REFRAMING CINEMATOGRAPHY

Table of Contents:

1.0 List of Figures

1.1 Abstract:

Current discussions around the practice of cinematography are focusing on the extension, or disruption, of the art-form as it is increasingly practiced in the realm of the virtual. The process of performing cinematography in a virtual environment is discussed initially by

reflecting on the work of early cinematographers compared and contrasted with the work of modern cinematographers. Following this, comparisons are made between current leading examples of virtual cinematography in the discipline. Traditional and 'new' virtual practices of cinematography are unpacked through the prism of concepts proposed by theorists Jean Baudrillard (*Simulacra and Simulation* 1995) and Charles Pierce (Triadic Model of Indexical, Iconic and Symbolic Signs). Conceptually this paper argues the practice of the contemporary cinematographer is, in style and substance, much the same as the very earliest cinematographic practice. In conclusion a summation of the application of the leading methodological virtual cinematographic processes to the independent, low-budget, feature-film *Space/Time* (Michael O'Halloran, 2017; in-production) is discussed by the author who is also the director of photography for this film.

Key Words: Cinematography, Virtual Cinematography, Virtual Filmmaking, Computer-Generated Imagery (CGI)

1.2 A short history of the virtual image

In 2010 the Australian Cinematographers Society became a very early contributor to the discussion of the recognition of virtual cinematography. The National President, Ron Johanson ACS and National Vice President, Ernie Clark ACS documented the debate for the society noting that one of the questions put to the board was how to define cinematography. 'Should cinematography be defined as the result of working with a

physical camera… what criteria defines a camera?'(Johanson 2013, 4-5). This could be seen as a new prospect in cinematography and cinema brought about by the introduction of computer-generated-imagery. Associate Professor Scott McQuire wrote in his 1997 book *Crossing the Digital Threshold* that 'CGI is significantly altering the role of the cinematographer by allowing the film image to become an increasingly composite image'(McQuire 1997, 3). This statement by McQuire comes at a time in cinema history not long after the first introductions of digital technologies. It was 1993 when the prospect of what computer-generated-imagery could do surfaced with prominent Hollywood director Steven Spielberg's use of it in *Jurassic Park (Steven Spielberg 1993)*. This was the first time CGI had been used to create 'real living beings.'

> '…through narrative, members of the audiences were given an opportunity to have the experience of seeing dinosaurs themselves for the first time. This point is made within the narrative by Hammond, the creator of the theme park, when he says, "I want to show them something that wasn't an illusion." In some way, the use of CG to portray these creatures is a step beyond the traditions of clay dinosaurs and toward a level of representation that is closer to science; an attempt to present a visual depiction that is a demonstration of scientific knowledge more than cinematic fancy.'(McClean 2004. 57)

Professor Stephen Prince notes in his discussion of digital imagery and realism in the journal Film Quarterly, '…even unreal images can be perceptually realistic.' In Jurassic Park he observes the computer-generated-images '…acquire a very powerful perceptual realism, despite the obvious ontological problems in calling them realistic. These are falsified correspondences, yet because the perceptual information they contain is valid, the dinosaurs acquire a remarkable degree of photographic realism'(Prince 1996, 27-38). This was the decade of a digital revolution in cinema and therefore a cause for much debate and readjustment. New processes in film production were being invented and new roles created. It is therefore not at all astonishing that McQuire refers to what he believes to be the cinematographer's altered role due to the image of cinema being an 'increasingly composite image.' However, McQuire fails to note cinematography's' history as an ever debated practice. Former President of the Digital Cinema Society and cinematographer James Mathers wrote:

> 'As a cinematographer, I've had to get used to the fact that my role is constantly changing, and while I don't think it is necessary, some have even suggested a new name for what we do. Whatever the specific skill-sets employed, we are still charged with guiding the cinematic motion image to the screen. That screen might be theatrical, TV, or mobile device. It does not matter the display medium or capture format. I'm not now a "Digital Cinematographer" any more than I was a "Film Cinematographer" over the many years I acquired images on celluloid. The technology doesn't define us; it is rather just a tool to help us achieve our creative intent. It is a means to an end, not the end itself.'(Mathers 2014, viewed 1/10/2014)

What Mathers notes is not new. Cinematographer Court Courant discussed perception problems with the journal International Photographer in 1935.

'In the first place, the word "cameraman" is unfortunate. The suggestion it conveys is too limited, too technical. "Chief artistic collaborator," were the phrase not so clumsy, would be less misleading. Well, what does good camerawork imply? Is it just to secure a clear, clean rich picture - a "good photo" in the Kodak sense of the word? No, good camerawork is to give each scene the atmosphere the scenario it calls for. I try to interpret it like an actor. You ask how is he a creative artist? Consider. A camera is a machine, a vehicle for the film; the lens is a piece of dead glass; a lamp is a lamp; the film itself is a chemical product; the projector is another machine, another vehicle. The man who can visualise a scene in terms of these dead things and from them create a work of living beauty, he is a creative artist.' (Dyer 1935, 16)

So the perception and definition of the practice of a cinematographer has always been a point of contention. As cinema goers we can be astonished by the spectacularity of the images we see today thanks to computer-generated-imagery. However, the images of cinema were always composite images. Norman Dawn was one of the earliest cinematographers to use special photographic techniques to produce seamless composite imagery for cinema as early as 1907 less than a decade after the invention of cinema itself.
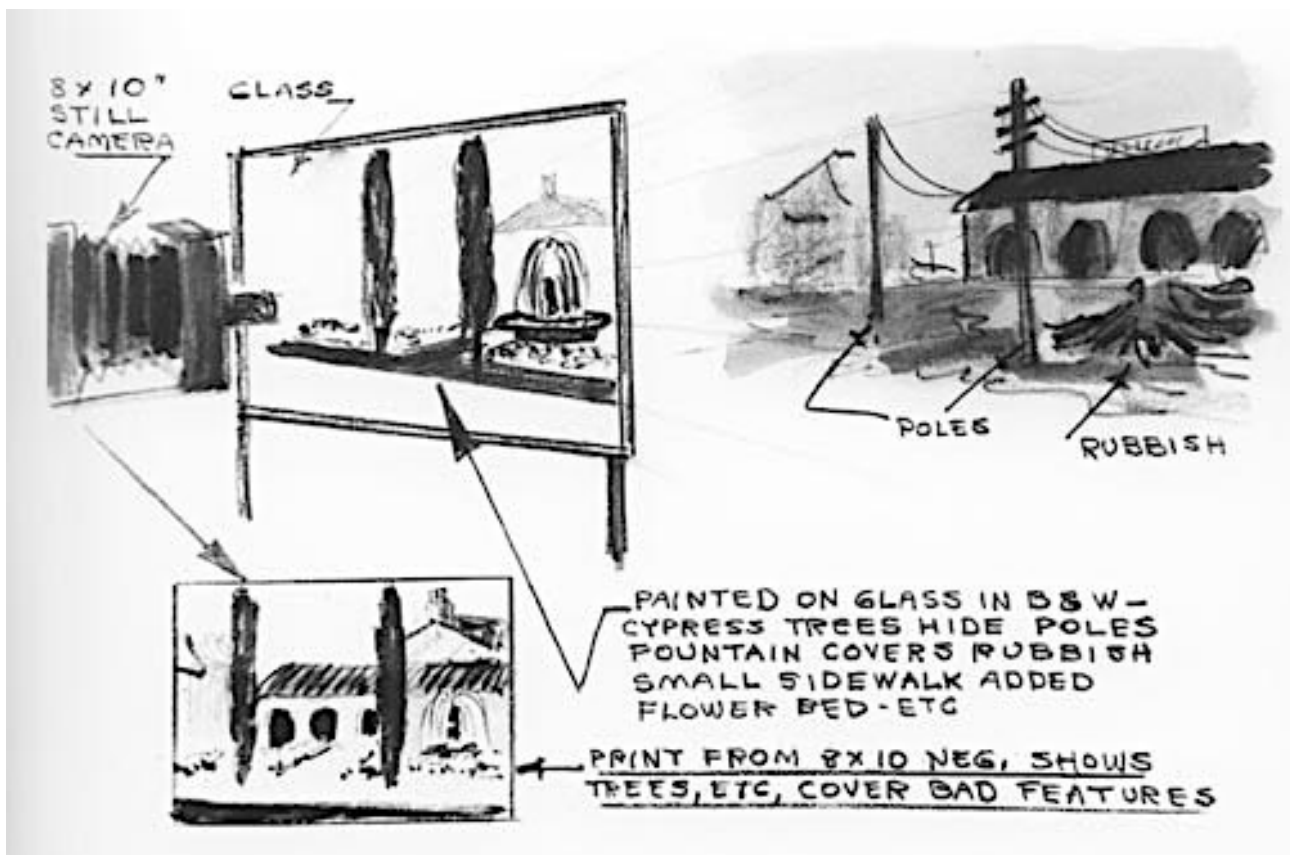

Figure 1. Dawn's own illustration indicates the process for achieving the Glass Plate Shot that he learned while working as a photographer for the Thorpe Engraving Company. He later adapted this process for first use in cinema. (Barron and Cotta Vaz 2004)

Dawn would accomplish this early virtual image by placing a piece of glass between the scene to be photographed and the camera. The cinematographer could then paint on the glass to either add to the scene or cover something undesirable. Figure one is an illustration of how this type of image is accomplished from Dawn's own notebook drawn while he worked at the Thorpe Engraving Company as a photographer in 1904. He was subsequently the first to apply this to motion photography when working on a travelogue titled *Missions of California* (Arthur Lee, 1907) where he used the technique to restore dilapidated houses to their former glory.

Norman Dawn went on to become a prolific filmmaker, cinematographer and visual effects pioneer. However, he gives us some insight as to why the world of virtual imagery and image manipulation in cinema was not considered significant until the digital revolution.

> 'The breakthrough of original-negative matte painting was never publicised. "even when I was at Universal, they (studio heads) didn't believe in telling anybody about effects," Dawn said. "…They considered anything that was a drawing or a glass shot a fake. So they didn't want to let the exhibitors know that this was a cheap picture full of fakes. "In the old days special effects was a secret thing," explained Ellis 'Bud' Thackery, a contemporary of Dawn. "We were not allowed to have screen credit in those days… it was all a big, dark secret."'(Barron and Cotta Vaz 2004, 42)
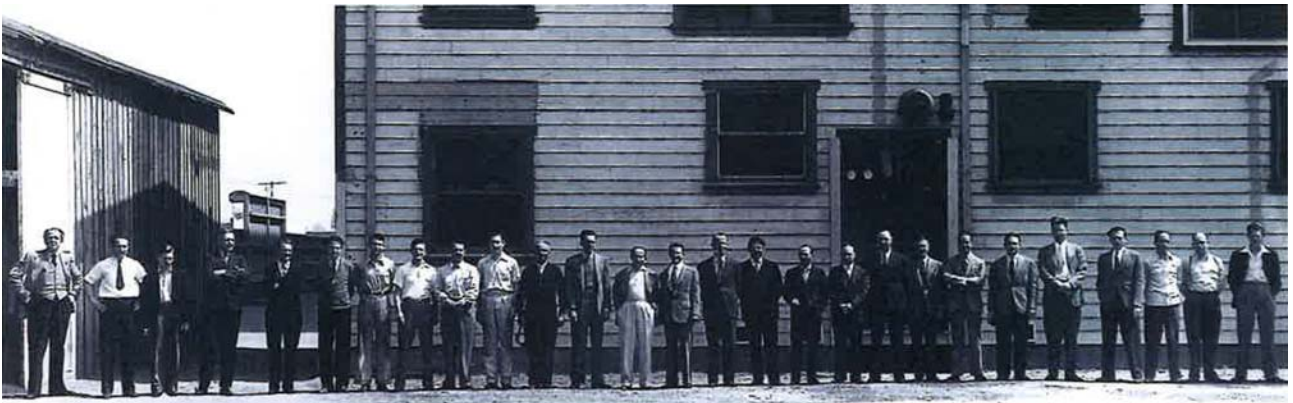
Figure 2. MGM Studios secret matte-painting department, note the blacked out windows. (Barron and Cotta Vaz 2004)

Dawn and other artists like him were generally uncredited for their work. Although it's hard to place exactly when this process of not crediting special-photographic-effects-artists was disbanded; it did continue, depending on the studio, until the 1960s. Cleopatra (Joseph Mankiewicz 1963) was the first film to win an Oscar for best Visual Effects by Emil Kosa, Jr., one of the men pictured in figure two, (prior to 1963 and beginning in 1938 the Oscar was awarded for an outstanding achievement in creating special photographic and sound effects). Outside of Hollywood however many European films credited visual-effects work from the very beginning. Many decades before Kosa's win Eugene Schufftan, ASC had great success in his native Germany perfecting a perspective effect which would become known as The Schufftan Process. This effect

combined miniature sets and live-action into the one shot instantaneously on film (Figure 3. and 4.) and was used most notably in *Metropolis* (Frtiz Lang 1927) . Schufftan became famous for this effect and travelled internationally to work with directors such as Alfred Hitchcock. Much later in his career Schufftan, in a letter to his agent in 1956, described how the cinematographer working in Europe was also charged with creating special effects.

…as the separation of special effects and camera work is not known in Europe in contrast to Hollywood. In Europe special effect departments don't exist. (Williams 2011, 102)
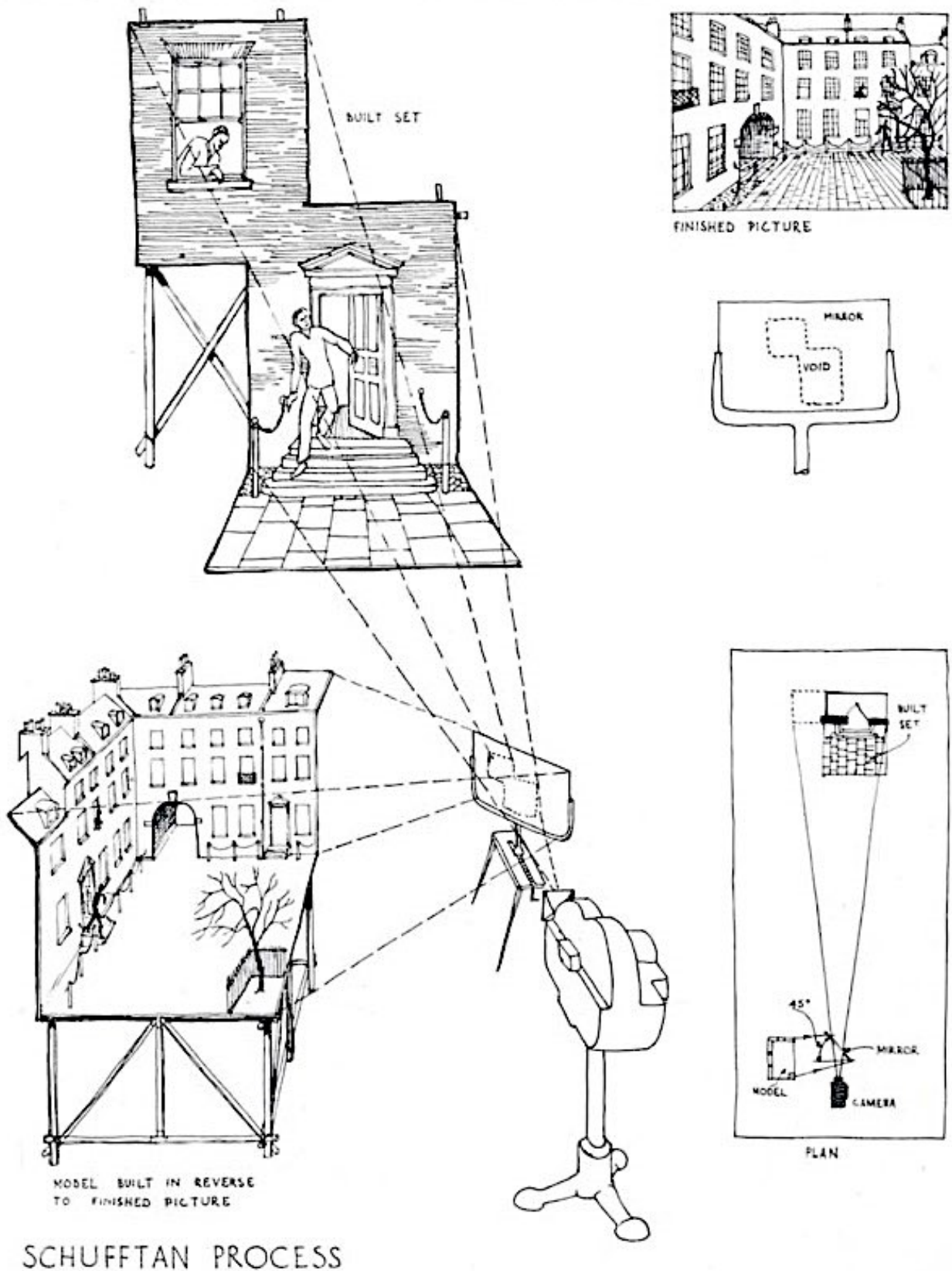
Figure 3. Illustrative explanation of the Schufftan Process. A photographic perspective effect used to compose a composite image of a miniature set and live actor (Carrick 1949).

Figure 4: Still from the film *Metropolis* (Fritz Lang 1927). This is the final result of the Schufftan Process merging the live actors at the bottom of the screen and the seemingly gigantic stadium, which is in fact a miniature, shot at exactly the same time through the use of a partial mirror.

Further, J.P. Telotte, in his monograph on the science fiction film, describes Schufftan's importance in the history of visual effects and cinematography; his importance to the history of cinema's images.

> We might think of Metropolis's development of the optical tricks of the Schufftan process (which employed a mirror arrangement to combine live action convincingly with miniatures or painted backdrops) and the later innovation of the optical printer (which allowed for the creation of such effects directly in the camera) as forming a bridge between Méliès fantastic mattes and disappearances in clouds of smoke and the recent development of computer-assisted cameras and computer-generated-imagery (CGI), (Telotte 2001).

Schufftan's recognition in Europe contrasts sharply with the work of similar artists in the United States of America at the time. An enthusiast of old Hollywood effects, Peter Cook, has compiled a weblog in order to

tell the (at the time secret) history of these artists. Cook relates to his readers a daughter's memory of her father's matte-painting work for Paramount Studios; matte-painting consists of painting an image to match in with a partial frame of a scene in order to create a composite image on celluloid film of a real location and painting - indiscernible as fake by the viewer. 'According to Jan Domela's daughter, the studio would offer a better salary package to Jan if he would forego a screen credit - which he was happy to do'(Cook, viewed 10/03/2014). Many decades later a compatriot of Jan Domela, Irmin Roberts, ASC gave a rare interview to American Cinematographer discussing his career.

> 'In the realm of moviemaking, few people qualify more for the title of "unsung hero" than the
> special effects man. Little is known about his work outside the studios, and few members of the
> filmgoing public give him much consideration.
> A man of great energy and enthusiasm, Roberts has worked for the best. His film credits read
> almost like a Who's Who in Hollywood, with major productions for such producers and
> directors as DeMiIIe, Stanley Kramer, Alfred Hitchcock, Norman Taurog, Edward Dmytryk,
> Hal Wallis, George Cukor, Billy Wilder, Michael Curtiz and George Stevens.' (Ormond 1974,
> viewed 5/05/2016)

Figure 5. Irmin Roberts, ASC (special photographic effects cinematographer) is on the right while Jan Domela (matte painter) stands beside the camera's left next to an unknown camera assistant. The camera is setup here with a panel of glass in front and some black matte-tape in order to segment the frame for

subsequent exposures of matte-paintings that will create the final composite image of the real and virtual images.

Despite his prolific career it is not only surprising how little the public knew but how little his own studio knew about his work. In 1944 Roberts was responsible for the special-photographic-effects (what we would call today visual effects) on the film *Frenchman's Creek* (Mitchell Leisen 1944). The picture, a period film set in England, was photographed in the northern coastal area of California. To create a large English manor house Roberts used a model approximately four feet high by four feet wide. He hung this miniature in front of the camera with some artificially created mist. In the movie one can see a coach being driven up to the (miniature) manor house and people getting out and going up the stairs into the house. Here Roberts recounts the New York office's reaction to the scene for a profile in *American Cinematographer* in 1974.

> 'The New York Paramount people wanted to fire everybody after seeing that, for having the nerve to build a big castle just for a movie, when everybody at the time was stressing economy and the war effort (Irmin chuckles)… That film won an Oscar for Art Direction and Set Decoration, but not for special effects. The studio never put the film up in that category… it would have won hands down.'(Ormond 1974, viewed 5/05/2016)

Figure 6. Two frames from Frenchman's Creek (1944) show the flawless hanging miniature house and ships in the background (Cook).

It is a clear and consistent fact that special-photographic-effects or visual-effects have been a large part of cinema since the very beginning. It is sometimes misconstrued by film critics, academics and the film going public that the 'special effect film' is a new digital age phenomenon. Yet, the literature shows many of the effects that are accomplished today inside a computer had similar if not the same counterparts in the pre-digital age. They were indeed slower and sometimes more difficult to achieve but conceptually no different. The digital revolution has not created special effects films but simply extended the obviousness of them while also democratising the tools one needs to accomplish such imagery. The effect this has had on cinematography, however, cannot be understated. When computers first came to be used to create imagery in cinema it was the first time in cinema's history that a cinematographer, with a camera, had not been used to create an image.

1.3 Authorship and the cinematic image

At the end of the 1980s, special effects for spectacles like the original *Batman* (Tim Burton 1989) were still dominated by models and miniatures, blue and green screen, matte-painting and compositing. All of these practices were achieved with celluloid film stock, a camera and a lens; this therefore necessitated a cinematographer. However, in the decade to come the practice of filmmaking began to change rapidly with the introduction of computer technology. Throughout the nineteen-nineties, the periodical *American Cinematographer* devoted increasing space to these issues, from computer-generated-imagery to digital cinematography and colour grading. For instance, in September 1992, an entire issue was devoted to electronic post-production tools and 'the changing art of the cinematographer,' proclaiming that "cinematography now stands at the crossroads of film, video and computer technologies," (Heuring 1992). Coverage of CGI as used in films as diverse as *Jurassic Park* (Steven Spielberg 1993), *Forrest Gump* (Robert Zemeckis 1994), and *The Age of Innocence* (Martin Scorsese 1993) noted its inexorable rise, not only for creating spectacle but, in the latter two cases, giving an authentic feel to an historical re-creation, (Ramaeker 2014). Christopher Lucas notes, however, that the late 1990s was a period of profound technological, and therefore cultural and artistic, disruption in the film industry. Lucas suggests this was perhaps a greater disruption than experienced in any previous era.

…greater than the dislocation and burst of invention that followed the rise of television and colour cinema in the 1940s and 1950s, or even the temporary hardships and new stylistic responses to the coming of sound in the 1930s. Through the 2000s new digital tools and techniques, such as the digital intermediate (also known as digital grading), high-definition video and digital cameras, stereoscopic 3-D, and the commonplace mingling of live-action images with computer-generated images (CGI) disrupted long-standing hierarchies of creative authority and craft practice. (Lucas 2014)

In 2002, the first major feature film produced out of Hollywood, to be shot entirely digitally, was released. *Star Wars Episode Two - Attack of the Clones* (George Lucas 2002) was George Lucas' revisiting of the epic he created in the 1970s. In the documentary film *Side by Side* (Chris Kenneally 2012) Lucas discusses being derided for his decision to shoot digitally instead of with the traditional analogue mode; celluloid film stock.

"They got up and had a big meeting saying that I was the devil incarnate, that I was going to destroy the industry, that I was going to destroy all our jobs, that this is inferior, that he says he shot Attack of The Clones digitally but he didn't, we have word that he actually used film cameras, that he's not shooting digital, that he's lying to everybody," (Kenneally 2012).

Adding to the criticism Visual Effects Director of Photography, David Stump, ASC argued that what George Lucas did by using a digital camera within a feature film paradigm was 'unthinkable' to the majority of the industry, suggesting it had become a polarising issue for Hollywood, (Kenneally 2012). What this example shows is the massive unrest new methods of practice can create within a society such as that of Hollywood filmmaking; which, it must be said, is the predominant filmmaking society, with respect to financial interest, in the English speaking world. *Star Wars Episode Two - Attack of the Clones* (George Lucas 2002), however, was released more than a decade after another spectacular and industry changing event in filmmaking, the first use and subsequent rise of computer-generated-images (CGI) rather than camera-captured-images. The first financially successful feature film to come out of Hollywood and use CGI was *The Abyss* (James Cameron 1989) for which director James Cameron required a slithery, underwater monster for the science-fiction/horror film. However, as Cameron himself notes, for *The Abyss* the computer technology was only used to solve single sequences, and if those sequences had failed the film itself would still have succeeded dramatically; so the risk was small, (McQuire 1997). On Cameron's subsequent film, *Terminator 2: Judgment Day* (James Cameron 1991) the success or failure of the film came down to the success or failure of the new digital techniques of CGI. Fortunately for Cameron the company he engaged to create these fantastic images was Industrial Light and Magic - a company that went on to be involved in some of the most memorable computer-generated-images in cinema. ILM was founded by George Lucas and helmed by many of those responsible for the effects in the first Star Wars trilogy including Dennis Muren, ASC. Although both of Cameron's films, *The Abyss* and *Terminator 2: Judgment Day* were financially successful the monsters their creative teams created had no real world referent. *Jurassic Park* (Steven Spielberg 1993) marked the first replication of living beings for a narrative film which needed to maintain a high-level of reality. At the time this offered an extraordinary challenge to ILM's Dennis Muren, ASC; one of the few visual-effects artists today to also be an accredited cinematographer.

"Although the dinosaurs in Jurassic Park were extinct, they had lived. They were real creatures - living creatures. We had to light them as we would living, breathing beings," Muren explains. "That's something we had never thought of before! Now we had to create the tools - computer coukaloris, flags and other equipment to make shadows. We had to figure out things like duplicating the inverse square law fall off. As light goes away from a source, it 'falls off,' " he explains. "It is no accident that a cameraman broke the program! A computer programmer doesn't know that the tools have to fit the rest of the movie. And, if that programmer has been told, he most assuredly doesn't understand all the subtle filmic concepts," (Rogers 1998).

As Muren states it was particularly important to treat the virtual dinosaurs as if they were real, and therefore, really shot by a film crew on location. The serious nature with which the filmmakers have treated the 'dinosaurs,' these virtual images, is a step towards a level of representation that is closer to science than cinematic fantasy, (McClean 2004). As Hammond the creator of the theme park within the narrative remarks in the film, "I want to show them something that isn't an illusion," (Jurassic Park, Steven Spielberg 1993). To that end cinematographer Dean Cundey, ASC explains his ideology for the film.

> "The audience has to believe the unbelievable," says Cundey. "You have to give them as much reality and recognisable truth as you can. They have to walk in the shoes of the characters. They have to feel the terror when the experiment goes wrong and a handful of people isolated on an island become prey for dinosaurs," (Ramaeker 2014)

Cundey notes the continuing struggle between the idea of reality and the trick of illusion in cinema; the verisimilitude. For instance, Stephen Prince notes that when the velociraptors hunt the children inside the park's kitchen during the climax of *Jurassic Park* (Steven Spielberg 1993), the film's viewer sees the dinosaurs' movements reflected on the gleaming metal surfaces of tables and cookware. These reflections anchor the creatures inside Cartesian space and perceptual reality and provide a bridge between the live-action and the computer-generated environment, (Prince 1996). Prince, in his article for *Film Quarterly, True Lies: Perceptual Realism, Digital Images, and Film Theory*, published in 1996 discusses the importance of this existential connection using Charles Pierce's Triadic Model of indexical, iconic and symbolic signs.

> "Photographs, especially instantaneous photographs, are very instructive, because we know that in certain respects 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," (Pierce as quoted in Prince 1996)

As cinema is most closely related to still photography Pierce's Triadic Model can apply easily. However, it would seem, with the introduction of CGI, the cinema image would no longer belong to that second class of signs, as, although the physical connection remains, even if somewhat partially, the alteration of the original copy weakens the physical connection therefore disconnecting it from its referent. For instance, light simulated in the computer doesn't need a source or lighting fixture to create it. Shadows can be painted in irrespective of the position of the existing light captured by the camera on location. Lighting, which in photography is responsible for creating the exposure and the resulting image, is, for computer images, strictly a matter of painting, of changing the brightness and colouration of individual pixels. As a result, lighting in computer imagery need not obey the rather fixed and rigid physical conditions which must prevail in order for photographs to be created, (Prince 1996). Yet, Dennis Muren, ASC engaged computer programmers to create software which would mimic physical cameras, physical lenses and physical lighting. Muren purposefully built in all the restrictions of the physical world of filmmaking into the software. In the case of *Jurassic Park* (Steven Spielberg 1993) the dinosaurs are not necessarily convincing realities but instead convincing photographic realities as Muren stated earlier "we had to light them as we would living, breathing beings," (Rogers 1998). Due to cinema's now over one hundred year history there has become, in the common psyche, a cinematic reality; one which applies specifically to cinema and is therefore not the same as an individual's reality though it does refer to it. Prince explains this complicated relationship to reality in his article.

> …even unreal images can be perceptually realistic. Unreal images are those which are referentially fictional. The Terminator is a represented fictional character that lacks reference to

any category of being existing outside the fiction. Spielberg's dinosaurs obviously refer to creatures that once existed, but as moving photographic images they are referentially fictional. By contrast, referentially realistic images bear indexical and iconic homologies with their referents. They resemble the referent, which, in turn, stands in a causal, existential relationship to the image. A perceptually realistic image is one which structurally corresponds to the viewer's audiovisual experience of three-dimensional space. Perceptually realistic images correspond to this experience because film-makers build them to do so, (Prince 1996).

Importantly Prince has stated 'filmmakers build them to do so,' indicating the perceptual reality of the images is created by filmmakers trying to simulate what the image would look like if captured by a cinema camera; a cinematic reality, the camera's reality. The concept of cinematic reality can be applied even to animated films, which do not have even a partial real world referent and yet, as director Andrew Stanton discovered on the animated feature film *WALL-E* (Andrew Stanton 2008), verisimilitude was key to its success. During production Stanton had experienced problems trying to create 'cinematic images' for this animation. Stanton thought previous animated films lacked what might be seen as the 'imperfections' of live-action film-making (Walt Disney Studios, *The Imperfect Lens*). Some of these imperfections include lens distortions such as chromatic aberration, pincushion and barrel distortion, and lens flare. Stanton also wanted the animations to more closely resemble the depth-of-field properties of the grand scope cinematic cameras of his youth. To do so, he engaged cinematographer Roger Deakins, BSC, ASC. Deakins hosted a workshop to educate the animators on the interaction of a physical light and lens and discussed his concepts of lighting and film-making. Stanton and Deakins then created models of the animated characters as real world referents, placed them in a physical space and shot them, with different lens options, on a cinema camera with celluloid film stock. These animated characters, which do not exist in reality, were made into physical characters and captured with a physical camera so the animators could then use the visual information and language created by the referent to create vision for the animated film that carried a cinematic reality; that appeared as if it were shot by a camera. Deakins then guided the look of the lighting with the animation team in their studios. This became the first time in cinema history that a cinematographer with no knowledge of visual-effects or computer-generated-imagery had worked on an animated feature-film with no live-action-photography. Deakins would be credited as a visual consultant and would go on to work on other feature animations such as *Rango* (Gore Verbinski 2011) and *Rise of the Guardians* (Peter Ramsey 2012) among many others. It was clear to Stanton that he and his team needed to understand not only the language of cinema but the language of cinematography; a language developed over the last hundred years of cinema. In *WALL-E* (Andrew Stanton 2008) an animation is reflecting live-action cinema and therefore seeks to simulate the language cinema uses; in this case creating virtual hand-held camera operation and virtual light flaring into a virtual lens, *WALL-E* even uses virtual lens zooms for a documentary aesthetic in certain scenes. We can see for *WALL-E* as Stephen Prince points out for *Jurassic Park* (Steven Spielberg 1993) that the images of this film become 'realistic' or acquire a 'cinematic realism' '…despite the obvious ontological problems in calling them realistic' (Prince 1996). This animated film is trying to acquire a stronger reality for the viewer through seeking to be cinematically real.

This is a phenomenon noted by theorist Jean Baudrillard, long before the digital revolution, in his book *Simulacra and Simulation* (Baudrillard 1995, translated from the French publication of 1981). Baudrillard discusses *Barry Lyndon* (Stanley Kubrick 1975) a period film about an Irish rogue who wins the heart of a rich widow and assumes her dead husband's aristocratic position in eighteenth-century England. Kubrick and his cinematographer John Alcott, BSC (who won an academy award for best cinematography for his work on this picture) used mostly historically correct lighting sources to illuminate the celluloid for this film. This therefore limited Alcott to daylight, in all its different forms, and candle light. The filmmakers went to great lengths to do this even acquiring special lenses from NASA so that they could achieve the correct amount of exposure for the film during scenes lit only with wax candles. The filmmakers then had to re-engineer their cinema cameras to suit these lenses. Baudrillard discusses the importance of this in his book.

Concurrently with this effort toward an absolute correspondence with the real, cinema also

approaches an absolute correspondence with itself - and this is not contradictory: it is the very

definition of the hyperreal.(Baudrillard 1995, 49)

Baudrillard goes on to suggest a close relationship between form (the style of a film and how it is made) and content (the narrative). *Barry Lyndon* achieves a strong realism in cinema as it seeks to simulate the conditions of the time period in which it is set. However, especially in his later years, Baudrillard goes on to discredit modern cinema suggesting in 2005 that films are increasingly 'stuffed with special effects' (Baudrillard 2005, 80). Doctor Gerry Coulter, founder the *International Journal of Baudrillard Studies*, suggests Baudrillard laments for the films of his youth, presumably the fifties and sixties, often suggesting that cinema is destroying itself through a desire to represent reality, especially through visual effects (Coulter 2010). Baudrillard and Coulter have made a similar conclusion that digital technologies have changed films; suggesting there was filmmaking before the digital revolution and filmmaking after and that these are remarkably different things. Cinematographer Bill Pope, ASC had similar notions when approached to direct the photography for the almost entirely virtual, CGI film The Jungle Book (Jon Favreau 2016). Here, from a panel at the International Cinematography Conference for 2016, Robert Legato, ASC the visual effects supervisor for *The Jungle Book* explains his early discussions with Pope, for this project which had only one physically real actor and no physically real locations.

'When I showed Bill the virtual camera, he said, why do you need me? I told him, film this the

same way you'd film it live, with a cinematographer's eye, time of day, lens choice and so on

— all those things mean a lot!" '(Kaufman 2016, para 9)

The Jungle Book was a steep learning curve for all involved, but this learning only relates to the new technology involved to achieve the story; a story which previously could only be achieved as a Disney animation. *The Jungle Book* is part of new trend back toward control and image authorship for the cinematographer that has not occurred since the pre-digital age of cinema. Michael Goldman, in his article for *American Cinematographer*, asks the question 'is cinematography the proper term to describe how *The Jungle Book's* images were captured?'(Goldman 2016) In the same article virtual camera layout artist John Brennan also discusses contention around the new practice.

There's a lot to learn and reconcile in a hybrid space like the DD [Digital Domain] stage, but

there were and are certain mandates — one being that virtual cinematography should be

recognizable as cinematography. There are aspects of virtual production that are new and

disruptive, but I don't think that's the whole picture. (Goldman 2016, 35)

So, although there is an apparent disruption both within the industry and via a view of the industry constructed by journalists, academics, theorists and others a reading of the history and practice of cinematography suggest otherwise. As former American Cinematography Society President Richard Crudo, ASC puts it, 'For all the talk of the revolution that has taken place, few seem to have noticed that it was really a load of nonsense. The cinematographer's job hasn't changed a bit, except that our table of responsibilities has grown exponentially'(Crudo 2016). Further, cinematographer Bill Pope, ASC contends the methodology allowed him to make traditional cinematography decisions in a digital space.

> Bill Pope, using his custom virtual-camera system, was able to not only direct the framing of characters in shots — either live in a motion-capture volume with actors, or virtually with animated characters — but could also direct how dappled light through trees fell on a character, live-controlling the depth of field, seeing how motion blur might affect an action sequence, and tonally dictating the overall mood of a shot.
>
> "With each shot captured in the virtual-camera volume," Balakrishnan continues, "Bill sat down with one of our Photon artists and hand-lit the shot in the computer with the custom digital light kit we developed for him. (Goldman 2016, 41)

In the first decades of cinema Norman Dawn would add to or obscure the imagery captured by his camera using the glass-plate-painting shot he brought to cinema. To put it simply, the team that created *The Jungle Book* has done very much the same thing but instead taking a photograph and integrating computer-generated-imagery (or analogue matte-painting) into that photograph the team starts with the CGI and the photograph is the smallest part of the final image.

> The film features a sole live-action actor, 13-year-old Neel Sethi, who portrays the human boy Mowgli. Only those pieces of the sets that Sethi directly interacted with are real; beyond them, all environments, and the entire cast of supporting animal characters, are CG constructs. (Goldman 2016, 32)

The methodology used to create the images for this film was very similar to a traditional live action approach. After storyboarding and pre-visualisation (both standard steps in filmmaking) the art-department would create 'virtual sets' which would be combined with motion capture performances and then passed to the 'virtual cinematography stage' where cinematographer Bill Pope laid out cameras in a virtual environment, blocking the scenes with the director, and lighting with virtual lights and physical fixtures so the relationship between the physical, blue screen, set and the virtual set where linked. Pope could choose a virtual dolly or crane shot or even operate a virtual hand-held camera.

Figure 7. Physical lighting is used on the blue-screen stage. The physical lighting matches the design first created virtually for the CG image by the cinematographer. (Defintion Magazine 2016)

Figure 8. The final image is a composite of a digital environment, lit and lensed by the cinematographer, and a physical actor and partial physical environment also lit and lensed by the cinematographer. (Defintion Magazine 2016)

This technology and methodology serves a story created by a team of artists and allows the 'distance

between artist and audience to be reduced' (Pizzello 2016, 10). As Pizzello notes this effort is all in service of the narrative and the concept of the suspension of disbelief in cinema a term first coined by Samuel Taylor Coleridge in the early nineteenth century with respect to the written narrative. When the photograph was born, then followed later by the motion image, they became an ideal that painting, no matter how skilled the artist, could never achieve; an ideal of direct correspondence between image and object/subject. This ideal was at the heart of photographic referentiality; the reality imbedded within the image. However, after the first few years of the motion image, the concept of editing was discovered, and later the montage.

> 'Cheating' with the order of events, or the times, locations and settings in which they occur, is second nature to film-makers. By the time cinema 'came of age' in the picture palace of the 1920s, a new logic of montage, shot matching and continuity had coalesced into the paradigm of 'classical narrative', and cinematic credibility belonged more to the movement of the text rather than the photographic moment — a shift Jean-Louis Commolli has neatly described in terms of a journey from purely optical to psychological realism, (McQuire 2000).

Norman Dawn saw his glass-plate painting technique as a permissible cheat that, instead of being fake, imbued the vision and narrative of *Missions of California* (Arthur Lee 1907) with an authenticity in a way that capturing the crumbling buildings as they were at the time, rather than what they were when first erected, never could. Dawn's process for image augmentation, for creating virtual image components to add to the landscape in front of his camera was a process not unlike that of the modern addition of images generated by a computer for the cinema. Other theatrical techniques such as performance, make-up, costumes, lighting and set design are augmented by specifically cinematic techniques such as stop motion photography and rear projection, as well as model-making and matte painting which entered the screen world via the optical printer, (McQuire 2000). Computer generated imagery fits neatly into this long tradition of simulation rather than direct correspondence in cinema. McQuire notes the aim of most computer artists working in contemporary cinema is not simply to create high resolution images, but to make these images look as if they might have been filmed. This includes adding various 'defects', such as film grain, lens flare, motion blur and edge halation, (McQuire 2000). Cinematographer, visual effects artist and author of *Digital Moviemaking*, Scott Billups, argues that film makers had to 'educate' computer programmers to achieve this end.

> "For years we were saying: 'Guys, you look out on the horizon and things get grayer and less crisp as they get farther away'. But those were the types of naturally occurring event structures that never got written into computer programs. They'd say 'Why do you want to reduce the resolution? Why do you want to blur it?" (McQuire 2000).

This concept of a history of cinematic reality has been proven in recent years with the attempt of some filmmakers to introduce a new technique in film production that could increase the perceived sense of realness of an image. *Billy Lynn's Long Halftime Walk* (Ang Lee 2016) is the latest incarnation of this attempt at re-writing, or evolving, the language of cinema images; the language of cinematography. *Billy*

Lynn's Long Halftime Walk (Ang Lee 2016) was shot at what has become known as 4K, or in other words, a very high definition digital image which has more than four times as many pixels as a high-definition digital television. This film was also captured in 3D using two cameras to replicate the two eyes of the human vision system. In addition to this the film was also captured at a much higher-frame-rate than standard cinema's twenty-four frames per-second. Lee and his cinematographer John Toll, ASC (a two time Oscar winner) shot the film at different frame-rates depending on the scene. These frame-rates ranged from forty-eight frames per-second to one-hundred and twenty frames per-second. The effect of this new technology and practice was to create an image for the film that is ultra-sharp and has no motion blur; the characteristic effect of fast action in cinema is to blur the image whereas every individual frame of *Billy Lynn's Long Halftime Walk* could be a sharp, still photograph. An article about the film in *Slate*, an online publication, by commentator Daniel Engber titled *'It Looked Great. It Was Unwatchable,'* (Engber 2016) discusses the reception of the film amongst cinema critics.

Ang Lee, the three-time Oscar-winning film director, did his best to lower expectations. "It's kind of an experimental movie," he said at the Friday night premiere of Billy Lynn's Long Halftime Walk at the New York Film Festival. …Lee knew its novel look—unrelenting clarity, abundant blooms of fine detail—might come off as more disturbing than impressive. "This is not just a new technology, but a new habit in watching movies," he warned the crowd. "I hope you keep an open mind," (Engber 2016).

Engber goes on to describe how a scene looked 'un-cinematic' like a 'theatre sketch acted out in virtual-reality.' Engber then explains the press notes for the film pointed out that by shooting in the unprecedented high-frame-rate, 3-D, high-resolution format, the production stored forty times more data than a standard film. That is five times as many frames per second, four times as many pixels in each frame, and then everything doubled for 3-D. Engber asks 'how could all this extra information fail to make the movie better?' (Engber 2016). Laurie Wilcox of York University, has recently addressed this question in her study, titled *'Evidence that Viewers Prefer Higher Frame-Rate Film.'* Viewers rated short movies on four technical attributes (realism, clarity, depth quality, and smoothness of motion) as well as on their overall likability. On every measure her subjects reported the high-frame-rate clips were superior. That preference has been remarkably consistent across her work, she says, and it applies to both 2-D and 3-D content, (Wilcox et al. 2015). Yet, as Engber claims, many commentators disagree with Wilcox's viewers suggesting that 'if high-frame-rate looks so damn good, then why don't we like it in the theatre?' (Engber 2016). Engber answers his question surmising that film clips used in high-frame-rate lab research tend to be artless and straightforward documentary shots of trees or abstract animations.

The frame rate could be a turnoff only when it's mixed with the grammar used for telling stories on the screen. Montages, tilts, and focus pulls provide a structure for a movie; they work like punctuation marks on a printed page, barely noticed guides for your attention. In Billy Lynn, the HFR makes those guides pop out. Panning shots no longer blur the background with their motion; cuts seem extra jagged. As a viewer, it felt like reading a book in which all the commas and periods had been put in bold and underlined, (Engber 2016).

These audience responses to high frame rate productions could be likened to readers' responses to stream of consciousness writing like that practiced by the Bloomsbury Group of writers such as Virginia Woolf. This type of writing involved depicting the multitudinous thoughts and feelings which pass through the mind and therefore was responsible for long, seemingly incomprehensible, sentences or passages with little or no punctuation. However, this experiment in form never took off en-masse and although it may be an interesting device in literary circles it is likely unknown to the mainstream consumer of novels. It is possible this ability of digital cameras and projectors to display high-frame-rate video may end up being viewed as an historical experiment rather than the new normal of film grammar. Higher frame rates than those used for traditional cinema, however, have been used successfully in video-games for years and therefore make up the grammar and language of that medium. As Julie Turnock points out in her essay, not all forms of moving pictures have the same prestige; some are deemed more sophisticated than the others. So a movie shot with a high-frame-rate suffers from its likeness to less vaunted forms of entertainment such as soap operas, sporting events and video games, (Turnock 2013). All forms of media have their own history and grammar and, seemingly at this point in history, the viewer of cinema has not been happy with any alteration in the cinematic grammar. Perhaps in a few years, filmmakers will study *Billy Lynn's Long Halftime Walk* to understand how cinematic visual grammar must be adapted when the image is delivering such unprecedented clarity and subtlety, (Heuring 2017). Only time will tell the outcome of these experiments from directors such as Ang Lee and Peter Jackson. Currently, however, the grammar of cinema holds several tenets. First, cinema conforms to camera reality that is to say the photograph or moving image is referential to the subjects and objects within the frame. This picture, however, is a simulacra that seeks to refer to its real world referent within the grammar of the film as dictated by the narrative's design and needs; hence the concept of director Andrew Stanton to have the images of the animated feature film *WALL-E* (Andrew Stanton 2008) appear as if they were filmed by a camera rather than created by a computer. Secondly, the narrative (content) informs the production of the film (form) such as with Jean Baudrillard's understanding of how cinematographer John Alcott along with his director Stanley Kubrick sought to illuminate the film *Barry Lyndon* (Stanley Kubrick 1975) with lighting sources that were available during the period in which the narrative is set; thus increasing the sense of reality for the audience. Finally, to further strengthen the visual link of camera reality it is important that the images include what would normally be considered to be defects associated with the cinema lens' optics or film-stock limitations such as lens flare or grain. This link between photograph and referent, the application of style and design so as to produce a convincing simulacra and the addition of defects that could possibly occur if a physical camera was used to capture the images rather than them being created as CGI are the tenets that have formed my process for directing photography on the project I will discuss in the following chapter. With this project I have not only directed the physical photography but also the virtual photography using these tenets. In this chapter I will explain how I have observed theory and practice from other leading cinematographers and theorists and created my own process and design striving to achieve verisimilitude for the project depending on its needs.

1.4 Low-budget virtual cinematography

The previous two chapters have explored the history and application of virtual cinematographic techniques from early cinema to modern practice. The history of virtual imagery and cinematographic authorship began to diverge with the introduction of computers to the filmmaking process. However, in modern times these two have begun to re-converge as technological progress allowed for Hollywood feature films to contain vast amounts of computer generated imagery. Stephen Pizzello, the editor of the periodical *American Cinematographer*, neatly summarises this recent history.

> During the 1990s, major advances in computer-generated imagery (CGI) led to a flood of movies that incorporated the technology to greater and greater degrees, with varying levels of success. Now, CGI is generally accepted as standard practice, whether the digital effects are applied in spectacular, eye-catching style or in a subtler, virtually undetectable manner for "real world" scenes. (Pizzello 2016, 10)

As explored in the literature and in this paper these applications are all in the context of large-budget Hollywood feature films. How effective, though, is a virtual cinematographic practice in a low-budget context? Is this a viable option for independent film makers? In this section I reflect on my own experiences as a traditional cinematographer engaging with a virtual cinematographic process. If the practice of virtual cinematography, as explored through history and through current leading examples, is adaptable to low-budget projects it would illustrate that the practice of cinematography is changing for all practitioners as CGI begins to permeate all forms of filmmaking, even low-budget and regional examples such as the feature film I present in this research.

Space/Time (Michael O'Halloran, 2017; in-production) is a low-budget independent science fiction film for which this author directed the photography. This film was produced in and around Brisbane, Queensland, Australia for a budget of under two hundred thousand dollars. With the generous help of the Griffith Film School the production was able to acquire cameras and a studio for free as this feature-film is part of the author's doctoral research. The film tells the story of a group of scientists, who, when developing an engine for interstellar travel, see their funding cut after a breakthrough leads to a fatal disaster. The disgraced group must resort to criminal activity to finance their operation as they rebuild their space-time device, (O'Halloran 2017). The challenge of this production was to produce a simulation of a time and a place, a referential Cartesian space, to have the audience engage with the film as an authentic representation. As discussed in section 1.3, the concept of a real-world-referent needs to be applied in order to create convincing composite images. The director and I (cinematographer) wanted the images to appear as if they were captured at the time and place in which the narrative is set (the near future) rather than created with CGI techniques or within constructed sets in a studio. Hence, the reading Baudrillard made of *Barry Lyndon* (Stanley Kubrick 1975) and of the process through which the filmmakers, especially the cinematographer, achieved a simulacrum of the period in which the story takes place applies here. An approach, similar to that taken by director Andrew Stanton for the creation of a cinematic reality within his animated feature *WALL-E* (Andrew Stanton 2008) was referenced along with the work of director Alfonso Cuarón and cinematographer Emmanuel Lubezki AMC, ASC on the films *Children of Men* (Alfonso Cuarón 2006) and *Gravity* (Alfonso Cuaron 2013); these two films also contain a significant amount of CGI. The approach taken by these filmmakers is to seed their films' images within camera reality (the cinema image is referential to the subjects and objects within the frame) even where the images contain no referent. In the case of no real world referent the images should appear as if they were filmed by a camera rather than created by a computer; ergo the animated characters in *WALL-E* (Andrew Stanton 2008) were physically created and filmed with a camera operated by a film crew in order to understand them as a referent. My own approach for *Space/Time* (Michael O'Halloran, 2017; in-production) was to constrain the amount of cinema lighting fixtures used and instead use, where possible, practical light sources such as windows, daylight, desk lamps etc. All of these sources are seen in frame by the viewer thus providing them with a referent. Cinematographer Emmanuel Lubezki's approach to lighting was borrowed here as explained in the following interview excerpt Lubezki discusses his approach to lighting for the film *Tree Of Life* (Terrence Malick 2011).

'On Tree of Life we really tried to do combinations of scenes with light and scenes without, and when you add movie lights they don't have the complexity of natural light. You're putting one

light that has one tone and one color [sic] through some diffusion, and it doesn't have the complexity of natural light coming in through the window from a blue sky and clouds bouncing green off the grass. Some would call that kind of light imperfect, but it's more accurate to call it more complex. That complexity of natural light and the way it hits the face is amazing, and when you start to go that way it's hard to go back and light [things artificially]. The less you use artificial light, the more you want to avoid it, because the scenes feel weak or weird or fake. (Hemphill 2013)

Therefore, to avoid artificiality within the lighting is to create a stronger link for the viewer between the look of the real world and the look of the cinema image; a referent of lighting. Lubezki along with Alfonso Cuarón, much like director Andrew Stanton, also chose to use long, moving takes to show the Cartesian space to the audience in full. Alfonso Cuarón chose not to introduce an edit for the film *Gravity* (2013) until the first scene was complete. This technique does not allow the audience to rest, to take a breath, the process brings them closer to the action in real time, with no alteration in time, the shot takes as long as the action takes; a referent of time and space. This methodology is not dissimilar to the experiments of Cinéma Vérité in the documentary medium and therefore lends authenticity to this narrative film. The following figures (nine and ten) are still images taken from the production and completion of a scene for *Space/Time* (Michael O'Halloran, 2017; in-production) illustrating the methodology in practice for a low-budget production.

Figure 9. The character Holt walks toward the 'engine' in this still from the cinema camera's moving image. The green-screen can clearly be seen in the back ground along with the practical lights on the scaffold and desks and the daylight streaming through the translucent panels on the right side of the warehouse. As much practical set as possible is used, especially in the foreground, to create real-world referents to capture.

Figure 10. In this finished image (from the visual-effects department) the practical lighting has been enhanced. Optical distortions such as lens flares have been added and the 'engine' has been composited in. The 'engine' is being lit by a fixture placed in shot but not turned on as the VFX Department could better control this as a virtual lighting source.

As is shown in these figures the application of methodologies used by Stanton, Cuarón and Lubezki and theory proposed by Baudrillard and Pierce create a singular shot out of otherwise disparate components. By having the CGI 'engine' in the background of the shot interact with the camera's physical lens through lens flare, and, by having the virtual light the 'engine' produces interact with other physical objects of the set the CGI 'engine' is given a physical referentiality; it is seen by the viewer to exist in reality as it interacts with the rest of reality in a preconceived way (reflections, lens flare, specular highlight).

The following figures eleven and twelve take these methods further. This image was captured in a studio environment though the set built was contained and could not be taken apart. The normal practice of being able to remove walls while shooting was not possible on this set as the director, Michael O'Halloran, wanted to imbue the studio process with the restrictions of location production. The only way we could shoot outside of the constructed set was by shooting through the viewing windows. Again, practical lighting sources are used where possible however the light external to the room, coming from other rooms, is added softly to the faces of those closest to the windows through the use of cinema lighting fixtures. Glass windows could not be used during production due to the possibility of reflecting the film-crew so they were created as computer-generated-imagery and the reflections of the external rooms were created and tracked over them. The external facade of the built set is also CGI with reflections and specular highlights reflecting practical light sources from the other rooms being created on the virtual structure.

Further examples from this feature film can be seen in the release of its theatrical teaser trailer online at http://www.spacetimemovie.com/trailer/

Figure 11. This still image taken from the cinema camera's motion image shows the constructed set with practical lighting in the ceiling.

Figure 12. In this finished image (from the visual-effects department) glass has been added with reflections and the practical lighting has been enhanced while subtle optical distortion has been added (such as flare and vignette).

These shots are made with the same or similar methodology used by the foremost practitioners of virtual cinematography in Hollywood Filmmaking today. Though they are applied in a low budget context the relationship they have to the theory presented earlier in this article is the same as that of the larger budget films. The images achieved for *Space/Time* (Michael O'Halloran, 2017; in-production) retain a singular direction and a singular author and therefore have a relationship with pre-digital cinematography and virtual imagery stretching back to Norman Dawn's glass-plate-painting technique. Academic John Mateer summates these changes and their affect in his article *Digital Cinematography: Evolution of Craft or Revolution in Production*, published in the *Journal of Film and Video* in 2014.

'The tools of the cinematographer have changed, and methods have been adapted accordingly, but fundamentally, the role is still centred on the creation of images through the understanding of light, optics, and story,' (Mateer 2014).

As Mateer points out the tools have changed and will always be changing but that need not alter the cinematographer's role as a director of photography or, dare it be said, the author of cinema imagery. The earliest cinematographers through to those at the end of the pre-digital age were always responsible, or part of a team of cinematographers responsible, for all of the imagery. As cinema relies on the effect of camera-reality, a notion built into it's very visual-language, it is vital for the cinematographer to be responsible for the authoring of those images. Cinematographers can only do that by embracing new methods as has happened on films such as *Gravity* (Alfonso Cuarón 2013) or *The Jungle Book* (Jon Favreau 2016), and, as *Space/Time* (Michael O'Halloran 2017) proves this can also apply to low-budget feature-films. Although images for cinema created by a computer are able to ignore the rules, methods, and philosophy to which a camera is bound this article proves they should not as they would not be adhering to the language of cinema created through its construction by the camera over more than one-hundred-years. Cinema is the language of images created by a camera, and hence, needs to remain true to the medium's grammar; cinematographers need to guide and guard this language in the formation of cinema narratives. Virtual cinematography is now becoming a mainstream and vital aspect of large-budget film production. In this author's opinion it will soon become a regular part of low-budget film productions as well. It is therefore necessary for traditional cinematographers to accept the presence of virtual techniques in modern filmmaking and to adapt their own skills. They have a lot to contribute in this virtual production landscape that does not threaten, but solidifies their importance in film production no matter the budget. Recently, prior to the release of the feature-film *The Jungle Book* (Jon Favreau 2016), visual effects supervisor and cinematographer Robert Legato, ASC was interviewed by co-founder of the *Global Cinematography Institute* Yuri Neyman, ASC. Neyman poses the question that if today's cinematographers acquire the skills necessary to create pictures for a project requiring both practical and virtual cinematography then they would become known as 'expanded cinematographers.' Legato's response to this question was, 'yes, or what will be, in a few years, a cinematographer,' ("Expanding Role of the Cinematographer" with Robert Legato, ASC, 2015, 3:18min). Cinematographers will always be one of the many vital authors of the multi-authored language that is cinema, and, as the production of cinema will always be changing so too will the skills and knowledge of its authors need to adapt.

1.6 Bibliography

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