressed through three main statements. First, that iterative links based on materiality between analog video and digital media demonstrate that analog video not only shares the discontinuity of its digital counterpart and so exhibits iconicity rather than indexicality, but that this strengthens a view of analog electronic media as a rehearsal for the diminishing materiality of digital media. This statement looks forward in time from the historical location of analog video. Secondly, analog video is materially and conceptually distinct from the filmic technology that it follows and is contemporaneous with. Notions of continuity and discretisation are inverted in this view with video being conventionally regarded as continuous against the discrete unit of the hallowed filmic frame. This statement looks historically back but without establishing lineage. Thirdly, the avowed disconnection of analog video from both film and digital media creates a marginalised space that has fostered a focus on an analog/digital divide that overlooks the subtleties of the technologies underpinning electronic moving images when considering their verisimilitude.

Historically, it is also in this analog electronic space that perceptual realism began to be significantly questioned in favour of materiality when questions of authenticity were asked. Smaller video display screens, fixed spatial resolution and reduced colour gamut all contributed to new considerations of veracity, no longer bound to apprehension. These were timely rehearsals for more recent preoccupation with the intangible materiality of digital images alongside its increased perceptual veracity and novelty.
The broad implication of the outcomes of this thesis is the possibility that historically, the attribution of indexicality to analog electronic moving images requires revision. The ramification of this is that the indexical relationship between reality and moving images from nominally, the birth of television through to the introduction of digital moving images, is no longer certain. The arguments made here contribute to a more finely granular understanding of the materiality of moving images, their relationships with the reality they refer to. The thesis adds substantially to understandings of the importance of the role of technology in defining these relationships.

Another significant outcome of the thesis is that the conclusions drawn here may be applied to photographic representations beyond moving images. Arguments made regarding analog electronic moving images can be applied to still photographic imagery of similar technologies, with the caveats noted near the beginning of Chapter Four in regard to the distinct development of still photography against moving image technologies. Similarly, the insular essentialism displayed by digital moving images and the new presentationist mode can be observed for photography other than that used in moving images, here also primarily restricted to those for cinematic exhibition.

The thesis then generates additional questions in need of further investigation and the findings of this thesis have a number of important implications for future practice and research. As noted above, the application of the new categories of indexicality presented in this thesis to other forms of electronic photographic imaging including light field photography, full spectrum photography including Infra-red and ultra-violet—and by extension spectroscopy—offer new trajectories for the inclusion of empirical data to be brought to bear on what has been a predominantly theoretical enterprise in terms of methodology.\footnote{Additional fields of imaging that are applicable here are High Dynamic Range (HDR) and Wide Dynamic Range (WDR) imaging, electrophotography, and radiography including tomography.}
This thesis opened with a quote from John Cage on technology; cautioning against a poorly defined fluidity between reality and television. In the same series of interviews Cage (1981), tackling the other touchstone of this thesis, speaks of reality thus:

The real. You say: the real, the world as it is. But it is not, it becomes! It moves, it changes! It doesn’t wait for us to change… it is more mobile than you can imagine. You are getting closer to this reality when you say as it "presents itself"; that means that it is not there, existing as an object. The world, the real is not an object. It is a process. (p. 80)

Cage prefigures Kuhn’s (2009) Bakhtin-like argument at the close of Chapter One on moving images’ ‘becoming’: ‘what we are seeking to understand or explain is not only diverse but also in a process of changing and becoming’ (p. 6). These statements articulate one of the central shared traits of digital moving images and reality—a relationship between image and viewer rather than image and reality.

Further research concerned with modes of presentation for emerging technologies of digital moving images would be of great help in continuing to refine understandings of the materiality of these images and their increasingly remote relationships with reality. Arguments made in Chapter Four on the nature of digital moving images combined with a recent focus by analytic philosophy in this area means that this is a fertile region for the generation of new ideas on what this means for the swiftly shifting apprehension and presentation of reality through contemporary automated moving images. It is a rapidly evolving space that is full of possibility and there is much latitude in tackling both the perceptual and material aspects of digital moving images, both primed to offer important understandings of these new technologically negotiated phenomena.
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101 The Publication Manual of the American Psychological Association (APA) for that citation style recommend entries to be listed alphabetically by Producer but this makes for difficult navigation given the number of works cited here. To aid readability, the running order of this section is alphabetical by title of audio-visual work.


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### Abbreviations

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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>2D</td>
<td>Two Dimensional</td>
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<tr>
<td>2.5D</td>
<td>Two-and-a-half-Dimensional [animation technique]</td>
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<tr>
<td>3D</td>
<td>Three Dimensional, referring to graphics and animation</td>
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<tr>
<td>3-D</td>
<td>Three-Dimensional, referring to stereoscopic images</td>
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<tr>
<td>ABC</td>
<td>American Broadcasting Company</td>
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<tr>
<td>BBC</td>
<td>British Broadcasting Company Ltd from 1922 until 1926</td>
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<td>BBC</td>
<td>British Broadcasting Corporation from 1926</td>
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<tr>
<td>BD</td>
<td>Blu-ray Disc</td>
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<tr>
<td>CCD</td>
<td>Charge Coupled Device [image sensor]</td>
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<tr>
<td>CGI</td>
<td>Computer Generated Imagery</td>
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<tr>
<td>CMOS</td>
<td>Complementary Metal Oxide Semiconductor [image sensor]</td>
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<td>CRT</td>
<td>Cathode Ray Tube</td>
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<td>DC</td>
<td>Direct Current</td>
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<td>DCP</td>
<td>Digital Cinema Package</td>
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<tr>
<td>DIY</td>
<td>Do It Yourself</td>
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<td>DLP</td>
<td>Digital Light Processing [display technology]</td>
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<td>DNA</td>
<td>Deoxyribonucleic Acid</td>
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<tr>
<td>DSLR</td>
<td>Digital Single Lens Reflex [hand held camera]</td>
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<tr>
<td>DVD</td>
<td>Digital Versatile Disc/Digital Video Disc</td>
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<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>DN</td>
<td>Dupe Negative [film print]</td>
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<tr>
<td>FCC</td>
<td>Federal Communications Commission [United States]</td>
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<tr>
<td>HD</td>
<td>High Definition [as opposed to Standard Definition]</td>
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<td>HDTV</td>
<td>High Definition Television</td>
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<tr>
<td>HTML</td>
<td>HyperText Markup Language</td>
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<tr>
<td>HTPC</td>
<td>Home Theatre Personal Computer</td>
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<td>ILM</td>
<td>Industrial Light &amp; Magic</td>
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<td>IP</td>
<td>Interpositive [film] Print</td>
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<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
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<tr>
<td>JPEG</td>
<td>Joint Photographic Experts</td>
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<td>LA</td>
<td>Los Angeles</td>
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<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
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<tr>
<td>LCOS</td>
<td>Liquid Crystal on Silicon (or LCoS) [display technology]</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode [here referring to display technology]</td>
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<tr>
<td>MASL</td>
<td>Mean Average Shot Length</td>
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<tr>
<td>mm</td>
<td>Millimetre</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NHK</td>
<td>日本放送協会, [Nippon Hoso Kyokai]. NHK’s official English name is Japan Broadcasting Corporation. NHK is Japan’s national public broadcaster</td>
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<tr>
<td>NTSC</td>
<td>National Television Systems Committee [United States; one of several television broadcasting standards]</td>
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OCN  Original Camera Negative [film print]
OLED  Organic Light Emitting Diode [display technology]
PAL  Phase Alternating Line [television broadcasting standard]
PDP  Plasma Display Panel [display technology]
POV  Point Of View
SD  Standard Definition [as opposed to High Definition]
SFX  Special Effects
SMPTE  The Society of Motion Picture and Television Engineers
UHD  Ultra High Definition [Digital Video Format]
VCR  Video Cassette Recorder
VFX  Visual Effects
VR  [digitally mediated] Virtual Reality
VTR  Video Tape Recorder
WWI  World War One
WWII  World War Two
www  World Wide Web