**Digital Visions: Visual Realisations**

Mediating image fidelity and digital decay in the cinematographer's process. A study interrogating digital technologies, agile working and craft knowledge in cinematographic practice.

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A thesis submitted in partial fulfilment of the requirements of Bournemouth University for the degree of Doctor of Philosophy

July 2023

Bournemouth University

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**Abstract**

**Digital Visions: Visual Realisations.** Mediating image fidelity and digital decay in the cinematographer's process. A study interrogating digital technologies, agile working and craft knowledge in cinematographic practice. By Mark Anthony Bond.

This is a practice led PhD, consisting of a series of practice artefacts and an accompanying written exegesis. The artefacts include digital films, *Outside In, The Garden* and a film and photography installation, *Digital Visions.* The research aims to understand the role of the cinematographer at this point in time in the digital evolution. The enquiry examines tacit skills and embodied craft to appreciate agility of thinking and doing in the cinematographic image construction process. The research adopts a creative approach to practice embracing poetic sensibilities to serve the enquiry. *The Garden* film and *Digital Visions* exhibition feature images of elemental decay in the forest environment, a metaphoric mirroring of entropy evident in the digital image medium. The metanarrative alludes to the interconnectedness of decay, nature and technology inherent in the digital ecology. The methodology employs autoethnographic methods drawing on ethnographic interviews to inform the approach to practice and reflective analysis. This is a qualitative research enquiry employing reflective empirical methods of investigation. Schon refers to this reflection as a 'reflective conversation with the materials of a situation' (1983, p.78). Experiential learning is a salient feature of the reflexive methods, including the Practice as Research model, Nelson (2013) and the Artistic Research model, Frayling (1993). The methodology employs critical dialogue and analytical contextualisation to substantiate the findings (Bell 2019). Significant in this enquiry is the cinematographer/image relationship where the cinematographer is positioned as the creator and guardian of the image in the filmmaking process. Visual understanding requires an energetic engagement, contingent on deep image knowledge and contextual situation. The research practice framework validates the poetic rendering of key themes facilitating a discourse that would be impossible to articulate by text alone. The research outcomes provide a valuable insight into the cinematographer's human process and foregrounds the next cycle of research in the digital evolution, virtual production.

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**Chapter 1: Introduction**

**1.1 Research Rationale**

**1.1.1 Image Construction and Poetic Themes**

"Picture-making, a social practice in which all cultures engage, has to be distinguished from visual perception or the generation of inner, mental pictures, for example. The question 'What is a picture?' seems to ask what is it that the picture consists of, what subjects and themes does it portray, and so forth. But this 'what' of the picture cannot be understood without the 'how', without in other words some understanding of the visual strategy by which to 'what' is carried out. It is also doubtful whether one can isolate the 'what' in the sense of content or theme from the 'how' of its creation, its mise en scène. The 'how' is the true statement, the real speech of pictures" (Belting 2001, p.10).

For as long as I can remember pictures have enchanted me. A late diagnosis of dyslexia in 2016 helped to explain the significance of image-making throughout my professional career. My research enquiry focuses on technological advancements and the creative, human interactions with digital cinematographic technologies. I am keen to understand what it means to be a cinematographer now, to understand the craft and the approach to creative cinematographic work. It occurs to me that deep-rooted themes have influenced my professional work as a cinematographer and academic. These themes could be said to present personal interests, channelling my thoughts and actions and dictating certain events. An autoethnographic approach to research practice has convinced me that feelings initiate movements in the logical mind into believing that personal decisions are pragmatic, deliberate, when in fact this attitude is far from true.  I am of the view that the opposite may be true, or at least that it is not the whole truth. Time and again I am drawn to the natural world, to the forest, to things of the earth, the existential. The elemental interconnectedness of the natural world propels me to the poetic, not necessarily by conscious design but rather an undercurrent that seems to infuse my thoughts and actions,

almost like a religiosity with a lack of awareness regarding the nexus. Nevertheless, these ecological themes assert themselves explicitly in my work and so I am compelled to acknowledge them, pronounce them and illuminate them. The research is primarily concerned with cinematographic image construction and the digital medium, how we see, and how we understand what we see. It examines digital image authenticity, lose and decay, and the mirroring of the material and ethereal qualities of the natural ecology. Creative human knowledge is inextricably tied to the world. The metanarrative is inherent in the digital ecology. The research enquiry aims to reveal cinematographic knowledge insights while the language of that discourse hints at existential conversations, this is the rationale for a poetic rendering of that which is unknown, unknowable and yet must be recognised.

### 1.1.2 Agile Practice and Experimentation

As a practicing cinematographer and research academic it was important for me to position image making at the centre of my enquiry. The methodology comprises methods of investigation that value reflexive practice and acknowledge the practitioner's craft engagement with the tools and materials of cinematography work in an autoethnographic journey of self-discovery and realisation. One of the defining factors in the decision to embark on this framework of enquiry was the requirement to be flexible, free of commercial boundaries as far as possible, to enable spontaneity, experimentation and chance in the process of discovery through reflective cinematic practice, the methodology to "discipline passion not deaden it" (Rose 2001, p.4). The proposition is to examine skills and acquired working practice knowledge and techniques influenced by an approach to image creation that is research focused rather than commercially instigated and commercially bound. The Practice as Research model promoted by Nelson (2013) and Artistic Research definitions (Arts and Humanities Research Board 2001, p.7) accept this degree of flexibility in designing a research framework that is "credible, rigorous and creative" (Paterson 2005, p.339). The enquiry seeks to illuminate an approach to cinematography that is to some extent automatic, tacit or hidden, even from the practitioners involved in the creative process, and to understand the intimate relationship the reflective practitioner has with tools,

techniques and materials. The enquiry seeks to understand how tacit skills and embodied craft enable an agility of thinking and doing in cinematographic practice.

### 1.1.3 Craft Knowledge

The notion of cinematography as craft is problematic, due in part to the association of advanced digital technology and mediation of the image as code or data. One more easily imagines the furniture maker or artist as a craftsperson, engaged in the workshop or studio, indentured as an apprentice, where the craftsperson learns to work with tools, materials and techniques under the guidance of a master. The cinematographer, then, requires an intimate knowledge of the medium in the same way the carpenter knows wood or the artist, pigments and canvas. It was important for me to engage in face-to-face conversations with established practioners in the field of cinematography to inform strands of my investigation. It was necessary to converse with experts in the field to avoid a closed internal dialogue, the maker and self-observation. Bell notes the importance of a "dialogue with that external world and the impulses and discourses" (Bell 2019, p.43). The cinematographer Boyle (2017, p.14) notes the significance of craft: "Any art done properly, you have to learn the craft first." Reflecting on visualisation techniques, he observes, "It's really important that you are able to visualise something, that for me is the actual shooting of a film." Bresson (1986, p.86) also notes the importance of visualisation: "Have a painter's eye, the painter creates by looking." The parallels with the craft of cinematography are clear, albeit in a different medium. Empirical knowledge of tools, materials and techniques is a prerequisite to being a craftsperson. In collaboration with the director, the cinematographer guides the development of a distinct visual aesthetic, the look of the film. As the artist's apprentice works base materials, the elemental components, it is, in the same way, a requirement for the cinematographer to develop a deep understanding regarding tools and materials, the moving image medium 'close knowledge', the elemental constructs of the film frame, the grain of the celluloid film stock or the pixel of the digital image. It is also necessary for the cinematographer to acquire the 'wider knowledge' of camera systems, lighting design, framing, composition and narrative storytelling. I am interested in assessing the impact of

digital transitions and the evolution of cinematographic working practices initiated by technological advances. In the research investigation, revisions to working practices and technological advances are manifested in a progressive series of reflective practice research events to better understand the interrelationship of the digital medium, image indexicality and image mediation; in other words, an awareness of how the contemporary cinematographer creates meaning, through craft, knowledge and technique, in the creative image-making process.

### 1.1.4 Displacement the Impetus for Enquiry

I transitioned from industry to academia in 2010. This disruption caused me to reflect on my practice as a professional cinematographer and reappraise the knowledge, working practices and craft skills now informing my teaching and research. In retrospect it was apparent how much had changed throughout the previous twenty years, the myriad technological advances and the digital revolution, framed by Belton (2002), that focused on the transition from celluloid film to digital video. Yet certain fundamental aspects of cinematography such as lighting and lens design seemed to have hardly changed at all. Boyle (2017, p.5) concurs: "Changes in technology have both had a huge effect on the cinematographer and none at all." With the advantage of hindsight, the digital revolution in film and television can be understood as a phase in the continuum of evolutionary technological development, where terms such as High Definition (HD) are synonymous with a stage in that ongoing development, as are Ultra High Definition (UHD) and each subsequent format, 4K, 6K, 8K, and high dynamic range (HDR). Each new technological advance gains prominence on introduction, only to be superseded in due course by the next innovation. In the new age of digital convergence technologies espoused by Jenkins (2006), I was interested to understand the relevance and value of traditional cinematographic craft skills and working practices learned in the field of film and television production. I decided to investigate how the role of the contemporary cinematographer had adapted to this new digital environment and the potential impact of these changes. To enable this investigation,

I adopted an appropriate research methodological framework to explore pertinent issues through a journey of reflective cinematographic practice enquiry.

## 1.2 Aims and Objectives

### 1.2.1 The Digital Image

Academic discourse around the emergence of digital cinematography has tended to focus on the transition from analogue to digital and the affordance of convergence technologies. These digital transitional advances can now be viewed with a degree of hindsight and can be re-assessed as a continuum of change and development. The HD format is no longer in the vanguard of visual technological development, superseded by UHD and HDR. Definition, therefore, can only be thought of as 'high definition' in relation to a lower 'standard definition'. Resolution, a term often used interchangeably with definition, represents the degree to which one can identify and measure the smallest visible element. Therefore, notions of quality and quality assessment are relative and variable, and dependent on viewing technologies, audience perspective and trends, to which the contemporary cinematographer must be attuned and sensitive. This is a prime consideration when reviewing the reflective practice artefacts that have specific aims and objectives. The transition from analogue image capture and photochemical processing to a digital environment has necessitated a change in working practice. Software and solid-state digital technologies have replaced electromechanical filming equipment in production and postproduction, requiring an adaptable, flexible approach from professional practitioners to skills development and knowledge acquisition as they engage with these new digital technologies. This in turn has influenced the visual aesthetic at key stages in the image production process. On the one hand, the drive to render images ever more faithful and true to the referent negates image mediation, and yet, paradoxically, there is a tendency to retrospection and a desire to recreate a favoured 'filmic look', where the organic grain structure is evident, drawing attention to the medium itself. Bazin refers to this counterforce as "obstinate resistance" (Bazin 1967 cited by Belton 2002). With the advantage of digital postproduction tools, the cinematographer now has the option to

modify the pristine image in the postproduction grading process to artificially add film grain effects and aberrations such as scratches and lens flare to mimic the look of celluloid film, if this is deemed appropriate. These effects and other visual adjustments are available to the contemporary cinematographer, providing an option to manipulate the material.

**1.2.2 Modes of Engagement**

The cinematographic practitioner has two primary modes of engagement: the intense (insider) close engagement as discussed by Hannula (2014) and the reflective (outsider) distance-taking engagement. Reflective practice offers an opportunity to explore aspects of cinematography in a way seldom examined in the commercial film and television industry. This enquiry seeks to examine the situation of people and materials, the interrelationship that includes the digital medium, the referent and the reflective practitioner. Essentially this is an experiential, visual enquiry where making images is positioned at the centre of the practice research investigation. The rationale for the research exegesis requires visual engagement and is therefore presented as a series of digital film and photography artefacts, complete with written contextualisation. Complementary writing is not intended to transpose the artefacts into the medium of words. As Nelson (2013, p.36) says, the complementary writing "assists in the articulation and evidencing of the research enquiry" Gadamer takes this further and considers that predefined language can itself be problematic in a research enquiry, by directing our logical thoughts (2005). Ellis and Bochner illustrate the problem by considering the story.

> "If you turn a story told into a story analysed ... you sacrifice the story at the altar of traditional sociological rigour. You transform the story into another language, the language of generalisation and analysis, and thus you lose the very qualities that make a story a story" (Ellis and Bochner 2000, p.440).

### 1.2.3 Image, Medium, Data

It interests me to understand how the appropriation of the image as digital code impacts on the craft relationship the cinematographer has with the digital medium, exposing as it does the immateriality of the medium in relation to the referent. The notion of the subject captured as a latent image and transferred as individual frames throughout the production workflow is challenged in the digital production environment. The cinematographer is the guardian of the image, but the idea of a tangible image chain is irrevocably disrupted as image files are transferred as a data stream, creating a sense of material separation from the referent.

> "At the beginning of digital video, whilst data was generated at low levels via proprietary formats it was possible to regard its limited presence as being immaterial – now we have to think again. In wanting as much detailed information to be retained as possible, Directors of Photography are expressing the desire for verisimilitude with the real world" (Flaxton 2011, p.9).

### 1.2.4 The Research Question and Sub Questions.

Considering the relevant research factors discussed the research questions have been designed to meet the aims and objectives of the reflective practice research enquiry:

*1. How does the application of new digital filmmaking technology, agile practice and tacit craft knowledge contribute to meaning and understanding in contemporary cinematography examined through my practice?*

*2. How does cinematographic image technology and notions of digital fidelity and digital decay determine cinematographic practice?*

*3. How does digital decay enable an eco-poetic rendering of the digital cinematographic image?*

**1.3 Methodology**

This section highlights key aspects of the methodological approach. The methodology will be considered in detail in Chapter 4.

**1.3.1 Reflective Practice, Research Methods**

It is important to understand the impact of digital transitions in the field of cinematographic practice by exploring the moving image constructs, image indexicality and image mediation through a series of reflective practice research events. Mediation is a fundamental component of the creative process which defines the elemental relationship between the practitioner and materials, between body and mind, between doing and thinking. Reflection in action and reflective analysis enable the practitioner to revisit the situation in a hermeneutic spiral of investigation and knowing. This process of reflective enquiry enables a deeper understanding of image appropriation and the creation of meaning, including notions of authenticity and verisimilitude, the 'what' and the 'how' of image making articulated by Belting (2001). Belting's 'how' of image making encompasses the close insider knowledge, while the 'what' is the opportunity to reflect at a distance. Nelson (2013) identifies three overlapping spheres of 'knowing' associated with image making in a reflective, Practice as Research investigation. Nelson refers to a central hub 'praxis', or intelligent practice, where he defines praxis as theory imbricated within practice. Bell contends that Artistic Research is "a cycle of experiential learning forged through the concrete tasks of artistic production." Reflexivity enables practice based on "pedagogic theory" (Bell 2019, p.26). To enable cinematographic image knowledge and image meaning, it is therefore necessary to understand that the creative image construction process is significant to the artefact, that the separate process states are an integral part of the whole. Without this understanding, knowledge and meaning will remain incomplete.

**1.3.2 Methodological Framework and Hermeneutic Enquiry**

The research investigation seeks understanding in a constructivist enquiry characterised by a relativist ontology and subjectivist epistemology (Gray 2004). The methodological framework for this enquiry will draw on aspects of the Practice as Research model as defined by Nelson (2013) and Artistic Research Methodology, which Hannula (2014) describes as an interpretive hermeneutic methodology. The hermeneutic lens can be understood, not as a circle of investigation, but as a network or spiral that has a justifiable variety of entry points, as originally envisaged by Lewin (1948). Makela (1997) considers that in hermeneutics a phenomenon occurs, is analysed and interpreted with the new information used to enable progress by returning to the start of the process again, but now at a higher, more advanced level, hence the notion of a spiral moving forward. Hermeneutics asserts Friedman (2002) allows for multiple interpretations and meanings (cited by Gray and Malins 2004). Hannula (2014) discusses Artistic Research Methodology and proposes a mode of enquiry where a series of works/artefacts (or 'pearls') are made over time with each pearl leaving a material track or record, documentation or data. Each pearl has a public component with critical feedback, which is fed back into research, analysis and making, thereby maintaining and nourishing its continued development.

**1.4 Conclusion**

**1.4.1 Tools for Thinking**

The core drivers for the research enquiry are grounded in reflective cinematographic practice, and serve the research questions, examining new digital technology, agile practice and tacit craft knowledge, to investigate how they contribute to meaning and understanding in contemporary cinematography. The reflective practice research methods are 'tools for thinking' (Hannula 2014). These methods encourage thinking about the processes and procedures fundamental to cinematography and thinking about cinematographic thinking. The methods permit visualisation techniques and internal imagining to be interrogated, offering insights into tacit craft skills, haptic proficiencies,

knowledge, and the creation of meaning through visual means. The research methods employed highlight the importance of experiential craft knowledge gained through many years of practice, but essentially acknowledge the need for spontaneity, chance and technical agility as a necessity. The reflective practice investigation challenges a cinematographic orthodoxy that is underpinned by experience-based hierarchies and industry-established ways of working. Instead, it recognises the value of an alternative, aligned approach that promotes the notion of professional agility, where an agile approach to cinematographic practice born out of professional inquisitiveness and play (Iliescu 2022) necessitates an engagement with new digital technologies in novel and exciting ways, challenging established craft protocols but not undermining accumulated craft knowledge.

**1.4.2 Summary**

In this introduction I have provided an overview of the investigative enquiry. I have discussed the background to the research and examined key features of the research subject field. I have considered the underlying themes of nature and the digital ecology and how a poetic approach is appropriate to explore aspects of the investigation that are difficult to articulate in words alone. I have identified research gaps relating to cinematographic technology, craft knowledge and working practices. I have formulated pertinent research questions, and I have presented my research rationale for a series of reflective practice events as the methodology to explore the role of the contemporary cinematographic practitioner. Research into literature in the field of contemporary cinematography has revealed gaps in cinematographic knowledge and understanding specifically relating to notions of cinematographic visualisation, image cognition and technical agility. The research methods chosen to provide a framework to evaluate the role of traditional craft skills and practices in a contemporary digital production environment, exploring what it means to be a professional cinematographer in a dynamic technological production domain. I have outlined the methodological approaches I am using and the conceptual investigative techniques that I have employed. The research outcomes provide

a valuable insight into the cinematographer's human process and foregrounds the next cycle of research in the digital evolution, virtual production.

**Chapter 2: Justification for the Research**

**2.1 Disruptive Technologies**

> "In digital filmmaking, shot footage is no longer the final point but just raw material to be manipulated in a computer where the real construction of a scene will take place. In short, the production becomes just the first stage of post-production" (Manovich 1996, p.42).

The research asks questions that seek to understand the role of the cinematographer, at this point in time, in this evolutionary process. As a cinematographer I have experienced considerable technological change, both in my professional freelance career and as a research academic involved in professional practice. I have lived through digital disruptions and recognised the need for research into the impact of these disruptions on the embodied craft of cinematography. It is evident that the tools and materials of the cinematographer's craft have changed and developed over time. The cameras, lenses, lights and media have all been affected by technological advances that have influenced the way that these tools and materials are used and have impacted on the ways of working and the visual image aesthetic. Central to these changes is the transition in cinematographic technologies from analogue systems and procedures to digital systems and procedures that have, in certain areas such as postproduction, completely changed the way that work is carried out. The surprising thing in many respects is that the core tools and materials have, to a remarkable degree, remained recognisable during this process of convergence (Jenkins 2006). The camera still captures the image, the lens still sits at the front of the camera and projects the subject image onto a recording plane within the camera body, the lights are still positioned and modified to illuminate the subject to the required degree, and the medium still holds the image (as data) for storage and postproduction. Mechanical equipment and photochemical processes have, to a large degree, been superseded by digital computer-driven equipment and digital software programmes. However, the cinematographer has

learned to navigate and adapt to technological developments and has retained the craft skills, competencies and responsibilities traditionally associated with the role.

Cinematographic craft knowledge and expertise are still important attributes of the cinematographer in a contemporary digital production environment, although this view is contested by some academics. Mateer (2014, p.1) asks, "Is this truly a new era in which the cinematographer has become more of a data-capture specialist than a visual artist?" Manovich claims that, in the new digital environment of raw data, images are data files to be worked on by technicians, that "live action footage is now only raw material to be manipulated by hand" (2012, p.5). I would argue that these views that undervalue the role of the cinematographer represent a phase (Belton 2002) in the evolution of cinematographic image construction, where technicians and cinematographers are redefining their roles and collaborative partnerships. This is exemplified by the recently established collaboration that exists between the DOP and the digital image technician (DIT) and the long-established partnership between the DOP and the colourist. The DOP acknowledges the skills and responsibilities required to effectively manage image data and refine the visual image aesthetic to achieve the desired visual outcomes. Tim Waller (2017, p.119), a renowned colourist, explains that, as postproduction systems become ever more complex, effective teamwork is essential: "Postproduction is a very difficult and complex area, and depending on what you're shooting there will be a different chain of events." However, Waller believes that, regardless of technology, "the creative element of any production is the human desire to create art and to create the images which are going to tell a story" (2017, p.130). Creativity, he points out, has to come from an individual's aspiration and creative ability. Sennett(2008, p.144) considers that the craftsperson "represents in each of us the desire to do something well, concretely for its own sake."

Manovich (1996) anticipated the impact of technological change on traditional craft roles. He predicted that advancements in digital technology would necessitate a level of adaptation and computer operation that had the potential to fundamentally change the craft role of the cinematographer. Key operations in pre-production, production and

postproduction may become desk-bound or automated, and tasks once considered core aspects of the role will become remote, or be farmed out to digital technicians or data wranglers, or disappear altogether. The cinematographer is in fact no longer a manual craftsperson but is now a computer operator. In this role the cinematographer is now supported on set by the DIT to manage the complex digital workflow and facilitate effective data management across production departments. Wilson (cited by Raldo 2015) explains that the DIT's role is more complicated than people at first realised and "that level of complexity is broadening all the time." The DIT requires a deep knowledge of data coding and digital systems used to manage the vast quantities of digital data that require faultless storage, copying and logging. The transition to a digital workflow required selective use of digital compression to reduce file sizes and create manageable data streams. However, the inevitable compromises associated with the loss of data is undesirable in 'high-quality' images, promoting the development of efficient lossless codecs that retain image fidelity to a far higher degree. "Cameras in essence became computers with lenses stuck on the front" (Boyle 2017, p.109), the complex electromechanical operations and the optical pathways replaced instead by digital processors and liquid crystal display (LCD) screens, the analogue recording medium superseded by solid-state storage cards and drives, with sound and image reduced to data.

Radlo (2015, p.1) notes additional responsibilities due to "increasing prevalence of digital technology in production". The additional responsibilities include an understanding of colour science, look-up tables (LUTs), digital formats and compression codecs, and knowing what works in different applications. Digital software capabilities and computer processing speeds are advancing ever more rapidly, with digital storage capacity increasing at an exponential rate and complex digital systems integrated across media platforms, as predicted by Jenkins (2006). As a film student in the 1980s I was trained on video and film camera systems. The 16mm film cameras I was trained on included the Bolex, Éclair, ARRI ST, ARRI BL and ARRI SR II. I knew these cameras intimately, an intimacy that evolved

through hands-on experience, by learning how to load film magazines by touch and feel in a light-proof changing bag, feeding the correct size film loop into the camera gate mechanism, cleaning the gate and operating the camera and lens systems. These skills took time and patience to master with confidence. The Éclair camera was used by cinematographer Raoul Coutard and director Jean-Luc Godard to shoot seminal French New Wave films, such as *Breathless* (1960). When I worked as a cameraman in the 1990s, these 16mm cameras were still being used professionally. In 1997 I was contracted by HTV/Filmfair/Cinar as the DOP to shoot series three and four of *The Wombles*, a children's stop-frame animation series, at their studios situated close to BBC Television Centre. The remarkable thing is that both series were shot on a range of adapted Bolex H16 reflex cameras which were valued for their excellent image stability and image quality. It is notable that these cameras were first released in 1956. Established film cameras had a long life.

The story with video cameras and video formats has been very different. Video camera designs have, on the whole, proved to be short-lived, with video cameras and video systems often obsolete within a few years of release. New camera models are revised and updated on a regular basis and the same is true of video formats, codecs and storage media. My observations suggest that an important factor that has enabled rapid digital transformations to take place while maintaining a remarkable degree of coherence for the cinematographer's role to date, is the fact that so many different systems, old and new, have been designed and used in parallel, overlapping systems as it were, for a significant period of time. New top-end, digital cinematography camera systems feature components that are retro designed to accommodate a dominant film production culture. Backwards design compatibility is clearly evident in camera lens design and digital camera file formats and media. Backward-compatible HDR MPEG video compression advantages investigated by Mantiuk, Efremov, Myszkowski and Seidel (2006) consider viable design solutions that permit transition from low-contrast video to HDR utilising established file formats. Advances in technology provide innovative design solutions that permit integration with legacy camera systems. The new must accommodate the old, until a point of assimilation is reached. Backwards compatibility is typically highlighted by equipment manufacturers to

ensure user confidence. When the ARRI camera company announced the new range of Alexa LF (large frame) cinematography cameras (2022), it stated, "Full compatibility with existing PL mount lenses and Alexa accessories is a cornerstone of the system's design." The PL (positive lock) lens mount system was initially designed (1980) for analogue camera systems. It has now transitioned into the digital domain and is common on top-end digital cinematography camera systems. Nikon (2022) notes compatibility in lens design to ensure "users get the most value from their lens investments", and is committed to "continue to design cameras that have that built-in backwards compatibility". Backwards design compatibilities have contributed to professional confidence across the analogue and digital cinematographic systems landscape. This hegemony is now coming to a close as a new generation of digital filmmakers emerge with little or no film knowledge or allegiance. Lachman interviewed by Frost (2021, p. 122) notes that a younger generation "who grew up on digital images may prefer seeing them digitally." Savides (2021) considers how younger people, having grown up with digital images, they have a different understanding of what film looks like, they are more accustomed to a visual film aesthetic where the "highlights are blown out, the colour and shadow detail different" (Frost, p.285). This research is important now, before the next stage in the evolutionary development, which may see a radical departure from established cinematographic production norms. The advent of virtual reality (VR) and virtual production (VP) promises unprecedented change, which is, as yet, impossible to predict accurately. This research aims to identify why it is important to investigate the role of the cinematographer now, before the next wave of technological change. The research seeks to understand the significance of embodied craft knowledge, where intuition and haptic knowledge are essential components of being a cinematographer.

## 2.2 Embodied Knowledge

The research considers the significance of craft knowledge, employing mind and body in the creation of the digital cinematographic artefact. This integrative process is dependent on technological systems that have undergone continual advancement, instigating changes to

the visual aesthetic and ways of working as identified by Beach (2015). As film camera technologies are superseded by digital capture technologies, Savides asks an important question: "Should movies look like film?" (Savadies 2007 cited by Beach 2015, p.174). Savides makes a number of observations regarding digital capture. On the one hand, he observes that digital creates a "more immersive" audience experience; however, on the other hand, the "synthetic" quality "can distract from the believable portrayal of the lived experience". Lucas notes that the cinematographer is, among other things, a mediator, testing and facilitating innovations and adapting to new ways of working and new ways of seeing. Lucas (2011, p.45) also notes the tensions that mediation imposes on the cinematographer, "resisting radical change while also pushing against convention". He argues that "Creativity in the face of convention is where cinematographers find reputation and recognition." The cinematographer's role is complex yet fluid; it is rooted in convention yet must necessarily be open to change. Nuska (2015, p.8) observes that "film technique development is in a constant state of change". Lucas (2011, p.160) contends that "there is an aspect of craft that requires techno-scepticism", an approach that acknowledges the potential for new, disruptive technology to challenge existing orthodoxies and consider other ways of doing things. The reflective practitioner requires a critical self-awareness that validates the positioning of the cinematographer at the centre of the image-making process, cognisant of notions of authenticity and artifice at the heart of the image construction. Beach considers how cinematographers are tasked with "achieving a sense of believability or authenticity" in the images that they presented" (2015, p.6). It has long been recognised, adopting a structuralist approach, that visual images can be understood in linguistic terms as a form of representation. The image generated is a representation that is contingent on signifiers relevant to the filming mode and context. Barthes (1964) contends that "signification can be conceived as a process; it is the act which binds the signifier and the signified" (Barthes 1964 cited by Hill and Wang, 1968).

This is the realm of the cinematographer, where craft knowledge, technique and understanding contribute to the visual design aesthetic and the look of the moving image. Moreover, the cinematographer embodies the role physically, with a direct engagement with the tools and materials of their craft, orchestrating camera, lens, lights and medium,

to imprint a distinct signature in the work that they create. Harper (1987, p.21) says that an expert is someone with "knowledge that allows them to see beyond elements of the technique to its overall purpose and coherence." In this respect I position the cinematographer as 'the guardian' of the image in the filmmaking process. The creative practitioner must navigate the challenges and opportunities posed with each new wave of technological development and consider how image meaning and understanding might shift accordingly. It is necessary to acknowledge the impact of these changes on the role of the cinematographer, as they mediate new disparate technologies in the quest for creative image opportunities. Lucas considers that this has always been an integral part of the cinematographer's craft.

> "New looks and competing aesthetic regimes have always been a part of cinematography; indeed, cinematographers see interpreting such shifts as a significant aspect of the craft" (Lucas 2011, p.59).

There is the potential, as digital technology advances, for sophisticated digital image capture, storage and manipulation processes to become further removed from the conventional production arena and be repositioned to remote desktop environments or automated processes governed by artificial intelligence algorithms. Manovich (1996, p.29) asserts that digital image rushes are "no longer the final point but just raw material to be manipulated in a computer". He argues that, in the future, the real image construction will take place in a postproduction environment. However, Manovich also points out that computerisation does not necessarily equate with automation and that in certain applications, such as digital effects, the opposite is true: "What was previously automatically recorded by a camera now has to be painted one frame at a time" (1996, p.31). This is a concern, as new digital technologies may *disembody* the cinematographer from traditional elements of cinematographic production. The cinematographer's role requires a physical interaction with the camera and filming equipment. Camera operation requires a physical intimacy with the camera components, the eye on the eyepiece, the shoulder on the shoulder mount, fingers positioned on familiar controls and the camera

perfectly balanced to move swiftly to capture dramatic action. It is pertinent to consider how disengagement and an accompanying loss of autonomy might impact the role of the cinematographer and the effect this would have on notions of authenticity and realism in the work that they create. "Cinematic realism," Manovich(1996, p.42) says, is "being displaced from being its dominant mode to become only one option among many." Cinematographer Dion Bebe is adamant that "Every cinematographer has his or her own identity, sense of working and lighting style" (Holbein 2004 cited by Lucas 2004, p.289). Now it has become necessary to consider to what degree the identity of the cinematographer is fixed to conventional practice, tools and materials. Advances in filmmaking technologies ensure that cinematography is in a constant state of flux. Some of the recent technological developments that have impacted the craft of cinematography include:

- Transition from analogue to digital capture
- Digital convergence technologies
- Three-dimensional filmmaking techniques
- Computer-generated images (CGI) in games design and animation filmmaking
- 360-degree image capture
- Mobile phone filmmaking
- VR
- VP filming methods

Beach describes how "many films use a form of 'digital suture' to blend live action with CG enhancements", noting how this "blurs the lines between cinematography and other forms of image creation" (2015, p.176) as seen in *Avatar* (2009). At the time of writing, the full impact of VP innovations on the role of the cinematographer is impossible to predict. Disruptive technologies have the potential to change working practices and film style. Willis notes how the advent of consumer-grade camera technology empowered independent filmmakers to "advocate a return to the real, the organic, the authentic" (2005, p.24). It is probable that VR and VP will have consequences for the role of the cinematographer in certain sectors of the industry. Software developments in pre-production (pre-visualisation) and postproduction (colour grading) image processing techniques are already effecting

change. Beach (2015, p.177) notes that "Advances in digital previsualisation software now enable filmmakers to experiment with cinema angles, composition and movement on 3-D virtual sets before the film is shot." There is now the option for digital pre-visualisation to be designed by technicians in collaboration with the director, potentially reducing the role of the cinematographer at this stage of the production process. The identification of these changes has established why this research is important now, as it offers a valuable insight into the role of the cinematographer as a barometer to reflect change in the industry at this moment in time.

## 2.3 The Research Questions

The research questions are designed to examine how key aspects of my cinematography practice that are linked to craft knowledge, digital image-making technology and traditional ways of working in the film and television industry can be understood and create meaning within a research context. Therefore, the research question is framed thus:

> *1. How does the application of new digital filmmaking technology, agile practice and tacit craft knowledge contribute to meaning and understanding in contemporary cinematography examined through my practice?*

> *2. How does cinematographic image technology and notions of digital fidelity and digital decay determine cinematographic practice?*

> *3. How does digital decay enable an eco-poetic rendering of the digital cinematographic image?*

The research question seeks to understand how tacit knowledge might influence an approach to reflective cinematographic practice and illuminate (make explicit) creative cinematographic thinking. The expert practitioner recognises a situation, and intuition, it seems, snaps into play with an instant solution. Kahneman's investigation of the two-brain

system proposes a fast and slow thinking process involved in decision-making. To understand the role of the contemporary cinematographer it is necessary to consider the significance of intuition and haptic perception in embodied craft practice. Intuition, Simon asserts, is "nothing more or nothing less than recognition" (1992, p.150). Kahneman (2011) expands, describing intuition as the ability of an expert to recognise "familiar elements in new situations". Kahneman explains that accurate intuition is not mysterious; the "apparent magic of intuition" can be reduced to cues that are recognised from accumulated experiential knowledge (2011, p.237). The term 'haptic', coined by Dessoir (1892), refers to a system of research related to the sense of touch. Gibson (1966, p.97) notes the links between haptic perception and body movement, "the sensibility of the individual to the world adjacent to his body by use of his body". By exploring my reflective practice in a series of practice research events I aim to make explicit techniques and approaches to cinematography in creative image construction. The field of exploration is practical and visual. Learning is experiential, as identified in Kolb's (1984, p.21) learning cycle, where practice and reflection leads to analysis and further practice as research in the quest for knowledge and understanding. Sennett's comments about a master craftsman may be applied equally to a cinematographer.

> "All craftsmanship is founded on skill developed to a high degree. By one commonly used measure about 10,000 hours of experience are required to produce a master carpenter or musician. Various studies show that as skill progresses, it becomes more problem attuned, like the lab technician worrying about procedure, whereas people with primitive levels of skill struggle more exclusively on getting things to work. At its higher reaches technique is no longer a mechanical activity; people can feel fully and think deeply what they are doing once they do it well" (Sennett 2009, p.20).

**2.4 Areas of Interest**

The research question has prompted the identification of four key areas of interest: Image Knowing, the Visual Realisation Cycle, Cinematographic Immediacy and Technical Agility. These areas of interest set the foundation for the Themes and Boundaries and the Gaps in the Field of Knowledge examined in Chapter 3: Literature Review.

Image Knowing

Recognition that the cinematographer has a deep understanding of image cognition and image mediation, which are utilised to create meaning.

The Visual Realisation Cycle

A reflexive three-stage process of cinematographic visualisation employed in conceptual image visualisation and creative image realisation, in a production and postproduction environment.

Cinematographic Immediacy

A self-awareness and understanding of the intuitive processes involved in creative cinematographic thinking in action.

Technical Agility

The ability to employ technical cinematographic equipment in adaptable and novel ways to achieve creative professional results.

These areas of interest can be summarised with reference to Crawford's conceptualisation of knowing more than we can say:

> "The basic idea of tacit knowledge is that we know more than we can say, and certainly more than we can specify in a formulaic way. Intuitive judgements of complex systems, especially those made by experts, such as an experienced firefighter, are sometimes richer than can be captured by any set of algorithms" (Crawford 2009, p.168).

### 2.4.1 Image Knowing

> "Every image embodies their way of seeing. Even a photograph. The photographs are not, as is often assumed, a mechanical record. Every time you look at a photograph, we are aware, however slightly, of the photographer selecting that site from an infinity of other possible sites" (Berger 1972, p.10).

To understand the special knowing relationship the cinematographer has with image creation it is necessary to consider two contentions by Cubitt (2014, p.244), the realisations that "analogue and digital photography produce a record of light, not things", and that "the video image, analogue or digital, does not exist." He goes on to explain that "Coherence has to be constructed after the event by applying massively reductive processes to the frame" (2014, p.251). Cubitt raises questions that are fundamental to the craft of cinematography, image realisation and the image medium. What is the image? How is the image perceived? Where does it exit and in what form?

The responses to these questions are at once both simple and complex and lie at the core of reflective cinematographic practice. There is no intrinsic digital image as such; the image does not exist at any point as a digital frame, in the way that the celluloid film negative or the latent image captured on the film emulsion exist. Digital cinematography is data centric, as Mateer (2014, p.9) notes: "Recorded images are nothing more than computer files." The digital image exists as digital data or code, within a carrier format, with sufficient data to render the referent in resolution and definition to the degree required. Flaxton (2011, p.4) discusses the advantages and limitations of Group of Pictures (GoP) digital compression where "The first and last frame in a group of pictures contain all the information, each succeeding picture only contains the changes in the information." Redundant information data is discarded in the process to meet the necessary economies required for effective data management and transmission, with digital entropy evident in even the highest quality data transfer. As Mateer (2014, p.10) asserts, "Setting exposure for these systems is about capturing as much data as possible rather than creating the exact look per se." Cubitt makes a similar point regarding compression:

"As every digital cinematographer knows, it is essential to gather as much information about the light as possible, because the quantity and quality of information begins to degrade from the moment of exposure. Despite the common belief that digital files can be copied an indefinite number of times with absolute accuracy, in practice the multiple compression-decompression cycles that files are subject to, added to the vagaries of transmission, demonstrate that digital media do not escape from the second law of thermodynamics any more than film print" (Cubitt 2014, p.251).

This realisation is important in understanding that image creation decay is ever present in the digital environment, as in the analogue environment. This is contrary to the common assumption (regarding digital cloning) where the clone is believed to be a perfect copy of the original. However, entropy or loss of image data resulting in image degradation, although considered a negative attribute, can have positive applications in software and in cinematographic techniques and processes. Visual degradation attributes may be considered as another cinematographic tool to utilise. Balsom (2017, p.79) considers Canudo's (1923) contention that "cinematic truth has nothing to do with the truth of visible reality". He questions how truth can be communicated when bound to visible reality, suggesting visual alterations, distortion, and manipulation, degrading the image, and so elevating it to art status. Balsom contends that high definition is not an essential attribute of the cinematographic art status, and instead points out that low-definition filming techniques "weaken the iconic likeness to the referent, and emphasise departure from physical reality" (2017, p.80). Willis (2005, p.222) notes that filmmakers "even celebrate the image degradation, making it integral to their stories", while Balsom notes the creative value of inexactitude:

"When new technologies are once again promising unprecedented heights of iconic fidelity, filmmakers are once again turning against the automatic production of exact likeness, in search of blurrier, smudgier ways of seeing" (Balsom 2017, p.87).

It is necessary to reconsider the image as a stand-alone entity, existent in mind and medium. In this regard the reflective cinematographic practitioner must consider the integrity of the image in the image generation process. Belting (2001, p.10) asserts that we must distinguish between making pictures as a social practice and "visual perception or the generation of inner, mental pictures." This distinction raises interesting questions regarding the image visualisation and the image medium. "The distinction between image and medium is rooted in the self-experience of our body" (2001, p.11). The carpenter's relationship with craft and medium is clearly manifest in the physical form of the artefact. To understand the complex relationship between the cinematographer and the image medium it is necessary to examine and differentiate between thinking, seeing, creation and generation of the image. "We only see what we look at," writes Berger(1972, p.8), "what we see is brought within our reach – though not necessarily within arm's reach." This suggests that the image exists in separate and joined domains. Belting (2001, p.36) contends that "Mental images, as has become evident, cannot be separated from physical images by means of any clear-cut dualistic scheme." The conceptual imagined image exists as a thought in the mind's eye. The image viewed exists as an immediate sensory perception subconsciously, prior to reflection, and consciously post reflection once the viewer has applied conscious thought to the image. Through the visualisation and realisation production process the image is modelled, finessed, captured and created by the cinematographer. The difference in the creation of the image, the bringing into existence of the image and the reflexive generation of the image in subsequent generations is subtle but worthy of note. The seeing, the sensory perception within the body as it were, may be understood as a synthesis of visual signals mapped against internal image memories, an archive of references linked to knowledge, experience and culture. This process acknowledges the existence of the image concurrently in different domains, a cognitive process that incorporates the fast and slow brain thinking as proposed by Kahneman (2011), intuitively employed in creative cinematographic design. This is supported by Belting, who notes the value of understanding embodied imagination:

> "The images of memory and imagination are generated in one's own body: the body
> is the living medium through which they are experienced. In turn the distinction
> between *memory* as the body's own image archive, and *remembrance* as the body's

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own generation of images has implications for this body experience" (Belting 2001, p.11).

Drawing on Belting's understanding, the cinematographer's mind and body are integral in the conceptualisation, visualisation and realisation process. The progression from conceptual thought to image capture and medium manipulation places the reflective practitioner at the centre of this special knowing relationship with image and image creation. In acknowledging the complexity of image cognition, the significance of the subjective gaze must also be considered. Mulvey (1975, p.10) introduced the concept of the male gaze, the notion of women objectified in film, where the "determining male gaze projects its fantasy onto the female figure." In a contemporary analysis, Guo (2023, p.14) notes the "absence of the female gaze" in Mulvey's argument and asserts that the male desire is examined while ignoring the "female desire and pleasure to see and be seen." This highlights the necessity for the reflective practitioner to look in the mirror and, as Taylor (2019, p.1) says, "check your privilege" – in my case, white, middle class, able-bodied, educated. Intersectionality, a term coined by Crenshaw (1998), establishes the importance of identifying overlapping systems of oppression. Intersectionality, Taylor (2019, p.1) explains, is an acknowledgement that each person has their own experience of discrimination, and anything can be used to marginalise people: "gender, race, class, sexual orientation, physical ability, etc."

## 2.4.2 The Visual Realisation Cycle

Visualisation

Pre-production | Production | Postproduction

Pre-visualisation | Actualisation | Realisation
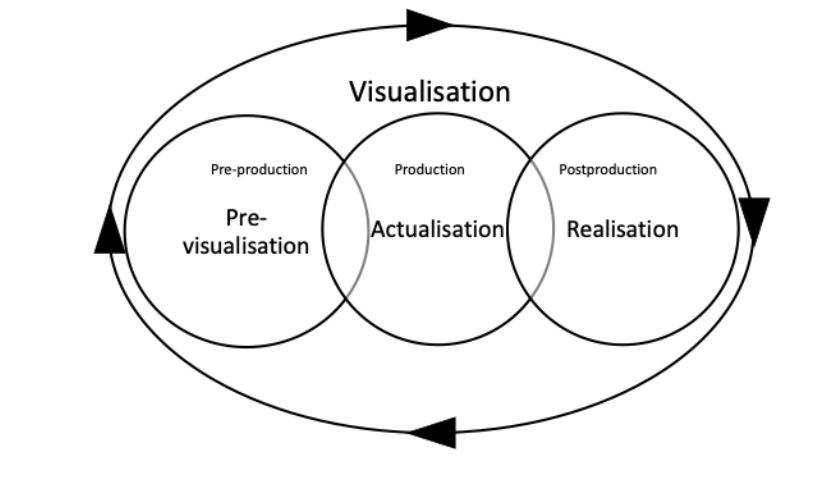
Figure 1. The Cinematographic Visualisation Process

The cinematographer maintains a discrete knowledge, an approach to image creation through embodied experience, assimilating external and internal image knowledge. It is helpful to consider how this philosophical knowing encompasses three parallel paths of visualisation, with each path referential to the other two. This will be discussed further in Chapter 4: Methodology. In the initial abstract pre-visualisation (phase 1) there is already an appreciation of the affordances of postproduction manipulation. During production (phase 2), reflection on the visual reality modelled, aligned to the imagined conceptual framework, requires further rethinking and reflexivity. In the final postproduction colour grading (phase 3), the referent's indexicality to the idealised visual reality and the initial conceits mesh, impressing intellectually and experientially, an amalgam of the three visualisation phases as a sensory experience perceived within the body.

> "Generally speaking, as the transmission arrives from the visual apparatus, the mind seizes upon a facet of the object out there and holds it for our potential use. Instantly, the clues activate a search for meaning based on what shows up in our memory bank. There are thus always markers to read, hints to decipher, plays that refer back to our own experience. Soon enough, we end up categorising what was

new or foreign just seconds before, making it possible to proceed forward assured that nothing is remiss" (Geuens 2000, p.161).

### 2.4.3 Cinematographic Immediacy

The research considers the influence of tacit craft knowledge on creative practice, exploring the physical interplay of materials, tools and technology in the realm of cinematography. Crawford (2009, p.163) suggests that "The things we know best are the ones we contend with in some realm of regular practice." While visualisation involves the process of creating mental images, craft engages body and mind with tools and materials, giving rise to a knowing familiarity which becomes semi-automatic like riding a bike: once you know how to do it, you do not question the complex balancing process but rather focus on the journey and pressing external factors. The cinematographer has an intrinsic body knowledge of their camera, and this familiarity ensures a confidence of movement, the lens becoming an extension of seeing. "Heidegger famously noted that the way we come to know a hammer is not by staring at it but grabbing hold of it and using it" (Crawford 2009, p.164). To know a camera, then, one must take hold of the camera and use it, physically, to make images. Body knowledge and image creation are inseparably tied. The orchestration of camera, lens, lights and medium is physical; it permits, or rather it is impossible to rule out, the multiplicity of subtle human variations, anomalies, missteps and synchronicities that contribute to the final rendering of the image. In his notes on cinematography, Bresson's advice is revealing: "Be as ignorant of what you are going to catch as a fisherman as of what is at the end of his fishing rod" (*The fish that arises from nowhere*) (Bresson 1975, p.73).

Where modes of work, human behaviours and communications are formalised and regulated, algorithms provide reductionist solutions to complex problems, fuelling the development of machine intelligence and undermining the distinct idiosyncratic outputs of creative visual artists such as the cinematographer. This has the potential to reduce intuitive craft skills to task-driven, repetitive, technical functions. Crawford (2009, p.166) notes how work can become degraded when intuition is replaced with rule following, "codifying

knowledge into abstract systems of symbols that then stand for situated knowledge." Bell refers to this codification as "intellectual technology" (Bell 1973 cited by Crawford 2009, p.167):

> "the substitution of algorithms (problem-solving rules) for intuitive judgements. These algorithms may be embodied in an automatic machine or a computer program or a set of instructions based on some statistical or mathematical formula" (Bell 1973, p.29).

**2.4.4 Technical Agility**

It is therefore necessary to re-examine the relationship of the craftsperson to their tools, of the cinematographer to camera, lens, light and medium, and the interplay of body, hand and eye coordination synchronised to capture and record visual realities, where conformity and consistency is the antithesis of creativity and the creative process. Through experience the body knows the camera operations in the same way the musician knows their instrument; the professional pianist doesn't have to think about finger placement on the keyboard but focuses instead on creating music as a live experience in the moment.

> "This leads us into the etymology of the term 'digital,' where it not only implies the most basic of differences in computing but reminds us also of the hand (with its fingers, or digits) as our most versatile of human tools, accessory, extension, and implement. Where the eye appears to have been the most important body part and sensory channel for much of the 20th century history of film (theory), today the hand (of the video game player, the photographer, the cinematographer, the designer and the draughtsperson) enters the media again, especially as in the eye-hand-coordination so central to computer games and to any action conducted with the mouse, another technological extension of humans into the (in)animate realm of conceptual metaphor" (Elsaesser and Hagener 2015, p.213).

The association of craft with digital technology can be viewed as problematic in cinematography and belies traditional craft skills, the empirical knowing of tools, materials and processes. Sennett contends that physical engagement in craft is satisfying in and of itself, bringing the reward of doing something well, the sense of fulfilment that comes with being present in the act of creation, where spontaneity, synchronicity and intuition contribute to creative reflexive practice. Craft, says Sennett (2008, p.144), "represents in each of us the desire to do something well, concretely for its own sake." Scorsese acknowledges "the passion and physical relationship" of "artist and craftsmen" working with film (Dean 2011). The justification for the research considers the importance of the tacit, experiential knowledge in revealing new insights in cinematography, as I have experienced and observed through my practice.

**Chapter 3: Literature Review**

**3.1 Themes and Boundaries**

To investigate the research questions I have considered the range of academic literature in the field of cinematographic practice. The review of published knowledge in my field of investigation can be broadly grouped into the following three categories:

1. Digital Technology

- Digital technology employed in the field of cinematography, including image capture, image storage and transfer, and image manipulation.
- The digital medium and the legacy of analogue.
- Image science and colour science.
- Image visualisation and realisation.

2. Craft Knowledge

- Cinematographic craft knowledge, craft practice and evolving working practices.
- An approach to the use of cinematographic tools and techniques.
- The application and adaptation of technology and technique.
- Heuristic knowledge.
- Tacit/explicit knowledge, fast and slow thinking and the two-brain system.

3. Reflective Practice

- Approaches to reflective and reflexive cinematographic practice.
- Practice as Research and Artistic Research models.
- The interrelationship of the medium, the artefact and the practitioner.
- Doing, seeing and understanding.

The survey of published literature promotes a critical evaluation and seeks to understand how research and thinking has developed in subject areas related to my field of interest. It interrogates the degree to which academic spheres of enquiry overlap, informing knowledge development, and illuminates gaps in knowledge and understanding in the enquiry pathway. This mapping (Gray 2004) of information has been important in establishing the scope, direction and boundaries of my enquiry, and has helped to identify gaps in the current discourse, enabling my methods of investigation to be effectively focused and provide knowledge and insights which are novel and original. Reflective cinematographic practice necessarily requires a deep understanding of the materials, tools and techniques associated with cinematographic image construction while recognising the value of traditional craft disciplines and novel ways of working and doing. The above summary forms the basis for my survey and subsequent organisation of the literature into distinct themes, permitting a pathway of investigation through my chosen methods and methodology.

**3.2 Identifying the Gaps in the Field of Knowledge**

Reviewing the literature identifies gaps across areas of knowledge relating to this research enquiry which I will aim to address, as detailed below. The gaps identified relate to three overlapping spheres of knowledge that incorporate technology, technique and reflective practice. The first area identifies a gap in conceptual image realisation regarding the process of image visualisation and image construction, in other words the marriage of the imagined image and the reality of the image constructed in a production environment, which is then modified and manipulated to address any shortfall in the initial imagining. This internalised 'back and forth' in this conceptual thinking process is a creative, tacit cinematographic skill developed over time through reflexive practice and experience.

The second area considers the importance of agile practice. This includes an agility of thinking and an agility in doing, where experimentation and testing are recognised as valuable attributes to practice. It considers a flexible approach to cinematography that recognises the importance of adapting tools and techniques when working with complex

digital cinematographic filming equipment and in a variety of challenging filmmaking circumstances. The third area questions the interrelationship between the image artefact and the subject, and the image medium and the image referent.

## Cinematographic Image Cognition

Visual Ontologies — Intuitive Understanding — Conscious Representation — Mediated Image

Time →

The world that the camera lens is pointing at.

Tacit image understanding. A subconscious knowing.

The internal imagined image. A conceptual construction incorporating art and design, and mise-en-scene.

The realised image artefact, corresponding to each stage of the image cognition process.

Figure 2. The Cinematographic Image Cognition Process

1. Cinematographic Visualisation

- An understanding of the creative, cognitive process of cinematographic image visualisation, realisation and mediation in cinematographic practice (Figure 1).

- The process considers the cinematographer's internal imagined images created through pre-visualisation, leading to image actualisation in a live production environment and image mediation through postproduction manipulation techniques in a cyclical reflective process (Figure 2).

2. Agile Practice

- Recognising the importance of a flexible and adaptive approach to technology, craft and technique in the field of cinematography and reflective cinematographic practice.

- Appreciating the adaptive design capabilities of the cinematographer's human factors and methods incorporating technology, materials, environment and evolving working practices.

- Examining practice and exploring the physical interaction with materials and technologies that consider new, agile ways of working that result in new ways of seeing and understanding.

3. Contextual Interrelationships

- Exploring the complex relationships that exist between the cinematographic reflective practitioner, the image medium and the artefact.

- The exploration considers image cognition and indexicality in relation to the referent in reflective cinematographic practice.
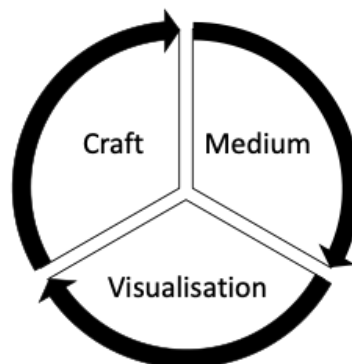


Figure 3. Cinematographic Knowing

**3.3 Digital Convergence, Craft and Image Hierarchies**

Mateer (2014) raises an important question regarding the evaluation of craft skills in a digital age; is the digital cinematographer a visual artist or a data capture specialist? McCulloch argues that the separation of "practical craft and fine art" has been ongoing since the Renaissance, where the artisan may be classed as a skilled manual worker while the artist is considered a creative intellectual. McCulloch (1996, p.12) notes that "tools and technologies have assisted and opposed the hand throughout history." Jenkins (2006) discusses the digital revolution and the impact of digital convergence on image capture technology, leading to a change to working practices in the film and television industry, although it is questionable if this has fundamentally challenged the cinematographer's craft. My investigation considers Manovich's (2001) argument that the digital revolution is devaluing the moving image, turning full circle back to painting or animation where rushes become merely raw data, material to be manipulated on a computer by a technician. However, this negates the upskilling required by cinematographers, who now have to understand a range of digital image systems, including for example, software programmes such as DaVinci Resolve by Blackmagic Design or Baselight by FilmLight, used in postproduction colour-grading, and the necessary prerequisite manual skills and mental dexterity required to navigate the new digital cinematographic environment. McCulloch considers the fine hand and eye coordination required to operate computer technologies, and how these fine motor skills are coupled with creative, intellectual agility to navigate visual domains. The 'skilled computer artisan' must conduct an "unprecedented set of actions" contends McCulloch (2021, p.19).

> "Expressed even more strongly: the digital, understood as the capacity of converting all analogue inscriptions (of sounds and images) and a symbolic notation (of written text and musical scores) into electric impulses which can be stored numerically reproduced in any chosen medium, meant that the digital was indeed a new ontology" (Manovich 2013 cited by Elsaesser and Hagener 2015, p.197).

Cubitt (2014) examines the rationale for the digital data reduction and the necessity for digital formats and codecs to manage storage and workflow, maintaining optimum definition and resolution as far as possible; but how do we measure and understand resolution and definition, terms that at times are used interchangeably?

> "It is useful to distinguish between resolution as the count of the 'smallest distinguishable elements' across the image with width and height (e.g., grain or pixel), a matter of quantity, and definition as a means of describing the degree of detail visible to the viewer, a matter of quality" (Balsom 2017, p.73).

These definitions are relative, and subjective to a certain degree, instigating the concept of visual image hierarchies and the idea of an elite 'film' aesthetic as proposed by Flaxton (2011) in his discussion on the development of high-definition, digital filming technologies. While definition and resolution are closely aligned with ideas of visual quality, it could be said that they are markers of fidelity or authenticity. These ideas are pursued by Balsom (2017, p.74), who states that "A filmmaker might choose to make use of blurred images below a definition while rendering these images in high-resolution." Hito Steyerl examines these contradictions and considers how poor images transform "quality into accessibility, exhibition value into cult value" (2009, p.1) Balsom contends that "Artists and filmmakers are keen to exploit the association of low-definition images with unsanctioned and the authentic," over high-definition, which may be considered a quality marker. McLuhan first introduced the term 'high-definition' or 'hot media' in 1964 to describe a medium as "well filled with data" when expounding his theory of hot and cold mediums; he proposed that the hot mediums of film required less audience engagement while cold mediums such as television demanded more engagement (1964, p.22). Mobile phone high-definition image technology offers easy access to moving image media and low-budget filming capabilities. Although films may be classed as high-definition by mobile phone manufacturers the moving image data captured through miniature lenses is highly compressed. Wilson (2021, p.2) argues that mobile phones are freeing, enabling filmmakers to access image creation tools without the need of technical experts. This Wilson contends frees the filmmaker to "concentrate on where and how their films are seen." Mobile phone films have the

potential to cross hierarchal film boundaries. Wilson (2021, p.10) considers how alternative film festivals present a 'liminal space' where underground films can potentially challenge mainstream sensibilities. Mobile phone films may be deemed a technological ascendant of the home movie, indicative of digital transition from Super 8mm film to accessible digital capture. Home movies however present a contradiction in terms. Movies, prior to the digital age, were screened in movie theatres designed to entertain a mass audience while encouraging viewers to suspend disbelief. The home movie by contrast feels more familiar, films typically present everyday events filmed by non-professional filmmakers on small handheld film cameras, primarily for home consumption. Sobchack examines spectator reception of home movies to understand viewing tensions generated through reversible movements. The spectator has a dual viewing experience, viewing the filmed image while simultaneously being aware of the filming process from the perspective of being filmed. Sobchack (1992, p.103) considers this "dialectic of lived experience," the viewer's self-awareness, grasping the potentiality of being both the "*viewing view* and its production, the *viewed-view.*" The spectator reception experience and home movie archive attribute distinct characteristics associated with home movies that draw on personal memories and notions of nostalgia. The Super 8mm introduction sequence in the ecological film *The Garden,* draws on collective memory and inherent notions of nostalgia. Harrison (1992, p.156) asserts that forests have an aura a "psychological effect of evoking memories of the past." The film explores materiality and decay in the regenerative forest ecology, in an allegorical narrative that sweeps the viewer upwards through the canopy of trees, an ascension towards the sun, the source of light and energy. The genesis of the idea was inspired by a thicket of trees which have fascinated me for a long time on my daily commute through the New Forest. For me the place has a special aura which I wished to portray in a poetic rendering on camera. Russell (2000, p.19) contends that "If ethnography is to become poetry, poetry can likewise become an ethnographic practice." The research film *Outside In* presents an autoethnographic reflection on time, place and remembering, however, it is worth mention that screening reviews revealed unintended readings of the film with some female viewers noting a perceived male threat to the inciting female character. The *Digital Visions* installation presented a film screening and photographic exhibition in adjoined gallery spaces. The distinct viewing conditions promoted specific

readings. Russell (2000, p.122) contends that research institutions seem reluctance to acknowledge the contextual importance and content relevance of specific viewing spaces, arguing that focus is biased "primarily with the written discourse about film/video, and to ignore film/video exhibition." Walden (2013, p.2) acknowledges Sobchack's home movie analysis that "considers spectatorship as pluralist" validating different viewpoints and different interpretations, including the "different positions one individual" might perceive. Sobchack identifies an uncanny subversion of the familiar associated with the home movies, whereby the "familiar is suddenly turned disturbingly strange and secretive" (2019, p.207).

> "However, the home movie makes this instability not only its form but also its content. It thus progressively provokes, for many of us who suddenly encounter our 'self' on-screen, the uncanny fundament not only of home movies, but also of human being" (Sobchack 2019, P.215)

Home movies and mobile phone film characteristics attributes qualities and alternative production processes that challenge mainstream orthodoxies. Mobile phone cinematography offers a green ecological alternative to high energy consumption associated with mainstream cinematographic production processes. Cubit considers the impact of digital media technologies on the environment. Cubit's ecological approach examines the inextricable interdependence of media, energy and capital in the mediation of earth's finite resources. Bozak (2011, p.190) identifies the ongoing convergence of the "digital revolution and the green revolution" and emphasises the entwined nature of the "energy economy and image economy." Despite the promise of 'clean, weightless' digital technology, the energy demands of the digital image sphere ensure constant resource dependence. Although the digital image is inert, it is, Bozak asserts, necessary to factor in image workflow and delivery to fully appreciate "just how heavy – and dirty and ethically questionable" the digital image really is (2011, p.28). Cubit highlights the exponential energy demands of digital media technologies and the incumbent social, ecological and environmental responsibilities. He acknowledges entropy evident in digital media structures where processes ultimately result in "waste produced in the form of heat and noise" (2017, p.14). Effective energy and waste management are an integral element of the

digital media environment and the cinematographic image production process. Energy and entropy are inextricably linked and as such inform critical cinematographic thinking and wider social behaviours, environmentalism and policy. It is necessary Cubit (2017p.15) says to know "what things are made of and their connectedness." Indeed, it is necessary to understand how things are connected and how things are 'disconnected' and the impact of this on people and environment. Cubit's analysis reflects ecological concerns regarding the responsible stewardship of the earth's limited resources, in this regard he refers to the UN Declaration on the Rights of Indigenous Peoples, that extend human rights to recognise the natural world and its geology. This shift says Cubit demands a "fundamental rethinking of the idea of rights" (p.183).

## 3.4 Embodied Craft Knowledge and the Characteristics of a Situation

The notion that technological advances ensure knowledge transfer is questioned by Sennett as he analyses the demise of Stradivarius in 1737, when the tacit knowledge of the master violin craftsman was lost.

> "Missing in these analyses is a reconstruction of the workshops of the master – more precisely, one element has irretrievably gone missing. This is the absorption into tacit knowledge, unspoken and codified in words, that occurred there and became a matter of habit, the thousand little everyday moves that add up in sum to a practice. The most significant fact we know about in Stradivarius's workshop was that he was all over it, popping up unexpectedly everywhere, gathering in and processing those thousands of bits of information that could not signify in the same way to assistants who are doing just one part" (Sennett 2008, p.78).

These comments by Sennett underpin the importance of this research enquiry: the necessity to reveal knowing and make knowledge transparent and transferable as far as possible, exploring how the tacit craft knowledge of the cinematographer can be articulated and exemplified to enhance understanding. Specialist craft knowledge may be poorly

understood by those outside of the specialism. Crawford (2009, p.168) explains that "The basic idea of tacit knowledge is that we know more than we can say." Marks (2000, p.129) considers how the cinematographer's haptic knowledge can be used to focus audience attention, to engage the senses through judicious image construction that in effect draw the senses together. Marks notes how cinematography can heighten the relationship between sight and touch, the switch between what she terms 'haptic and optical vision.' The psychologist Klein has examined experts working under pressure and comments: "Experts learn to perceive things that are invisible to novices, such as the characteristics of a typical situation" (Klein 1992 cited by Crawford 2009, p.168). The ability of the craftsperson to draw on embodied knowledge, craft culture and ten thousand hours of experience belies the speed of thinking and of the reflection, reasoning and design capabilities of the subconscious decision-making processes, and presents these as innate abilities, which is misleading.

"Emotional learning may be quick, but what we consider as 'expertise' usually takes a long time to develop. The acquisition of expertise and complex tasks such as high-level chess, professional basketball, or firefighting is intricate and slow because expertise in a domain is not a single skill but rather a large collection of mini skills. Chess is a good example. An expert player can understand complex positions at a glance, but it takes years to develop that level of ability" (Kahneman 2011, p.238).

Kahneman (2011) explores information processing by experts in testing situations and contends that we have a dual thought process that manages fast and slow thinking in problem-solving situations which require complex emotional and critical thinking. Berger (1972) examines subconscious bias and seeks to understand 'seeing' in his seminal book *Ways of seeing,* in which he examines how we see and read images and discusses the influence of commerce, semiotics and cultural bias inherent in the visual aesthetics and presentation of the image. The DOP Nestor Almendros (1980) highlights the importance of cultural knowledge over technique alone.

"In my opinion, the main qualities a director of photography needs are plastic sensitivity and a solid cultural background. So-called cinematographic technique is only the secondary importance, and depends above all on one's assistants. Many cinematographers take refuge in technique" (Almendros 1980, p.10).

Seeing is never 'pure' and is always contextualised in a socio-political environment, a cultural and knowledge framework (1980, p.10). Hansen (1958 cited by Alvesson and Skoldberg 2000, p.6) advocates "that there is evidence that we never see single sense data, but always interpreted data, data that are placed in a certain frame of reference". The DOP Billy Williams, like many other cinematographers, finds it difficult to articulate the analytical processes involved in creating cinematic images. On framing and composition, he says:

"I don't think there is any one single element. It is something you are born with or acquire. There are people who can never compose properly. It is not something you can describe in words: you can only describe it with the picture you take" (Shafer and Salvato 1984, p.276).

Geuens (2000, p.175) suggests that this innate sense could be no more than "a largely unconscious assimilation of compositions in thousands of films that technicians have seen and admired." This inability to articulate cinematographic craft skills comes up time and again in interviews with established cinematographers. It is highly relevant to a Practice as Research enquiry, where an understanding of the cinematographic process of making moving images is fundamental to the enquiry and identifies the problematic nature of attempting to articulate image sensory cognitive processes and tacit actions in words alone, rendering the inclusion of practice artefacts central to effective understanding. De Certeau (1984, p.65) considers the relevance of "*know-how*" and the importance of contextual discourse on method.

"Art is thus a kind of knowledge that operates outside the enlightened discourse that it lacks. More importantly this *know-how* surpasses, in its complexity, enlightened science" (De Certeau 1984, p.66).

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De Certeau considers Bourdieu and contends that displacement is necessary to see that which is evident with greater clarity. De Certeau asserts that we travel to distant lands to discover "something whose presence at home has become unrecognisable" (1984, p.50). Repositioning enables a contextual revaluation, illuminating that previously not recognised. Cinematographic self-awareness regarding the tacit habits and subconscious cinematographic behaviours were made explicit to me through reflective research practice. Reflection in action revealed patterns in the ways of working, the sets of actions that are habitually enacted to accomplish cinematographic tasks. Working on the research film *The Garden* I became acutely aware of the small, incremental adjustments to the camera framing and lens focus that are required to follow specific actions. As an experienced cinematographer I am used to making predictive adjustments without giving it much thought. As the project leader/director, working with a novice crew and collaborating in a loose hierarchy, it revealed the complexity of apparently simple tasks, and the difficulty of articulating specific actions embodied through practice. The process however, was rewarding with crew members finding textual details such as the ethereal light patterns created by sunlight reflected off of moving water, thereby contributing to the film's visual aesthetic and the success of the shoot. To understand cinematographic practice and process requires a mental acuity to acknowledge the embodied situation and ways of workings specific to the individual.

> "Paradoxically, social science makes greatest use of the language of rules precisely in the cases where it is most totally inadequate, that is, in analysing social formations in which, because of the constancy of the objective conditions over time, rules have a particularly small part to play in the determination of practices" (Bourdieu 1990, p.143).

Schatzki (2001) asserts that practice is primarily a series of embodied actions. The cinematographer's actions are the behaviours associated with cinematography, namely camera operation and lighting, including the multitude of associated tasks, looking, talking,

writing, handling equipment, management, logistics, etc. Schatzki (2001, p.56) notes the mediation of connected actions by mind, "practices are organised mentally."

> "Conceptual understandings of the actions that compose a practice are contained in the understandings that organise the practice" (Schatzki 2001, p.63).

It is of interest to note that the study of practice methodology has over time shifted from the field of sociology to anthropology. Bell (2019) identified the influence of the philosopher Immanuel Kant, and the philosopher, political theorist, sociologist Karl Marx on artistic research methodology, and considers how critical thinking about research methods has developed to encompass ethnographic and autoethnographic approaches that reflect social positioning and the actions and habits of the practioner. Bell considers Kant's rationale that foregrounds "moral reasoning" and "aesthetic judgement" as the foundation to research knowledge. Marx analysis says Bell (2019, p.12), is guided by a "critique of political economy and capitalist society" to understanding and provide the "scientific basis for transforming society."

> "Auto-ethnography differs from traditional anthropological ethnography in that it embraces and foregrounds the researcher's subjectivity and emotional reactions to situations rather than attempting to limit this, as in many "objective" approaches within empirical social research" (Bell 2019, P.291.

The practice research enquiry reveals knowledge and informs a deeper understanding regarding the reflective/reflexive cinematographic practice. 'Praxis' is identified by Nelson as "theory imbricated within practice" (2013, p.37). Nelson (2013, p.27) contends that "Both arts practices and research investigations take place in contexts."

> "Intelligent practice is at the core of my model and practice is characteristically submitted as substantial evidence of the research enquiry. In 'know-how' I advocate 'doing-knowing', akin to what Schon, in a seminal study, calls 'knowledge-in-practice'. Knowing how to ride a bike is in knowing-doing largely beyond verbal

explanation. Arts practitioners manifest many kinds of know-how of this kind, much learned through practising with others (often in the context of formal education)" (Nelson 2013, p.40).

Nelson's model of praxis presents three modes of knowing: 'Know-How', 'Know-What' and 'Know-That', where the synthesis of these modes – praxis (practice research) – aims to reveal new insights. It is beneficial to compare Nelson's model with alternative models of Artistic Research presented by Makela and Routarinne (2006). The term 'Artistic Research' coined by Frayling (1993) diverges from positivist scientific research methodology (Guntur 2020). Bell notes the importance of experiential learning in the Artistic Research process where learning by doing is enabled through reflexive practice and "critical dialogue with other interlocutors outside of the reflective dynamic" (2019, p28). Context is pertinent. Artistic Research is the research work done by artist says Bell, not the research of their work (2019, p.11). These models are, by contrast, varied and suited to the particular need of the research subject and have much in common with the highly versatile mapping models as proposed by Gray and Malins (2004), drawing on visual techniques to demonstrate complex connections and including mapping diagrams and more freeform techniques such as sketches, cartoons and drawings. Bell (2019) notes the primacy of practice in Artistic Research, where research is led by discovery.

> "Firstly, artistic research employs a research process executed through the making of artwork – paintings, sculptures, films, art propositions, events, photographs, sonic and performance activities and recorded outputs, etc. It is, in other words, practice-based. Secondly, such research is "discovery-led" rather than hypothesis-driven like much research in the dominant scientific tradition" (Bell 2019, p.16).

Bell (2019, p.17) contends that the creative idea alone is insufficient, the idea, the critical thinking, is embodied in the doing and making, the actions and habits of practice that are inherent in the finished artistic work.

**3.5 Creative Knowing**

This qualitative research enquiry is interested in reflective practice encompassing an exploration of image medium, materials and techniques in image creation, where reflexive practice questions image cognition and metacognition, the image referent and image indexicality.

> "Thus, in the literature there are different uses of reflexivity or reflection which typically draw attention to the complex relationship between processes of knowledge production and various contexts of such processes, as well as involvement of the knowledge producer. This involves operating on at least two levels in research work and paying much attention to how one thinks about thinking" (Maranhao 1991 cited by Alvesson and Skoldberg 1991, p.8).

Doing, observing, conceptualising and testing are central to reflective practice and essential components of experiential learning identified in Kolb's learning cycle (1984). Kolb discusses the importance of experiential learning through doing and reflecting on doing, thinking and conceptualising, testing new concepts through experimentation and re-doing. This immersion in the learning cycle creates a depth of knowledge that encompasses both mind and body intelligence in the knowing and learning experience. McAleese (1999) takes this a step further and proposes two additional tools, concept mapping and reflective journals, tools that Gray and Malins (2004, p.58) assert "enable and externalise the reflection-on-action". They refer to these as "off-loading devices" in that they allow the learner to store aspects of the learning while learning. In learning through observation, it is valuable to analyse the human factors and methods of the cinematographer's craft in relation to complex systems at work. This is a design capability commonly explored in complex safety and procedural systems, such as air traffic control and machine operation safety, but can of course be applied to any set of systematic behaviours employing technology and procedure. One of the common systems explored as a model and discussed by Walker (2016, p.52) is the familiar process of making a cup of tea. I am keen to examine the adaptive capabilities

of the cinematographer in interacting with evolving digital technologies central to craft knowledge and agility of the cinematographer.

> "Another important attribute is *reflexivity*. There is no one-way street between the researcher and the object of study; rather, the two reflect each other mutually and continually throughout the course of the research process" (Alvesson and Skoldberg 2000, p.79).

**Chapter 4: Practice Events**

**4.1 Introduction**

This chapter provides overview and aims for each project in the sequence of practice events. Chapter 6 examines the processes, investigating elements that are intrinsic to the cinematographic practice.

**4.2 *Outside In*. Film**

*Outside In* constructs a parallel, synchronous seeing experience, by presenting side-by-side frames of moving images captured from alternative perspectives. A car passes a bicycle on a quiet country road in the New Forest. The moment the two vehicles pass triggers a recollection in the car driver – a second where time slips and stretches, a dreamlike moment where segments of a journey are forgotten. This simple event is filmed from different perspectives and presented as two side-by-side frames running concurrently. The events viewed from an audience perspective are simultaneous until the passing point. The passing triggers a disruption in one of the viewing frames. The images freeze, interrupting the illusion of the moving image, which is conventionally maintained at 25 frames per second. The dislocation of synchronous events draws attention to the moving image medium. The illusion is revealed as a construct of individual frames/pixels.

**4.2.1 Project Aims**

The *Outside In* project seeks to examine the depth of knowing engagement by the practitioner in all aspects of image creation and engender a deeper understanding of the reflective process in the creative cinematographic production endeavour. It considers the impact of the many small practical and creative decisions in the production journey and the imprint of these actions on the visual artefact. The project aims to employ reflexivity to illuminate the production processes behind the creative premise, to highlight the scaffolding and building blocks of the film and to make evident the visual constructs and the carrier medium. The intention of these revelations is to provoke an energetic audience

reading that permits and encourages a deeper analysis and understanding. The film is not a surface event to entertain; it has deep roots and aims to illuminate tacit cinematographic techniques. The cinematography incorporates a low-tech approach to production, utilising accessible digital filming equipment. The reflective practice project explores ways of working and notions of agility in thinking and action associated with new digital image capture technology, and also investigates an approach to digital production that is rooted in craft knowledge yet is still accessible. The film draws on traditional cinematography skills and expertise with the aim of exploring new ways of filming that seek to address the nature of the filming process, while also considering memory, time and medium. The film asks questions that mirror the main research question about how films are made and how meaning is created and understood. It asks how the application of digital technology, image realisation techniques and tacit craft knowledge employed in my cinematography contribute to meaning and understanding in my practice-as-research films. The visual aesthetic of the *Outside In* film was defined at the outset. The production took place in the New Forest in a spot that I am familiar with as I pass through it on my daily commute. The filming take place within a wooded area, a section of twisting tree-lined road and the surrounding thicket of trees. The location feels special to me. Harrison (1992, p.156) notes that forests have the "psychological effect of evoking memories of the past"; they have the aura to set a primal scene for poetic memory. The space has a distinct, melancholy atmosphere and perfectly suited the requirements of the film; long-lens surveillance techniques and close inspection were employed to create a suspenseful filming style. When the two central characters' paths cross, a visual consensus is disrupted. The integrity of the moving image is challenged with magnified single image frames revealing a fragmented mosaic of pixels. The deeper the inspection, the more difficult it is for the viewer to define known forms. The film considers how memory plays with, and tests, image understanding. It probes the tacit knowledge of image creation and considers the paradox of making the real unreal, in the service of remembering.

**4.3 *The Garden*. Film**

*The Garden* has a distinct significance for each person, drawing on childhood memories of imagined worlds; a place to escape rooted in many cultures – in our stories, myths and legends. It is an exploration of memory, medium and decay. The film begins with a grainy Super 8mm home movie showing a mature felled tree in a forest glade, before cutting to high-resolution digital images. The digital film cuts from micro to macro, from a close-up detail of a cobweb covered in early morning dew to a wide establishing shot of the forest, then closes in to reveal another tree split in two. A carefully choreographed sequence of shots examines the physical damage to the branches, the insect attack, fungus and decay. In the following location we revisit the first tree and see the effects of nature at play, the elemental forces, earth, water, wind and sun, the forest ecosystem in a cycle of regeneration. The final sequence of shots spirals upwards through leaf-covered branches into the forest canopy and brilliant sunlight.

**4.3.1 Project Aims**

The *Garden* project aims to illuminate tacit cinematographic techniques and communication hierarchies that contribute to meaning through my reflective practice research films. The filming techniques employed incorporate a high-tech approach to production and postproduction, utilising top-end, professional digital cinematography filming equipment. The aim of the second reflective practice film production project is to explore agile working in a more controlled production environment, encompassing professional image capture digital technology and an approach to production that is rooted in craft knowledge. The second film asks similar questions to the first, seeking to understand how meaning is created and understood, and exploring memory, time and medium, with the potential for greater complexity in the investigation. The process adopted recognised the importance of craft, yet aimed to offer an inventive, distinctive, alternative way of seeing and making. The project aimed to create a professional production environment in the pursuit of authentic, high-quality cinematography using sophisticated industry-standard camera and grip systems. This was in contrast to the previous 'run and gun' approach, which

Blain Brown (2015, p.262) describes as working with a skeleton crew, "jumping in and out of vans to get shots here and there." The *Garden* project was conducted along more conventional, professional lines. Digital cinematography camera equipment was operated by a fully crewed camera department, observing craft etiquette and adopting a flexible approach to communications to maximise creative opportunities. The images captured explore the destructive processes on trees felled through catastrophic natural phenomena juxtaposed with images of organic decay and decomposition through environmental erosion, fungus and insect attack over time. The film examines the cinematographic approach to filming in the forest, exploring form and materiality, and provoking a dialogue regarding the limitations of a narrative enquiry fixed to a human timescale.

Cinematically, the dramatic camera movements and high-resolution filming techniques aim to emphasise the potential energy manifest in the elemental materials of the forest as revealed in the shots of water and the traumatic fissures to the tree trunks and branches. Insect attack and fungus speed decomposition and the transformative processes involved in regeneration. In the final scene the camera sweeps upward towards the canopy, employing a range of camera shutter speeds which, in sequence, freeze and blur images bathed in sunlight (the source of energy), to generate a sensation of flight and possibilities for transcendence.

### 4.1 *Digital Visions*. Installation

The installation comprised two separate adjoined gallery spaces. The first space was a photographic gallery exhibition, presenting eight large colour prints, 300mm x 300mm, at eye level on white walls. The prints were matt finish, uncovered by glass or Perspex, to reduce physical separation and any surface reflections. The images related to scenes in the research film *The Garden*, referencing Super 8mm shots and digital shots. Images included landscapes and extreme close-up details of woodworm and decay that revealed the image pixels and evidence of digital entropy. The viewer was required to pass through the exhibition to enter the second space, the screening room. Here, the *Garden* practice

research film was presented on a repeating loop in the dark interior. Seats were arranged for viewing.

### 4.4.1 Project Aims

The installation examined the cinematographic approach to filming in the forest, exploring form and materiality, and provoking a dialogue regarding the limitations of a narrative enquiry fixed to a human timescale. I was interested to explore how digital filming techniques/processes could be synthesised to examine parallel timescales, synchronising immediate traumatic events with decomposition over far longer periods of time.

Examining *The Garden* practice research film on a range of video screen technologies raised important considerations regarding the sensory viewing experience of reading the digital video medium and notions of consistency. Cubitt (2014, p.27) comments that no film is a single text but rather a "raft of particular, historical and discrete events", where the nature of distribution technologies meet "the specifics of the place where it is screened." Although screen technology may vary (cathode ray tube, LCD, plasma), essentially the final transmission is light emanating from a screen, where even the darkest blacks are made visible as grey via the emitted light. In this sense Cubitt (2014, p.27) considers that black on screen is a virtual representation of black, "a capacity rather than something achieved and complete in itself." In conversation, Sinden (2006, p.27) observes that as monitors age the default setting for black deteriorates so that the depth of black "becomes far paler grey". In the quest for quality, each stage in the production of the digital cinematography image aims to achieve an authentic likeness with the referent by avoiding any loss of digital data that might introduce visual artefacts. In this pursuit, each component in the image chain (capture, processing and screening) must contribute to the preservation of image fidelity. It is therefore necessary to employ lenses with high resolving capabilities, large camera sensors with efficient photo sites, cameras with extended exposure latitude, lossless codecs and high-contrast organic light-emitting diode (OLED) screens. The *Outside In* research film examined and questioned the illusion of the moving image. To continue the investigative research journey, it was necessary to question how the video images in the film *The Garden*

might be read anew. Might a deeper reading be enhanced by supplementary images in another carrier medium such as photographic prints on paper, a physical medium, a surface that reflects light rather than emits light? I wished to create a tangible, complementary viewing experience to support the digital screen medium. It was a necessary aspect of the research to explore a multi-medium experience where the combined sensory experience of alternative mediums might enable a deeper meaning in the cinematographic representations. An installation exhibiting photographic prints and screened images would, I believed, have the potential to enhance audience understanding and provoke a screen reading imbued with deeper meaning. The contemporary video artist Bill Viola creates installations which challenge conventional reading by controlling the viewing environment. Neumaier (2004, p.54) contends that Viola "uses space to stimulate us into seeing things from an unfamiliar perspective". Viola's work explores the temporality of human existence, where Neumaier believes that video, being a time-based medium, is "well suited" to expressing the concerns of temporality. Compared to a photograph, the video image is transitory, and as such exists "as a whole only in the mind of the viewer" (2004, p.69). The aim of the approach I adopted was to achieve a clarity in understanding and new meaning through an energetic paradigm shift. The experience of viewing alternative mediums sequentially would, I considered, provoke a fundamental change in underlying assumptions regarding the screened film images. To do this, the gallery exhibition was designed with two separate audience spaces, each space designed with a specific intended function. The sequence of viewing was controlled so that it was necessary for the audience to enter the photographic exhibition first, before proceeding to the second space, the screening room. The aim was to prime viewers with carefully chosen, specific printed images, prior to the screening, to influence their subjective reading of the film images.

## Chapter 5: Methodology

### 5.1 Overview

The research methodological framework is comprised of research methods that enable effective interrogation of the research questions. Cinematography and cinematographic practice are at the core of the investigation and the methodology and chosen research methods are situated to examine principal components in the field of the research enquiry. The chosen methods enable constructive dialogue and critical analysis, employing underlying themes of digital ecology and ecopoetic representations to illuminate specific aspects of the enquiry pertinent to the investigation. The key research methods include practical filmmaking used as a type of fieldwork to examine cinematography practice and process, cinematography technical testing of equipment and systems, exhibition and screening, and para-ethnographic interviews with contemporary critical practicioners. Greenhalgh identifies the lack of detailed analysis by film theorists regarding filmmaking practice, the actual making of films. The cinematographic process and the "collaborative nature of the crew" is "rarely" acknowledged says Greenhalgh (2010, p. 307). For this reason, it was essential to foreground the research enquiry with intelligent discussions with established critical experts in the field of cinematography. Critical conversations have tested my thinking and informed an autoethnographic journey of knowledge discovery through a series of cinematography practice events designed to ensure reflexive experiential learning. This is fundamentally a research enquiry exploring practice through practice, situating the practioner researcher at the centre of the research inquiry. The methodology provides a multidimensional insight into the cinematographer's process allowing a detailed picture to be built from a variety of sources. The methodology adopts a hermeneutic approach building knowledge incrementally, combined with triangulation to map related elements of the research narrative tangentially. This double interrogation approach validates a multidimensional perspective. Narrative threads are interwoven to provide a complex understanding from variable viewpoints resulting in illuminating insights. To demonstrate how this methodology works I have presented a typical model and three simple examples

of methodological narrative threads, routes that can be applied to build a complex knowledge story.

## 5.2 Methodological Narrative Threads

At a basic level the methodological model asks something, does something, understands something. The methodological model draws on autoethnographic practice experience, para-ethnographic interviews, filmmaking practice, cinematography testing, exhibition and screening, critical reflection, poetic presentations, digital ecology and forward projection to create the methodological narrative threads that contribute to the development of a complex knowledge story. The methodological model typically pursues the following line of enquiry:

Typical Model

- Research hunch based on intuitive cinematography practice experience.
- Council with expert interlocuters explore issues and expand thinking within field of concern.
- Proposition examined through reflexive cinematographic practice in the field.
- Resulting visual artefacts present significant indicators of image medium, cinematographic technology, ways of working, meaning.
- Metanarrative explores eco-poetic themes and digital ecology to inform understanding.
- Exhibition and screening contextualise, significant indicators, cognisance, meaning.
- Significant insights expand knowledge and understanding.

Thread Example One

New DSLR image capture video technology has impacted the cinematographer's process. Proposition explored with Geoff Boyle, Terry Flaxton, Guy Walker, discussion raised issues relating to agile working, convergence technologies, medium, image resolution, camera

ergonomics. Production project *Outside In* tested ideas relating to agile working and image construction. Meta narrative explored notions of memory, image construction, natural environment. Knowledge insights and learning influenced design, testing and observations in next research production event and informed critical analysis.

Thread Example Two

Working impacts seeing in the cinematographer's process. Proposition explored with Geoff Boyle, Terry Flaxton, Sam Measure, discussion raised issues relating to visualisation, craft knowledge, embodied knowing, collaboration. Production project *The Garden* tested ideas relating to experimentation, creativity, hierarchy, collaboration. Meta narrative explored notions of decay, materiality, ecology, energy. Knowledge insights and learning influenced design, testing and observation in next research production event and informed critical analysis.

Thread Example Three

The image medium has an intrinsic relationship with technology and environment impacting the cinematographer's process. Proposition explored with Terry Flaxton, Tim Waller, Sam Measure, discussion raised issues relating to data, resolution, definition, seeing, virtual production. *Digital Visions* installation tested ideas relating to image cognition, quality markers, contextualisation, meaning. Metanarrative explored notions of self, entropy, digital ecology. Knowledge insights and learning informed critical analysis.

**5.3 Reflective Methods, Tools for Thinking**

The enquiry examines cinematographic techniques in a series of practice research events. The exploration of practice and the relationship between the reflective practitioner and the tools and materials employed in cinematographic craft practice aims to promote understanding. The reflective practice research methods are 'tools for thinking' (Hannula 2014). These methods encourage thinking about the processes and procedures

fundamental to cinematography. The methods employed enable metacognition, in this case a self-awareness regarding thinking about cinematographic thinking and a deeper understanding regarding the thinking and cognitive processes involved during the course of work. The methods permit visualisation techniques and internal imagining to be interrogated, offering insights into tacit craft skills, haptic proficiencies, knowledge and the creation of meaning through visual cinematographic means. The research methods employed highlight the importance of experiential craft knowledge gained through many years of practice, and acknowledge the necessity of spontaneity, chance and technical agility as an essential prerequisite to creative practice. The reflective practice investigation challenges a cinematographic orthodoxy that is underpinned by experience-based hierarchies and industry-established ways of working, and instead recognises the value of alternative, aligned approaches that promote the notion of professional agility. An agile approach to cinematographic practice is born out of professional inquisitiveness and play (Iliescu 2022) but is also born out of experience to know the shortcuts to get the job done. The freedom and desire to experiment necessitates an engagement with new digital filmmaking technologies in novel and exciting ways, challenging established craft protocols and valuing accumulated craft knowledge in search of the new. Iliescu notes the importance of play as a creative professional tool, guided by the principles of practice:

"The kind of play that takes place when artists make art or when architects design is different. It is more concentrated and serious, and, while pleasurable, it is always guided by certain rules or ordering principles" (Iliescu 2022, p.26).

The research epistemology seeks to explore and make explicit tacit knowledge within the framework of professional practice. It aims to examine the reflective processes and illuminate creative thinking in action. It considers the drivers for creative moderations to practice, the reflexive rethinking and doing on the job. It is imperative to examine how things are done, the relationship between the researcher and the object being studied. Alvesson and Skoldberg note that this is not a "one-way street" and assert that the "two affect each other mutually and continually" throughout the duration of the research process (2000, p.79).

Alexander (2016, p.44) notes the importance of "how questions" in Artistic Research, "since they can be addressed through practice, and through demonstrations, at least to some extent." The methods adopted recognise the potential value of alternative approaches, where conscious attention to haptic behaviours might change the practice route map, resulting in different and improved outcomes. The methodology adopted is responsive to the creative dynamic and is characteristic of creative practice research enquiry in the arts. Gray and Malins question why the creative practitioner might engage in research and suggest that it is not just simply motivation, "but also an epistemological question about the nature of the relationship between the knower and the known" (2004, p.19). This framework for research combines thought, action and practice and "acknowledges the particular and special knowledge of the practitioner" (2004, p.22). The special knowledge of the cinematographic practitioner is central to the enquiry and is examined in Chapter 2, 2.4.1, Image Knowing. Steier notes the importance of a self-reference and reflexivity to inform a methodological approach:

"… a turning back of one's experience upon oneself … a circular process … This looping back may … unfold as a spiralling, if we allow for multiple perspectives, and acknowledge that 'the same self' may be different as a result of its own self-pointing. Thus, included within this focus are issues of self-reference, and how issues of self-reference can inform methodologies and the research process in general" (Steier 1991 cited by Gray and Malins 2004, p.203).
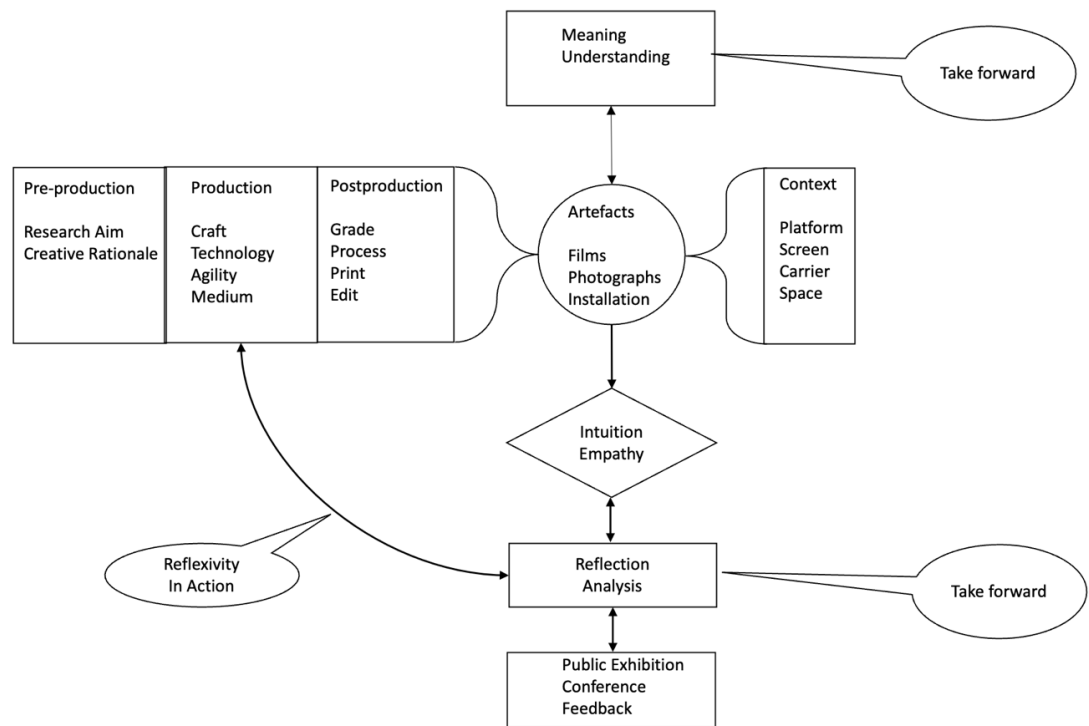
Figure 4. Reflective Practice Method Model

As discussed in Chapter 2, it is important to examine the impact of digital transitions in the field of cinematographic practice, at this point in time, before the next wave of 'disruptive technology'. Flaxton (2010) argues that we are now in a post-digital age. It may be argued that the term 'digital' in relation to digital cinematography is becoming superfluous as the digital process is now commonplace in image construction techniques and therefore does not require emphasis. This applies to camera design. Cameras used for still and moving images are no longer routinely denoted as digital as this is now standard. Descriptors denoting analogue film processes are more likely to be highlighted. It is now the 'film' camera that requires the additional descriptor. However, it is worth noting that this does not apply across all areas of cinematographic practice. There are techniques and practices that are specifically identified as digital, where the digital coding aspect of the process is integral to that process, and for this reason it is justified to use the term digital in this research enquiry. There is a correlation between practice and process that requires a nomenclature that denotes digital as an intrinsic component in certain technology-driven practice. The digital imaging technician (DIT) is a case in point. The job descriptor identifies the importance of 'digital' understanding and 'digital' competencies as essential to the role.

Brown (2016, p.338) examines the roles and responsibilities of digital camera technicians, including the digital loader or data wrangler: "a digital loader will bring media to the camera", working under the auspices of the DIT, who has a broader range of digital image workflow responsibilities. For the research enquiry, it is necessary to understand the impact of cinematographic digital transitions by exploring the moving image constructs, image indexicality and image mediation through a series of reflective practice research events that position the reflective cinematographer at the centre of the enquiry. The cinematographer, Lucas notes (2011, p.45), has an important role to play as a mediator challenging conventions and "resisting radical change". Mediation is a fundamental component of the creative production process which defines the elemental relationship between the creative practitioner and the tools and materials of their craft; it embraces mind and body, thinking and doing.

Reflection in action and reflective analysis enable the creative practitioner to revisit the situation in a hermeneutic spiral of investigation and knowing. McAlpine and Weston (2002, p.69) note that "Reflection requires linking existing knowledge to the analysis of the relationship between current experience and future action." This process of reflective enquiry enables a deeper understanding of image appropriation and the creation of meaning, including notions of authenticity and verisimilitude, the 'what' and the 'how' of image making articulated by Belting (2001). Belting's 'how' of image making encompasses the close insider knowledge, and the 'what' reflection at a distance. Nelson (2013) identifies three overlapping spheres of 'knowing' associated with image making in a reflective, Practice as Research investigation. Nelson refers to a central hub 'praxis', or intelligent practice, where he defines praxis as theory imbricated within practice. To enable cinematographic image knowledge and image meaning, it is therefore necessary to understand that the creative image construction process is significant to the artefact, that the separate process states are an integral part of the whole. Without this understanding, knowledge and meaning will remain incomplete.

Nelson's spheres of knowing:

***Know-how: Insider close-up knowing.***

*Experiential, Haptic knowing, Performative knowing, Tacit knowledge, Embodied knowledge.*

***Know-what: Tacit made explicit through critical reflection.***

*Know what works, Know what methods, Know what principles of composition, Know what impacts.*

***Know-that: Outsider distant knowledge.***

*Spectator studies, Conceptual frameworks, Cognitive propositional knowledge*.

```
                    ┌──────────────────────┐
                    │      Know How        │
                    │   Tacit Knowledge    │
                    │  Embodied Knowledge  │
                    └──────────────────────┘

                          △ Praxis
                            Theory
                          Imbricated
                        within Practice

  ┌──────────────────────────┐        ┌──────────────────────┐
  │        Know What         │        │      Know That       │
  │    Tacit made Explicit   │        │  Cognitive Academic  │
  │  Through Critical Reflection│     │      Knowledge       │
  │     Explicit Knowledge   │        └──────────────────────┘
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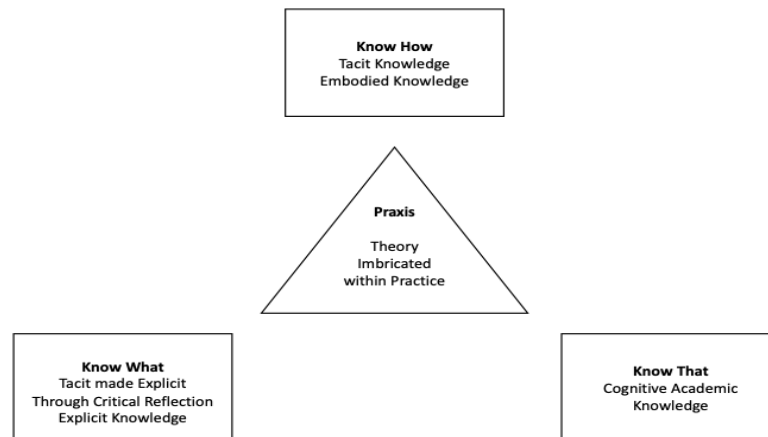
Figure 5. Modes of Knowing. Practice as Research Model (Nelson 2013)

## 5.4 The Framework for Enquiry

This is a constructivist enquiry characterised by a relativist ontology and subjectivist epistemology (Gray 2004), as an alternative to a 'positivist' research paradigm. The

constructivist enquiry aims to understand realities as contextualised personal constructs, instead of using scientific research methods to explain. A relativist approach recognises realities as personal constructs. The methodological framework for this enquiry will draw on the Practice as Research model as defined by Nelson (2013) and Artistic Research Methodology (Hannula 2014), employing the term 'Artistic Research' which was first used by Frayling (1993) as an alternative to scientific research methodology (Guntur 2020). The enquiry will use a hermeneutic interpretive lens to examine the research methods (Makela 1997). The framework for this research paradigm is suited to a practice research qualitative enquiry, typically employing a multi-method interpretive focus as an alternative to an established scientific research paradigm. Guntur (2020) asserts that knowledge generated through Artistic Research methods is different from knowledge generated through scientific methods. He notes that both approaches draw on "theories of knowledge" which are applied to the particular research methods "to answer the question of how the knowledge is obtained, or in other words the methodology" (2020, p.18). The relativist ontology recognises the nature of reality (the knowable) and acknowledges that realities exist as personal constructs, and the subjectivist epistemology recognises the nature of the relationship between the inquirer and the knowable, which is relative and contextual (Guba 1990 cited by Gray and Malins 2004). Guntur (2020) notes the subjective nature of Artistic Research enquiry:

> "This objective and universal status of knowledge is avoided in artistic research, which is more accepting of the subjective view that knowledge is the result of interaction between the researcher and the research object, or that the relationship between the researcher and the research object is connected by certain values" (Guntur 2020, p.18).

The practice-led research enquiry aims to reveal new knowledge and insights relating to cinematographic practice, employing reflective practice methods. This is a qualitative research enquiry employing reflective empirical methods of investigation, where reflective research as defined by Alvesson and Skoldberg (2009) has two basic characteristics, careful interpretation and reflection, to inform understanding rather than establish truths. Schon

refers to this reflection as a "reflective conversation with the materials of a situation" (1983, p.78). Alvesson and Skoldberg identify the need to take a sceptical approach to reflective enquiry:

"Empirical research in a reflective mode starts from a sceptical approach to what appears at a superficial glance as unproblematic replicas of the way reality functions, while at the same time maintaining the belief in the study of suitable (well thought out) excerpts from this reality can provide an important basis for a generation of knowledge that opens up rather than closes, and furnishes opportunities for understanding rather than establishes 'truths'" (Alvesson and Skoldberg 2000, p.9).

It is necessary here to distinguish between methodology and methods, between the methodological framework for the research enquiry and the research methods used within that framework. Gray and Malins (2004) assert that methodology is a way of structuring thinking and enquiry using different research approaches and a variety of methods to understand not only the product of the enquiry but also the process. Friedman (2002) notes the requirement for methodological sophistication that leads to appropriate method selection. The methods used include reflective practice, films, photographic images, installation and analytical tools to provide the data to address the research aims. The methodology is informed by the methods and techniques used to illuminate the process of investigation (Gray and Malins 2004).

The methodology underpins the reflective practice methods applied here to explore cinematographic practice and address the research question: *How does the application of new digital filmmaking technology, agile practice and tacit craft knowledge contribute to meaning and understanding in contemporary cinematography examined through my practice?*

The methodology model (Figure 6) provides a useful overview of the multi-method research paradigm. The research methods will be examined in more detail in the next section (Figure 5). It is necessary to acknowledge that creative practice research methodologies may be

regarded as problematic. Arlander (2018) notes contentions relating to Artistic Research and practice research methodologies:

> "The term 'artistic research' is in itself a contested concept, as are 'practice-as-research' (Nelson 2013) or 'creative arts research' (Barrett and Bolt 2014) … 'artistic research' can be understood as research where the making of art forms an important part of the process. Artistic research can also be discussed as an interdisciplinary and speculative practice" (Arlander 2018, p.44).

Frayling notes that Artistic Research "needs a great deal of further research" to develop an archive of creative practice research methodologies to enable practitioners to lose their fear of research and to move forward with confidence. He asserts that "we don't need to be scared of 'research' – or in some strange way protected from it".

> "Where artists, craftspeople and designers are concerned, the word 'research' – the r word – sometimes seems to describe an activity which is a long way from their respective practices" (Frayling 1993, p.5).

While the term 'Artistic Research' incorporates the word 'art', it is important to note that Artistic Research Methodology is not restricted to the art practice or the arts. Arlander (2018, p.44) maintains that Artistic Research can be interdisciplinary. Schwab notes that Artistic Research in different fields of practice "needs to negotiate its border not only with philosophy but also with other disciplines" (2018, p.205). Schwab (2018) explores notions of transposition in Artistic Research across a range of areas including physics, mathematics, anthropology, healthcare and law. These fields of study recognise and value a constructivist, multi-method approach to research methodologies that position the reflective practitioner at the core of the research enquiry and value a subjectivist epistemological attitude to knowledge enquiry. Schwab (2018) considers the importance of cross-discipline transpositions and artistic appropriation of research:

"While notions of transposition have emerged in different disciplines and fields of study, there seems to be something particular about how the artistic appropriation of the term articulates the movement of research" (Schwab 2018, p.8).

Kirkkopelto (2018, p.38) asserts that Artistic Research may be understood as a "transpositional practice: a technique, a device, a point of view, a product, a concept, or an agency" removed from one practice context and repositioned in an alternative context to examine the consequences of that repositioning. The reflective practitioner is best placed to design the methods of enquiry most suited to their mode of practice. A concern that Artistic Research methods might be less reliable than the established scientific methods of enquiry is challenged by Fitje (2018). He notes that where scientific methods employ "measurement, experiment, and modification of hypotheses" it would seem that "artistic practice cannot traditionally meet all these conditions" (2018, p.128). However, Fitje asserts that this contention is flawed, and that scientific methods are equally prone to subjective interpretations, scientific measurement and data analysis that do not always add up.

"Looking closer though, reproducibility emerges as a more problematic principle than what is usually declared. A recent survey of more than 1,500 researchers conducted by Nature showed that more than 70 per cent of the participants had tried and failed to reproduce another scientist's experiments, and more than 50 per cent had failed to reproduce their own" (Baker 2016 cited by Fitje 2018, p.128).
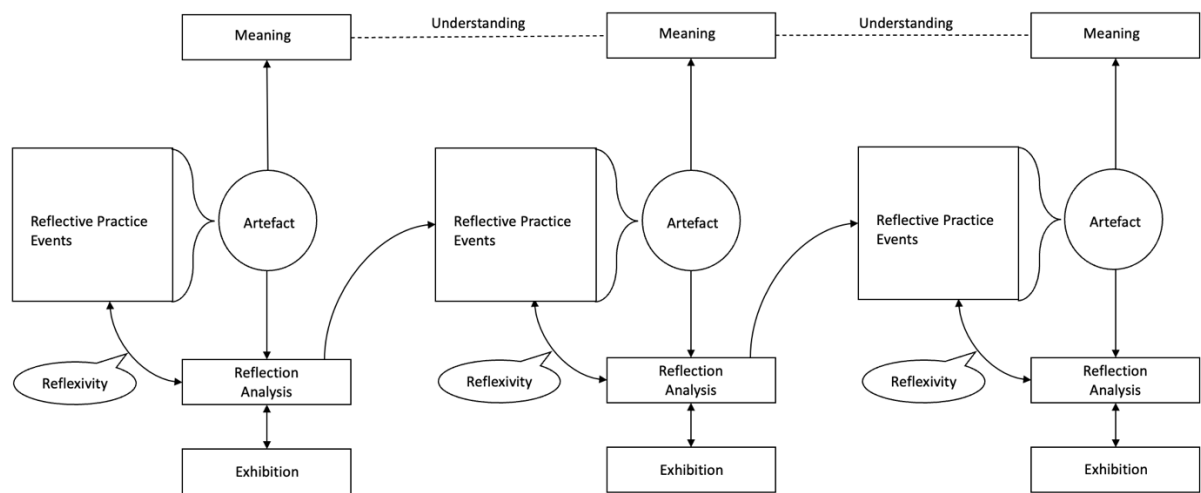


Figure 6. Methodology Model

**5.5 Mapping the Terrain through the Lens of Hermeneutic Enquiry**

Hermeneutics draws on deductive reasoning to illuminate knowledge enquiry (Drew 2018). Deductive reasoning adopts a top-down approach, moving from the general to the specific where logic dictates that if the premise is true the conclusion must be true. The word 'hermeneutics' is derived from the name Hermes. In Greek mythology Hermes was a messenger of the gods "who bore knowledge and understanding between the gods and mortals" (Paterson and Higgs 2005). Alvesson and Skoldberg (2009, p.29) note that hermeneutic interpretation of texts, exegesis, has been pursued by scholars along two interconnected paths, one being the "Protestant analysis of the Bible", the other the "humanist study of the ancient classics." The theory of hermeneutic deduction has a close association with the interpretation of biblical texts in the 17th century (Crotty 1998), for example Spinoza, 'On the Interpretation of Scripture', section 3, in *Political-Theological Treatise* (Drew 2018). Renowned scholars and theologians such as Dilthey (1988); Gadamer, (1975); Heidegger (1962); Ricoeur (1976); Schleiermacher (1977) have, Paterson and Higgs assert, "developed variations of hermeneutic philosophy and subsequent methodologies" (2005, p.342). However, Drew (2018) argues that hermeneutic philosophical reasoning can be traced back to Plato:

> "Every speech must be put together to have a certain body of its own; so as to be neither headless nor footless but to have middle parts and end parts, written suitably to each other and to the whole" *(Phaedrus 264c).*

The primary characteristic of a hermeneutic enquiry is that it considers the relationship between the part and the whole. This cycle of understanding is represented by a circle, the objectivist hermeneutic circle (Alvesson and Skoldberg 2009). Ricoeur advocates a hermeneutic oscillation between pre-understanding and understanding (1981). Alvesson and Skoldberg assert that, from the very beginning, the "meaning of the part can only be understood if it is related to the whole" (2009, p.92). Inversely, it must also stand that

knowledge of the whole must reveal truths relating to the constituent parts and their functioning within the greater system or whole. The part necessarily informs a greater understanding of the whole and vice versa.
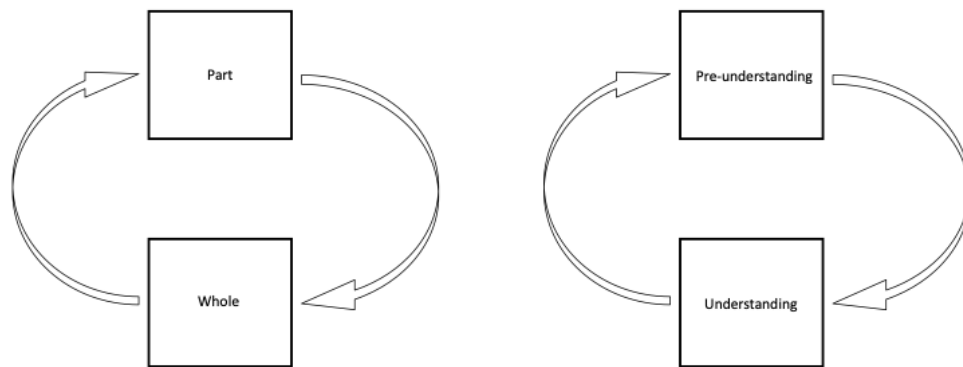


Figure 7. Hermeneutic Circles (Alvesson and Skoldberg 2009)

The model of the hermeneutic circle presents a continual cycle of enquiry between the part and the whole, the whole and the part. This unresolved hermeneutic circle is resolved by Radnitzky (1970, p.23), who transforms the hermeneutic circle into a hermeneutic spiral of enquiry, where each loop of the spiral presents a progression in understanding. The spiral expanding outwards denotes the expansion of knowledge and understanding. In the hermeneutic spiral the journey of discovery from part to whole is continued except that, in the spiral model, the return to the part carries new knowledge of the whole, which in turn sheds new light on the part (Alvesson and Skoldberg 2009, p.92).

Attica and Edge identify the need for researchers to "craft procedures integral to the environments in which they operate" (2017, p.33). They recognise that by doing so researchers become a "functioning constituent" in the research enquiry. Reflexive interactions in practice instigate change, leading to moderations in the work and a

repositioning of the researcher. In this regard Attica and Edge assert that reflexive interactions impose a shaping on the researcher as much as they shape the work and that it is therefore necessary for the researcher to consciously step back and become an observer.

This duality, the close-up reflexivity and step-back observation, requires the researcher to develop a criticality regarding their subjective actions and objective observations. This multi-distancing, near and far, is aligned with a hermeneutic interpretive approach that values a repositioning and evaluation of events from a variety of viewpoints to validate findings and inform understanding. Edge (2011, p.34) proposes that reflexivity may be characterised as having two "interacting elements: prospective and retrospective reflexivity." He asserts that prospective reflexivity considers "the effect of the whole-person-researcher on the research" Considering Sandywell (1996), Attia and Edge maintain that retrospective reflexivity "concerns itself with the effect of the research on the researcher" (2011, p.35). Attia and Edge notes the significance of a developmental approach "a metaphorical sense of movement, of distance travelled" and the impossibility of returning to the point of origin, as the research trajectory progressively shapes the work and the researcher.  Attia and Edge note Dewey's (2016) examination of qualitive research experience:

> "On the active hand, experience is *trying* – a meaning which is made explicit in the connected term, experiment. On the passive, it is *undergoing*. When we experience something, we act upon it, we do something with it; then we suffer or undergo the consequences. We do something to the thing and then it does something to us in return. Such is the peculiar combination. The connection of these two phases of experience measures the fruitfulness or value of the experience" (Dewey 1916, cited Attia and Edge 2017, p.36).

The hermeneutic lens can be understood, not as a circle of investigation, but as a network or spiral that has a justifiable variety of entry points, as originally envisaged by Lewin (1948). Makela (1997) considers that in hermeneutics a phenomenon occurs, is analysed and

interpreted with the new information used to enable progress by returning to the start of the process again, but now at a higher, more advanced level, hence the notion of a spiral moving forward.

Hermeneutics allows for multiple interpretations and meanings (Friedman 2002). Alvesson and Skoldberg (2009, p.93) note the importance of empathy in bringing meaning to understanding: the need, with imagination, to "think oneself" into another agent's situation.

"The idea is that in the last instance the mind of one individual – especially its more creative, non-rule bound aspects – is not accessible to the reason of another individual, trying to analyse it from the outside; only intuition can fully assimilate the mental universe of another human being" (Alvesson and Skoldberg 2009, p.93).
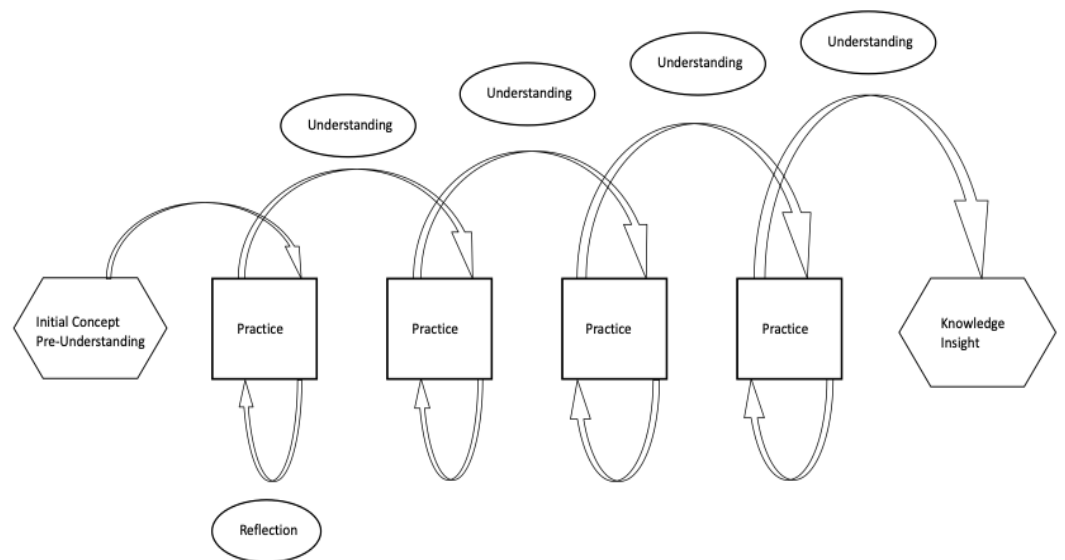
Figure 8. The Hermeneutic Spiral Model

Hannula (2014) discusses Artistic Research Methodology and proposes a series of works/artefacts, which he terms 'pearls', that are made over time with each pearl leaving a material track or record, documentation or data. Each pearl has a public component with critical feedback, which is fed back into the research, analysis and making, thereby maintaining and nourishing its continued development (Figure 9).

Bell (2006, p.98) notes that knowledge is created by researchers engaged in production who are also most likely to be involved in the public exhibition of the work to explore "its public meanings with others."
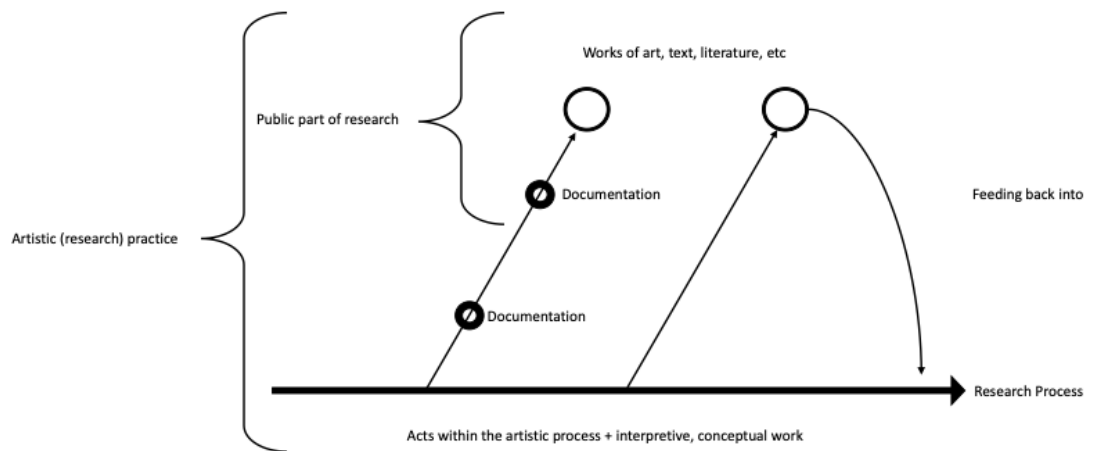


Figure 9. Artistic Research Practice and the Public Part of Research (Hannula 2014)

The research framework employs methods of enquiry that position experiential image making at the centre of the practice research investigation. The rationale for the research exegesis requires a visual engagement with the research materials presented as digital film artefacts, including still and moving images, complete with a written contextualisation. Complementary writing establishes an interpretive positioning as Grushta (2005) notes, "the act of writing about one's art work immediately positions the work as object" (cited by Bell 2006, p.99). It should be noted, however, that the complementary writing is not intended to transpose the artefacts into the medium of words; as Nelson says, the complementary writing "assists in the articulation and evidencing of the research enquiry" (2013, p.36). Gadamer consider the concept of metaphor to explore meaning "every word, as the event of a moment, carries with it the unsaid' (2005, p.474). Nelson asserts that writing is not required to transpose artwork into the medium of words:

> "The aim of complementary writing is absolutely not to transpose the artwork from its own medium into that of words. It is not a requirement to translate the work as some have alleged. By way of complementing the practice, writings assist in the *articulation and evidencing of the research enquiry*" (Nelson 2013, p.36).

Spatz (2018, p.152) contends that writing has maintained a position of prominence for so long that one tends to "think of words as if they derive their meaning from their inscription." The research methods will consider modes of knowing as identified in Nelson's dynamic model (know-how, know-what and know-that), where praxis (the practice research activity) is understood as theory imbricated within practice. The research framework will address modes of knowing and three-point mapping techniques to underpin reflective analysis and substantiate meaning and understanding.

## 5.6 Understanding and Meaning in Reflective Practice Research Methodologies

Golafshani (2003, p.604) notes that constructivist methodology in a qualitative research enquiry "values multiple realities that people have in their minds". In this respect the

generation of reliable and valid, diverse realities requires a multi-method approach to the research enquiry. When considering the internalised realities of another agent, Alvesson and Skoldberg (2009) contend that feelings and empathy are an important consideration to better understand intuition and contextualise meaning. They argue that it is even possible for an interpreter to have a better understanding of another agent than the agent themselves. Bell (2006) notes the requirement for an inter-subjective framework to contextualise understanding and underpin meaning:

> "For, there is little doubt that the artist/researcher, if they commit themselves to the task of documentation and critical contextualisation and reflection on their work, can, in collaboration with like-minded others, produce an inter-subjective framework for understanding the work they produce" (Bell 2006, p.99).

Essentially, to understand meaning requires an affinity with another individual's meaning-field, note Alvesson and Skoldberg. They maintain that "every world is a 'horizon' of meanings which signifies that it is determined by its outlook" (2009, p.120). Understanding, therefore, is illuminated by a variety of vantage points, leading to a corroboration of views and a validation of meaning. In a constructivist qualitative enquiry it is necessary, therefore, to employ research methods that enable empathetic access to the meaning 'horizon', which is, Gadamer notes, flexible and prone to change. Golafshani (2003) contends that it is necessary to redefine the research concepts employed to determine notions of truth:

> "Therefore, reliability, validity and triangulation, if they are to be relevant research concepts, particularly from a qualitative point of view, have to be redefined as we have seen in order to reflect the multiple ways of establishing truth" (Golafshani 2003, p.604).

The research methods comprise reflective practice, image artefacts and an exhibition/installation, to permit a 'triangulation' of methods to map the cinematographic research terrain (Figure 10 which, Gray observes, gives us a 'fix' to understand complex issues from different perspectives (2004).

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Method 1

Method 2

Complex Research Issue

1 Method – Singular set of information
Unreliable? Subjective? Biased?

2 Methods – Two sets of information
More reliable, inter-subjective, less biased

3 Methods (or more) – Multiple views
More reliable, corroborative, critical

Method 3
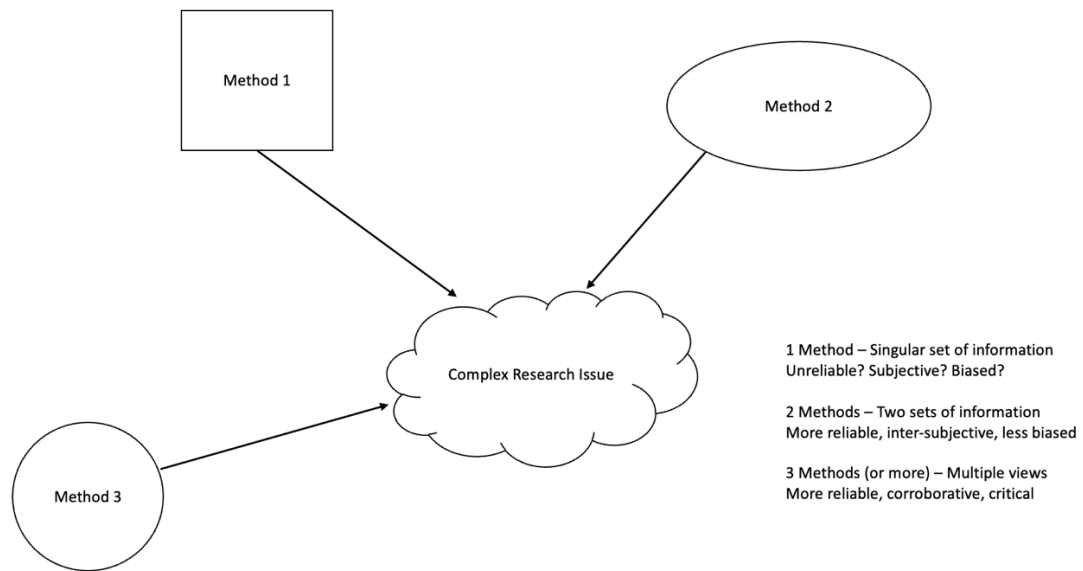
Figure 10. Triangulation (Gray 2014)

Nelson (2013) explores new ways of interrogating practice and proposes alternative research models outside of the conventional positivist research orthodoxies. Nelson argues that reflective practice is an integral part of research enquiry and identifies the challenge to devise processes of investigation that are significant and rigorous in presenting new insights. The core of Nelson's Practice as Research model is based on intelligent practice, where practice constitutes a substantial contribution to the research evidence. Nelson uses the term 'praxis' at the central core of his research paradigm, where praxis is "theory imbricated within practice" and incorporates the activities of the multi-mode Practice as Research enquiry.

"The condition of invention – the state of being that allows a state of becoming to emerge – is a perception, or recognition, of the ambiguity of appearances. Invention begins when what signifies exceeds its signification – when what means one thing, or conventionally functions in one role, discloses other possibilities … In general, a double movement occurs, in which the found elements are rendered strange, and

of recontextualization, in which new families of association and structures of meaning are established" (Carter 2007 cited by Nelson 2013, p.40).

The core drivers for the research enquiry are centred around reflective cinematographic practice and aim to explore the interplay of tacit knowledge, tools and materials to address the research question: *How does the application of new digital filmmaking technology, agile practice and tacit craft knowledge contribute to meaning and understanding in contemporary cinematography examined through my practice?* Technique and technology are core to reflective cinematographic practice where the researcher utilises tools and materials in creative production processes. When actively engaged in reflexive practice this can reveal new meanings, or inventions – 'double movements' as identified by Carter (2013). These double movements are significant in revealing new insights in technique and/or technology, although Williams advises that there are significant differences between the two.

> "A technique is a particular skill or application of a skill. A technical invention is then a development of such a skill or the development or invention of one of its devices. A technology by contrast is, first, the body of knowledge appropriate to the development of such skills and applications and, second, a body of knowledge and conditions for the practical use and application of a range of devices" (Williams 1981 cited by Nelson 2013, p.41).

The multi-method reflective enquiry presents multiple vantage points to provide a corroboration of views. The methods include reflective practice research films, and a still and moving image installation. The methods chosen are 'tools for thinking' (Hannula 2014), thinking about the processes of image creation in reflective cinematographic practice, and are structured to promote thinking in action and meta-thinking (thinking about thinking), facilitating understanding and underpinning meaning. Typically, triangulation provides a useful strategy to enhance "validity and reliability" of research outcomes (Golafshani 2003, p.603). Mathison (1988) notes the importance of triangulation in qualitative research enquiry:

"Triangulation has risen as an important methodological issue in naturalistic and qualitative approaches to evaluation control bias and establishing valid propositions because traditional scientific techniques are incompatible with this alternate epistemology" (Mathison 1988, p.13).

**Chapter 6: Practice Productions**

**6.1 Introduction**

This chapter explores the approach to each of the practice research production projects. It examines the processes and the progression from project to project, investigating elements that are intrinsic to the cinematographic practice, and offers a blueprint to understand the approach adopted. The research seeks to uncover and make known feelings that are elusive and difficult to articulate, and that are connected to cinematography and to the creation of a distinct cinematographic image. The research seeks to understand why things are done in the way that they are done, with the intention to better understand the hidden drivers and the rationale for a set course of action. The enquiry aims to illuminate tacit knowledge, analysing the interplay of craft and technology, and considering connections between craft knowledge, research practice and industry practice.

**6.2 *Outside In*, Film.**

**6.2.1 New Digital Technologies**

*Outside In* was filmed with a Canon EOS 5D Mark II (hereinafter 5D Mark II), a 21-megapixel full-frame, digital single lens reflex (DSLR ) camera, using a Canon L series zoom lens 24–70mm, f 2.8. The camera support system used was a lightweight Vinten tripod with a Vision 3 head and a Redrock shoulder rig complete with an optical viewfinder. According to Shane Hurlbut (2018, p.16), the DOP on *Terminator Salvation* (2009), the 5D Mark II was a "game changer." It represented a paradigm shift in camera design which Hurlbut describes as revolutionary. The 5D Mark II, released in 2008, was the first Canon EOS camera to have video recording capabilities and the first full-frame sensor DSLR camera to feature 1080p video recording capabilities (Wan et al. 2009). The video capture, with full-frame sensor capture capabilities, enabled the 5D Mark II to compete with professional high-end movie cameras in image capture. Compared to expensive professional movie cameras such as the ARRI Alexa Classic and the Red One camera, the 5D Mark II is compact, lightweight and affordable.

Nuska (2018, p.24) identifies the 5D Mark II as the camera that started the DSLR revolution, a movement that enabled filmmakers to create high-quality filmic images at relatively low cost and compete across a range of platforms. The reason that the movement was democratising, says Nuska, was the image quality achievable by these cameras, "which was closer to a film look (also known as cinematic look) than a video look". However, as well as quality and cost benefits there are also challenges that require the cinematographer to appreciate the limitations of the DSLR camera system and understand how to achieve the best results. DOP Geoff Boyle (2017, p.129) describes the 5D Mark II as "a wonderful thing and a dreadful thing", revealing the ambivalence that some cinematographers have for the camera. To film moving images effectively with the 5D Mark II requires skill and expertise. Additional accessories need to be fitted to the camera to enable it to be used in a similar fashion to a professional digital cinematography camera, and a good understanding of the digital technology and the digital workflow is required to achieve professional-looking results. For these reasons it is not a simple low-cost solution. There are a myriad of technical issues requiring careful navigation, such as rolling shutter effect, aliasing, soft focus and remote monitoring. In addition, the camera has a relatively low bitrate (38 Mbps) unacceptable for HD terrestrial broadcast, which demands a minimum of 50 Mbps. It is necessary to provide a summary of the camera's evolution and the subsequent impact on digital cinematography camera design in relation to commercial film and television production. In 2005 Canon introduced the EOS 5D DSLR camera, the first full frame DSLR camera offering unparalleled camera image resolution through the use of a large 35.8mm x 23.9mm full frame, complementary metal-oxide semiconductor (CMOS) sensor (Askey 2005). The next iteration, the 5D Mark II released in 2008, offered a high-quality, HD filming option (Wan et al. 2009). The camera offered high image quality (at a fraction of the cost of professional film camera systems) due to the large sensor size and new CMOS digital imaging system. The sensor area was larger than most professional digital film cameras available at that time, larger than the standard 35mm film frame and the Super 35mm film frame. The cost advantages of the 5D Mark II were clear, with its release list price of £3,049 (Wan et al. 2009) compared to the Red One at £12,919 (Behar 2008) and the ARRI Alexa at £50,000 (Shipman-Muller 2010).

The impact of DSLR cameras in European documentary and ethnographic film production is notable. Nuska (2018) collated data from twenty-three European film Festivals between 2011 and 2014 and identified a rising trend. In 2011, 25% of respondents said their films were partly filmed using DSLRs; by 2014 usage had increased, with 25% saying they had exclusively filmed on DSLRs and 12.5% saying they had partly filmed on DSLRs. While the 5D Mark II has understandably proved popular with media production students and low-budget filmmakers due to its affordability, compact size and a distinctive shallow focus filmic look, there were also a number of mainstream productions that employed the camera in 2010. These include *House*, produced by Fox (Savov 2010), *Shelfstackers*, a BBC2 comedy series (Pennington 2010) and *Hawaii Five-O* from K/O Paper Products/CBS (Loli 2010).

The success of the 5D Mark II directly influenced the design and introduction in 2011 of the Canon EOS C300 (Super 35mm sensor). *Televisual* the media magazine reported in its 2014 technology production survey that the C300 was the most hired professional digital cinematography camera in the UK that year. In the 2020 survey it was still in the top ten. The new compact modular design heralded what are now commonly referred to as digital cinematography cameras. The modular design was a radical departure from the longer, traditional broadcast-style video camera. The evolution of camera technologies has changed the way cinematographers work and how meaning may be understood.

### 6.2.2 Agile Working

The project aims required an agile approach to filming, with a small team that was able to work in a fast and flexible manner. The team needed to react speedily to events and quickly reposition, when necessary; this required the use of a compact DSLR camera system. For the *Outside In* practice research project, the 5D Mark II's compact size and versatility of working, complete with a fast (low f-stop) zoom lens, enabled effective filming inside a moving vehicle and in dense forest undergrowth. To meet the project aims, it was also important to use a camera with the facility to take high-quality still images with a comparable visual aesthetic to the moving images' visual aesthetic. The fact that the 5D Mark II camera and a shoulder rig could be quickly mounted on a tripod without the need

to remove the shoulder rig first was an advantage. The advent of DSLR cameras and associated filming equipment have made this agile approach to filming feasible; the system can be as compact or extensive as required by the filming conditions – "full of possibilities and endless creativity" (Hulburt 2012 cited Lancaster 2018, p.7).

In retrospect it is possible to discern an evolution in digital cinematography camera design (and associated filming equipment) due to the crossover between DSLR photographic camera systems and modular digital cinematography camera systems from 2010. The so-called DSLR revolution has led to camera manufacturers such as Canon, Panasonic, Sony and Blackmagic releasing low-end digital cinematography cameras, and mirrorless cameras that are even smaller and lighter than the range of DSLR cameras. As Lancaster (2018, p.25) contends, the design and release of these new accessible digital cinematography cameras was only possible due to the "popularity of DSLRs as tools for independent filmmakers." This expansion in DSLR camera capabilities contributed to the so-called DSLR revolution and, as Lancaster (2011, p.405) argues, the "democratisation of the cinema look". One result of this exponential expansion of low-cost modular systems was the propensity of camera operators to adapt equipment to suit their needs. When filming two episodes ('Guilt' and 'The Courier') of *Wallander* in 2009, captured on the modular Red One digital cinematography camera, DOP Geoff Boyle (2017, p.100) commented that the picture quality was great, although he found it difficult to build the camera system required and had to resort to using Velcro webbing to configure a handheld rig to suit his personal specification. This hands-on problem-solving approach by camera operators engendered an agile approach to cinematography that was exciting and versatile. Cinematographers no longer felt restricted to the bespoke range of expensive top-end camera systems and were mixing and matching a variety of filming equipment, with camera skeleton cages introduced by Zackuto in 2011 and Redrock in 2012 to facilitate flexible positioning of camera accessories to suit the operator's requirements. However, there were also cinematographers like Ales Suk (Nuska 2015, p.49) that valued the simplicity of discreet filming with a DSLR, unhindered by the accessories that offered ergonomic comfort and control.

### 6.2.3 Craft Knowledge

Gordon Willis, DOP on *The Godfather* (1972) (Craft Truck 2013) describes how craft knowledge and experience is liberating; it enables the cinematographer to realise visual ideas with skill and creativity, confident in the outcomes. Craft represents, says Sennett (2008, p.144), the desire to "do something well, concretely, for its own sake." Craft permits engagement with cinematographic equipment and techniques with predictable results. Willis (1992, p.284) considers that "Movies are craft, they're not art. The art comes out of the craft." He goes on to explain that, although one can have a great idea for a painting, without the craft skills the idea is worthless. Pre-visualisation, the ability to form a mental visual image, is an important cinematographic craft skill. It offers a reliable guide to the final visual aesthetic, accurately assessing each stage in the image production journey. At the same time, it enables a creative approach to working where confidence in technology, materials and technique allows agility in thought and actions and the flexibility to veer from the original plans as situations demand. Beach (2015, p.177) reports that advances in digital pre-visualisation software now permit filmmakers to "experiment with cinema angles, composition and movement" prior to production.

In the *Outside In* film project, craft knowledge and experience was important. I was continually assessing the performance and the limitations of working with the 5D Mark II, and comparing working practice with how I would otherwise be leading the project if I was working with an alternative top-end digital cinematography camera. The limitations of the 5D Mark II are numerous and include:

- Poor ergonomics
- Limited shot length
- Overheating
- No optical viewfinder in live-view mode
- Poor LCD screen resolution and brightness
- Limited frame rates
- Poor access to camera controls
- Multi-layer menus

It confirmed my thinking that an agile approach, the capacity to be flexible in challenging situations and the ability to adapt equipment to suit filming requirements and work fast were becoming essential attributes for cinematographers in the highly competitive film and television industry. Cinematographers have always had to have a deep knowledge of camera systems, only now the breadth of their knowledge must encompass a greater variety of complex equipment. They must, says Stump (2014, p.30), "be familiar with the broad spectrum of hardware available for their work". I believe that for cinematographers to navigate these systems successfully it requires meaningful research and practice, an understanding of core craft principles and agility in thinking and action.

In the *Outside In* project, meaning and understanding are created in stages through a progressive process. Abduction (Alvesson 2009, p.4) provides a reflexive model where empirical research is developed and theory adjusted and refined as the project moves forward. A reflective approach was adopted throughout the project; at key stages a conscious standing back and distancing was necessary to reflect and reorder thoughts and research ambitions, in a reflexive cycle of investigation. A deep understanding was fleeting. The complex interplay of technologies and working practices involved in constructing the visual artefacts required reflection in action, and again a separation and reflection, at the end of the project. The reflection revealed insights, prompting further investigation in a hermeneutic reflexive enquiry. The hermeneutic spiral (Radnitzky 1970, p.23) provides a way of making sense of this progressive interplay between part and whole.

A narrative film, Rabiger explains (2013, p.53), engages the audience in a story when viewers empathise with the characters. In *Outside In* the viewer seeks to make sense of the audio-visual images as presented, searching for the familiar, looking for patterns and connections that contribute to understanding the narrative signifiers and so predicting the next sequence of probable events. Unpicking the puzzle, making significant connections, enhances meaning, as Dudley says: "the drive to hold events in sequence, to traverse them, to come to an end" (1984, p.16). This analytical process applies to the *Outside In* practice research film project. Observation must necessarily occur through a subjective lens imbued with a distinct, albeit subconscious, personal knowledge base and cultural bias. Cinematographer Vittorio Storaro says: "We are not merely using technology to tell

someone else's thought, because we are also using our own emotion, our culture, and our inner being" (Bergery 1989 cited by Maddock 2021, p.4). When considering the main qualities required to be a DOP, Nestor Almendros (1985, p.10) says that a solid cultural background is even more important than cinematographic technique. It stands to reason, then, that cinematographers are attuned to the visual constructs employed in film production, as they have a deep understanding of how images are made and the processes by which image meaning is understood. Story is powerful, asserts Rabiger (2013); a strong storytelling voice "lends enchantment to all effective storytelling" (p.123). Rabiger considers how stylistic choices contribute to the visual aesthetic and "serve as proxies for the storyteller's point of view", although he contends that a film may have different points of view or different perspectives positioned one inside the other "like Russian dolls" (p.124). These differing points of view exist within the body of the film but also in the collaborative interplay between the director and the cinematographer. In *Saving Private Ryan* (1999) Beach considers how Spielberg set out to create an authentic audience experience by positioning the viewer at the centre of the Normandy beach landings (2015, p.156). The cinematographer, Janusz Kaminski, recreated a realistic newsreel aesthetic by using multiple viewpoints, and adopting similar lenses to those used by wartime camera operators and a variety of technological camera devices to affect the look of the image. The results are powerful and convincing; Beach identifies the effectiveness of new technologies in creating a "more authentically 'realistic' sense of the look and feel of combat during World War II" (2015, p.161). This suggests that empathetic engagement with character and story can negate the artifice of the digital medium. The engaged viewer may easily overlook visual artefacts inherent in the carrier medium, belying the craft, technologies and working practice. In other words, the viewer suspends disbelief in the service of the story. The *Outside In* research film subverts this acquiescence and instead confronts it. To this end the *Outside In* film disrupts the persistence of vision and subjective perspective, creating a dynamic space for audience reflection and an opportunity to assess fundamental meaning and understanding at the level of each image in the stream of image frames. The disruption is designed to provoke the viewer to interrogate the cinematographic image construction and examine the elemental composition and the image sequencing. The intention of this reflective introspection is to expose the interrelationship between the image medium, the

craft process and the cinematographer. Active reflection illuminates implicit craft knowledge, promoting practitioner agency, understanding and expertise. As Harper explains, an expert is someone with "knowledge that allows them to see beyond the elements of a technique to its overall purpose and coherence" (Harper cited Sennett 2008, p.248).

### 6.3 *The Garden*, Film

### 6.3.1 New Digital Technologies

The film was shot utilising high-quality industry-standard equipment: the ARRI Alexa Classic digital cinematography camera (Super 35mm sensor), Alura lightweight zoom lens 15.5–45mm, T 2.8, Zeiss CP2, T 1.5 lens set 18mm, 35mm, 50mm, 85mm and 135mm, ARRI follow focus, matte box and filters. The camera support included a Panther dolly and jib system, with images files edited in Avid and colour graded in DaVinci Resolve. The camera system is considered to be professional industry-standard equipment suitable for feature film production and theatrical release. Stephen Follows' film data and education (2018) reports that around 80% of top 100 grossing movies were shot using an ARRI Alexa digital camera in 2018. Roger Deakins in conversation with Holben (2011, p.2) says, "This camera has brought us to the point where digital is simply better." Deakins who used the ARRI Alexa camera on *Blade Runner 2049* (2018) and on *1917* (2020) won the Academy Award for Best Cinematography for both films.

After reflecting on the first research film, it was considered important to conduct the next film with a focus on cinematographic image quality and professional working practices. All stages in the digital workflow – image capture, processing, encoding, storage and postproduction – had to retain maximum data information to maintain fidelity to the referent. Using complex professional equipment required exact setup procedures and operation. It was therefore necessary to have a sufficient number of people in the camera department to manage and operate the systems effectively, adopting professional working practices and modes of communication to aid efficiency. Only by observing these strict

protocols would it be possible to fully appreciate the impact of the different approaches to practice across the research film productions.

### 6.3.2 Agile Working

The volume of expensive filming equipment and the large crew required a pragmatic and professional approach to cinematography, drawing on craft knowledge and experience. It remained important for the research aims that an agility of thought and actions was encouraged to emulate the efficiencies found on a commercial production, where deadlines dictate a flexible approach to meet tight schedules. While communication and camera roles were based on professional industry protocols, a more relaxed approach to communications was established, with the freedom for any member of the team to contribute and voice their thoughts whenever they wished. The professional craft protocols permitted the camera department to work quickly when needed but also to be flexible to circumstances as they arose. A loose hierarchical structure was employed that permitted a two-way communication flow. The DOP Vittorio Storaro compares the role of the DOP to being a captain, a conductor: "You need a leader to give the right direction" (Schaefer and Salvato 1984, p.229); but he also recognises the need for the camera crew to be able to express themselves, and refers to his camera crew as his family: 'It is like my family, my professional family." By contrast Mario Tosi, DOP, says that "sometimes I feel like a general commanding an army" (Schaefer and Salvato 1984, p.235). Collaborating with postgraduate students encouraged creative discussion and constructive lateral thinking, engendering a problem-solving, positive working relationship.

### 6.3.3 Craft Knowledge

Craft knowledge and a good understanding of craft skills proved invaluable for the first project, enabling an agile approach to the cinematography and working practice in the field. In this case, craft knowledge enhanced the research outcomes. In the second film project,

craft knowledge and experience was essential. Due to the complexity of sophisticated, professional, digital camera systems, a thorough understanding of the digital technologies, including the hardware and software systems, was necessary not only to ensure excellent results but also for practical health and safety reasons. Cinematography at this level of operation requires the accumulated craft skills and knowledge base that many years of practice experience afford. From a commercial perspective, experience is a necessary prerequisite to guarantee expensive, sensitive equipment is not damaged and to ensure that productions complete on time and within budgets. From a research perspective these considerations are still relevant. "Transforming experiential and tacit knowledge into principled explicit knowledge", McAlpine and Weston (2002, p.69) say, requires "intentional reflection for the purpose of making sense of learning from experience." Moon acknowledges that there is "relatively little literature that directly and explicitly links reflection and learning from experience" (2004, p.81). Without the assurance that craft knowledge inspires, the approach to each task in the chain of production events becomes laboured and time consuming. In a research practice environment this has a deadening effect, reducing higher level thinking to functional task-based thinking. My research has shown that, in a collaborative interactive production environment, craft hierarchies are effective due to the filtering of decision-making based on years of accumulated implicit craft knowledge and experience. It not only ensures efficiency but actively energises creative potential. This link between craft and creativity is important and can easily be overlooked and remain unrecognised in craft-based 'below the line' roles such as cinematography.

## 6.4 *Digital Visions*, Installation

### 6.4.1 New Digital Technologies

To realise the aims of the installation it was necessary to utilise new digital cinematographic technologies across production phases. In the pre-production recce, full-frame digital photographs were essential. During production, a professional digital camera system was a necessity; in postproduction editing and colour grading, proprietary software was indispensable. In the final phase, the production of large, high-quality digital prints for

display required a professional digital printer and professional operator. The common factor running through all of these complex processes is the creation and manipulation of the digital image. It is relevant to my research to examine digital image capture, the digital medium and the interrelationship of one with the other, exploring notions of authenticity peculiar to their creation, replication and presentation. Quality indicators are assigned to the image at each stage in the digital process, specific to the medium. There is a direct association between notions of quality and authenticity where visual artefacts signal a greater separation between the digital image and the referent. Paradoxically, Balsom (2017, p.85)says that "markers of mediation become signifiers of immediacy." In addition, the carrier medium – in this case paper or screen – exhibits inherent qualities that may also have an impact on the visual aesthetic and notions of authenticity dependent on context. Casetti observes that low-resolution images can be understood as indicators of authenticity or truth, where the poor image quality might betray the precarious production circumstances. Balsom (2017) asserts that visual artists may introduce markers to make visible the transition between the referent and representation.

**6.4.2 Agile Working**

For the installation project to be effective a flexible approach to curation was demanded, orchestrating compatible digital systems and mediums to create a coherent cinematographic audience experience. Agility of working and thinking within the *Garden* practice research project was, on reflection, manifest in the installation. This awareness was vital in ensuring efficient digital interconnectedness with the realisation of the project aims and ambitions. Curating the installation afforded an alternative visual perspective, contributing to problem-solving (technically and creatively) and enhancing visual cohesion, as exemplified in the approach to achieving the appropriate image sharpness of the digital prints. The procedure involved testing in a professional photographic print studio laboratory and then viewing the test prints in the exhibition setting, while considering gallery lighting, positioning and framing. The initial colour correction and digital sharpening assessments were made working on a digital screen and proved to be incorrect once the

absorption rates of the high-quality photographic art print papers were tested. Professional photographic paper has distinct attributes affecting colour, contrast, surface texture, reflectance, ink absorption and archival longevity. Testing in situ was essential to find the right balance within the viewing distance range. This resulted in over sharpening of the digital negatives to compensate for the ink bleed, which would otherwise reduce sharp focus on close inspection. It was particularly important for the project that focus was as sharp as possible under close scrutiny to reveal the anomalies of digital entropy evident in the digital print. This precision under inspection was essential to the efficacy of the installation, as it drew attention to the resolution limits of the digital screening.

### 6.4.3 Craft Knowledge

Craft knowledge is a crucial prerequisite in the search for quality cinematographic outcomes in a practice research project of this complexity. Craft foregrounds creative thinking, planning and decision-making. Craft knowledge illuminates choices, providing the confidence to know what will work and how it will work. Sennett notes one common measure of craftsmanship at about ten thousand hours of experience. He considers that as craft skill develops it becomes "more problem attuned" (2009, p.20), and that at a higher level "technique is no longer a mechanical activity; people can feel fully and think deeply". Craft knowledge provides the experience to accurately predict project outcomes, to select the appropriate cinematographic tools and materials, and to operate digital cameras and support systems in testing situations. It informs decisions about people and process: who will do what and how they might do it, the degree of operation preparedness appropriate to each member of the team, and the assessment of professional contributors' competencies and abilities. Craft knowledge and experience in all these areas impacts positively on potential outcomes. Creative endeavours are bolstered by research practice insights in the field, feeding back and leading forward, which are assimilated into future practice and actions, and further research developments.

**Chapter 7: Practice Events.**

**Links**

**7.1 Films**

[*Outside In*](#)


[*The Garden*](#)


**7.2 Exhibition**

*Digital Visions*

**Chapter 8: Implications for the Key Findings**

**8.1 Practice Pathway**

This chapter presents the findings of the practice-led enquiry and aims to address the research question. The research question is multi-faceted and seeks to uncover illusive truths pertinent to cinematic practice that may not be immediately recognisable and that can be difficult to articulate in words alone. It is necessary to view the practice event visual artefacts prior to reading this chapter and Chapter 8. The significant findings will be analysed further in Chapter 8, with research insights and thoughts for future development discussed in the conclusion. The investigation is necessarily practice led, with one practice event leading on to the next. It is useful to refer to the Methodology Model (Figure 6) and the Reflective Practice Method Model (Figure 4) to consider the progressive significance of reflection and reflexive practice as the enquiry moves forward, building on knowledge gained to enhance meaning and understanding.
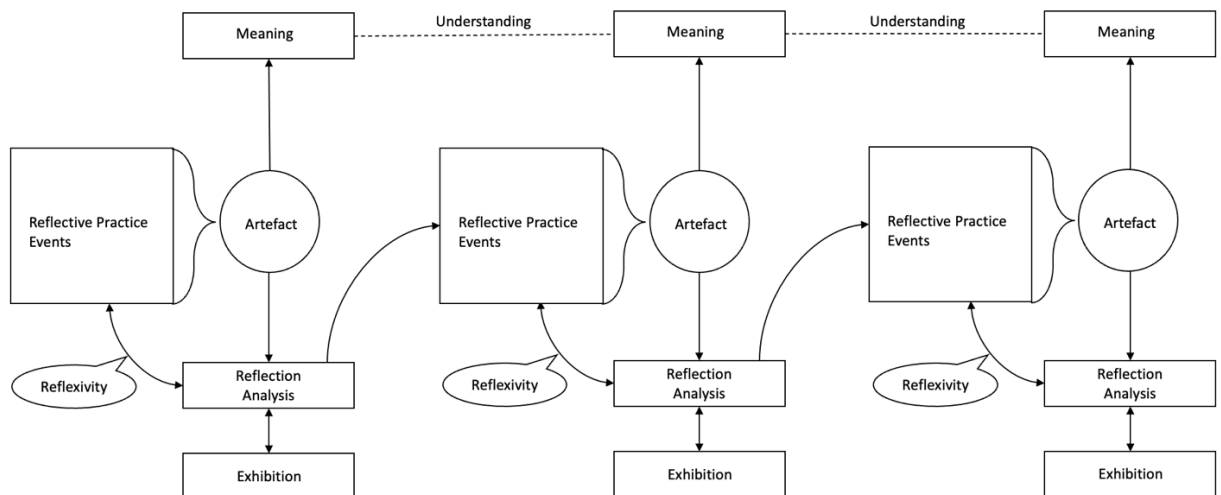


Figure 6. Methodology Model
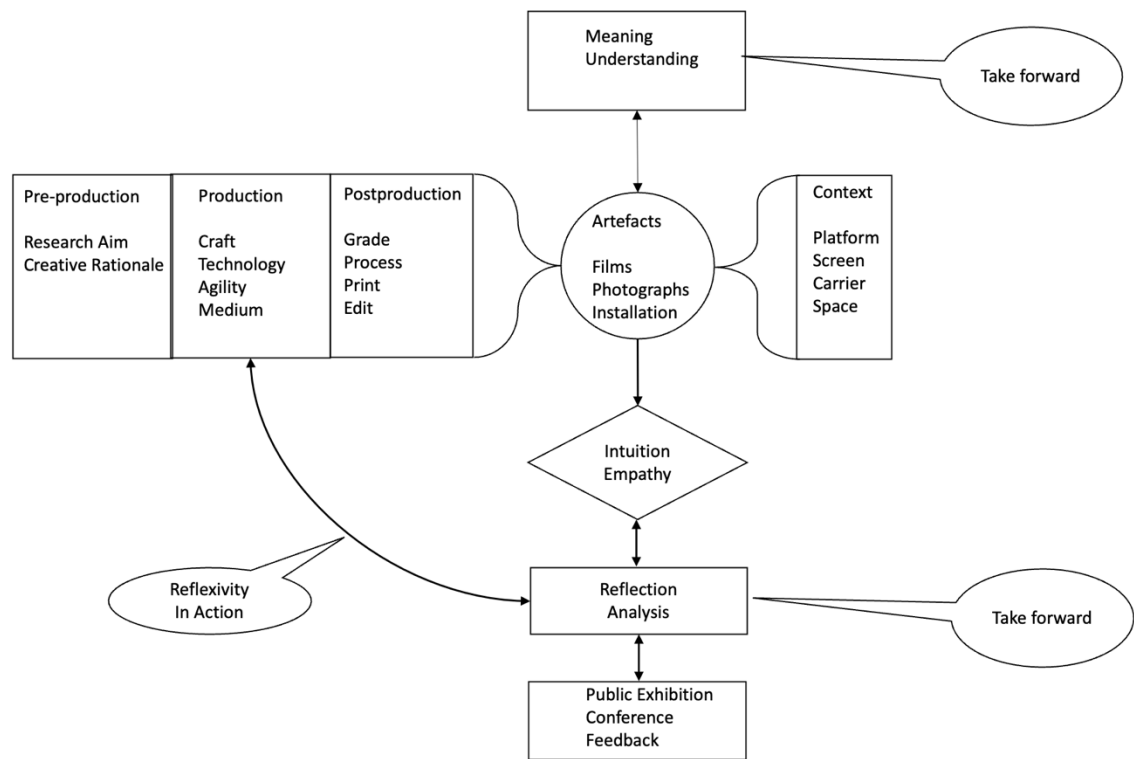
Figure 4. Reflective Practice Method Model

## 8.2 Reviewing the Research Gaps

Prior to examining the findings, it is useful to reconsider the research gaps discussed in Chapter 3 as they have a direct bearing on the investigative practice pathway. The research identifies gaps in cinematographic knowledge that are pertinent to the research enquiry. The gaps consider and make explicit four aspects of tacit cinematographic knowledge that I have termed Image Knowing, the Visual Realisation Cycle, Cinematographic Immediacy and Technical Agility. The following descriptors provide context. Image Knowing: a recognition that the cinematographer has a deep understanding of image cognition and image mediation, which is utilised to create meaning. The Visual Realisation Cycle: a reflexive three-stage process of cinematographic visualisation employed in conceptual image visualisation and creative image realisation in a pre-production, production and postproduction environment. Cinematographic Immediacy: a critical self-awareness and

understanding regarding the intuitive processes involved in creative cinematographic thinking in action. Technical Agility: the ability to employ technical cinematographic equipment in adaptable and novel ways to achieve creative professional results. These cinematographic attributes which I have identified are employed to select the investigative pathway and prioritise the findings as significant. The cinematographic attributes identified and explored, in addition to the visual artefacts associated with the investigation, are considered to be in-scope in relation to the research enquiry. There are a variety of disciplines associated with the production of the visual artefacts that, while necessary for the successful completion of the artefacts, are considered to be out-of-scope for this research enquiry. These include the audio recordings and postproduction editing associated with the visual artefacts.

**8.3 Situation and Circumstances**

The enquiry examines an experimental approach to cinematographic image construction that acknowledges the visual aesthetic and narrative drivers as significant to the research aims. This necessitates a looking back and reaching forward, as exemplified in the Hermeneutic Spiral Model (Figure 8) (Radnitzky 1970, p.23), where knowledge and understanding are incremental, building in stages, springing from one revelatory point of discovery to another. The data is not one-dimensional but rather draws from interconnected sources across the research enquiry practice landscape. The non-linear findings switch focus between disparate elements to build a meaningful research picture. A triangulation of methods (Figure10) is used to map the terrain (Gray 2014) and better understand the complex research issues relating to cinematographic practice. Central to this enquiry is the aim to understand what it means to be a cinematographer, and what being a (critically self-aware) cinematographer brings to meaning and understanding in contemporary cinematographic practice. The findings primarily refer to the reflective components in the practice artefacts (Chapter 5). It should be noted that the findings are nuanced and are relevant to specific research situations. In this respect it is not valid to make overarching claims regarding a technology or typical ways of working, but rather to

acknowledge the contingent factors and how their interrelationship and significance may change depending on the circumstances. In other words, a technology or technique should not be quality assessed or valued in isolation but validated by its appropriateness to a set of circumstances. Although camera technology, agile working and craft knowledge are discussed in relation to each of the practice events in Chapter 5, the significant findings are highlighted, relevant to the practice events, as detailed below.

## 8.4 Focus of the Practice

1. *Outside In*

Agile working with new accessible hybrid camera technology.

2. *The Garden*

Craft knowledge and the creative advantages of a loose hierarchy.

3. *Digital Visions*

Considering the digital image. Digital entropy, a transformative process.

## 8.4.1 The Key Findings for *Outside In*

Chapter 5 explored the flexible operation of the Canon 5D Mark II camera system used during the *Outside In* production and considered the impact of new hybrid stills camera technology on subsequent digital cinematography camera design. (Hurlbut 2018, p.??) identified the 5D Mark II as a "game changer"; he described it as revolutionary, saying it represented a paradigm shift in camera design. The 5D Mark II is lightweight, compact, and affordable when compared to more expensive professional movie cameras such as the ARRI Alexa Classic and the Red One camera system. The camera offers a range of configuration options enabling a versatile approach to cinematography. *Outside In* employed fluid camera techniques and an agile approach to filming that took full advantage of the 5D Mark II hybrid stills camera technology. However, practitioners must understand the limitations of the hybrid system. The experimental film *Outside In* is unconventional in structure, in terms of

both the narrative and the film format. The film presentation screening format positions two 16:9 windows side by side to play concurrent moving image clips featuring synchronised and non-synchronised action – the aim being to disrupt continuity and expose the single image frame for scrutiny within the moving image stream. A single frame is frozen on one screen and magnified to reveal the image pixelation, signifying the relationship between the digital data and the referent, the subject as seen through the camera lens. The moving image artifice is laid bare. The medium and referent are connected. In a similar fashion the research investigation seeks to understand how the adaptation and physical interaction of hybrid filming technology has resulted in agile working methods and a corresponding agility of thinking in action to create new forms of image making. There is a direct correlation between the experimental image construction and the agile approach to working methods manifest in the artefact, contributing to new meaning and understanding. The invisible is made visible. The research practice demonstrates the importance of effective communication to enable agile working with adaptable lightweight filming equipment. Communication required a common language that recognised film language conventions coupled with cinematographic craft skills and competencies. In the *Outside In* production event the three interconnecting spheres of new digital technology, agile working and cinematographic craft knowledge were not in perfect equilibrium, although collaboration was relatively effective, enabling the expected production outcomes. The trade-off (experience versus time) was that each filming operation took longer. It is worth noting the impact of this on the next project. While it was interesting working with the new 5D Mark II digital camera technology, it was also challenging and at times frustrating. It required a degree of double-checking to be confident that images were sharp. This double-checking necessarily included playing back files in the field, to check framing and composition. As a professional cinematographer one would generally avoid this practice, as it interrupts the flow of a production and creates an unnecessary distraction for the director and camera crew. One of the reasons necessitating this action is the fact that it is not possible to feed a video signal to a remote monitor while the camera is in live-view mode. The camera does not support this function. Frame accuracy is not reliable, with framing discrepancies common between the viewfinder and the external monitor. Additionally, the camera LCD screen, which becomes the viewfinder in live filming mode, lacks brightness

and resolution detail. These limitations are a disadvantage when using this hybrid camera technology. Agile working combined with the ergonomics of repurposed DSLR equipment is challenging. It is a process that DOP Geoff Boyle (2017, p.24) describes as "like putting a jigsaw together – everything is modular". On reflection, it was important for the next investigative practice research cinematography project to encompass high-quality, high-end camera equipment and have a camera department with dedicated crew roles. It would be essential to view high-resolution images remotely on a professional-quality HD field monitor. For the next project it was important to focus on fine image detail and creative composition, framing and movement without having to work around mechanical limitations and restrictive 5D Mark II functions. In this regard it was judged that having professional camera equipment and a dedicated camera crew would afford a higher degree of creative cinematographic control.

**8.4.2 The Key Findings for *The Garden***

In the second practice event, the *Garden* film production project adopted a relaxed hierarchical approach to cinematography which inevitably led to a looser control over certain aspects in the image production chain. Although this impacted on the efficacy of fine image control, the trade-off was acceptable, resulting in minor compromises. The compromises resulted in image capture inconsistencies in three core areas: 1) shots not being held static for a sufficient time at the start and finish of each shot, thereby reducing the sequence construction options in postproduction; 2) focus issues, including soft focus, slow focus and indecisive focus; and 3) exposure (under- and overexposure). The lack of precise focus control and exposure consistency was evident when reviewing rushes. The student camera crew collaborated in their roles with enthusiasm and tenacity. However, it is worth noting observations regarding an approach to craft where the novice is still acquiring deeper experiential skills knowledge and comparing this to a craft knowledge acquired and developed over twenty years or more of professional industry experience. Sennett (2009, p.20) contends that "All craftsmanship is founded on skill developed to a high degree." He notes that one common mode of assessment estimates that "10,000 hours of experience are required to produce a master carpenter or musician." These comments

can be equally applied to the cinematographer. As craft competencies develop, precise use of language necessitates specific and equally precise actions. In this regard communications lacked the clarity and concise instruction expected in a professional commercial production. Autoethnographic reflection reveals the depth of embodied craft knowledge and the accumulation of haptic skills, intuition and methods of communication that signify cinematographic craft professionalism – traditional skills that would be passed from the master to the apprentice in traditional indentured crafts. However, minor deviations are natural and may sometimes even be desirable. One can ascribe deviations to an individual style. Considering the stylistic approach taken by his cinematography peers, the cinematographer John Baily says, "They each have a unique way of looking at things" (Schaefer and Salvato 1984, p.64). Every camera operator will have a different feel, a style that is personal. Cinematographers may receive recognition and praise for their particular style of framing, camerawork or lighting. These distinctive personal skills can be very difficult to articulate with words and equally difficult to replicate. On reflection, an agile approach to cinematography practice, a loose hierarchy and freedom in communications fed into the positive working atmosphere and impacted on the creative outcomes in the *Garden* production event. The creative team energy was invigorating. In this scenario it led directly to capturing ethereal images of sunlight illuminating a tree trunk, the light reflecting off the surface of rippling water to create a moving, flickering light-pattern – a moment that perfectly encapsulated the interaction of natural elemental forces at play in the forest environment. Creative decision-making in action can be limited by commercial considerations. Geuens (2000, p.256) argues that big budgets, stars and professional crews can bring "viewpoints and attitudes" that are "antagonistic to innovative filmmaking". To reflect in action requires the situation and circumstances where time and commercial considerations are not the defining factors. It was necessary to step outside of conventional professional boundaries to appreciate this observation. Professional craft discipline affords efficient modes of working that have been honed and refined since the early days of cinema. Maddock (2021, p.2) explores the impact of the first "believable motion-effect" invented by Louis Le Prince in 1888. Maddock contends that, in the twenty years following Le Prince's first film, 1888–1928, "almost every possible variation of cinematographic practice was produced for the first time". The introduction of this new visual recording technology

stimulated creative experimentation, free of restrictions that would later come into play as filmmaking tropes and conventions became established. Research for the *Garden* production event required planning and location recces to find the best forest sites to study felled trees in preparation for the production. The investigation and close association with materials in the field assisted the development of effective research drivers. During the recces an extensive image archive was established to plan the shots and camera positions. The photographic archive included panoramas and images examining the minute details of decomposition due to insect attack and fungal erosion on trees in the forest environment. The preliminary images contributed to the conceptualisation and helped to create the look of the film. As a visualisation tool they proved an effective means to communicate visual ideas. It became apparent that this awareness was an important aspect of the practice research process that needed to be made more explicit. Meaning and understanding would be enhanced by actively involving the viewer in the journey of research discovery. This could be achieved by engaging the viewer in a multi-media sensory experience to appreciate the relationship between the referent and the way this is realised (made real) by the carrier medium. This informed my thinking for the next stage in the cinematographic research enquiry.

### 8.4.3 The Key Findings for *Digital Visions*

The *Digital Visions* installation encourages a reflective visual engagement, prompting questions about the fidelity and permanence of the digital medium and the viewer's spatial and temporal interactions with the digital visualisation of events recorded in the forest. The installation explores themes investigated in the previous practice events and seeks to understand the significance of meaning created through cinematographic research practice. The installation governs the sequential viewing of artefacts through a variety of mediums in controlled viewing spaces and considers how meanings may change and develop to enhance cinematographic understanding. The necessity to explore the boundaries of the digital cinematographic medium and the quest to expand sensory engagement are at the forefront of the Artistic Research endeavour, whatever the medium, be it paint, dance, images or words. Writing in 1854, Thoreau describes his experience of

living a simple life close to nature at Walden Pond in Massachusetts. His retreat to the woods was a journey of self-discovery, to "see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived". To experience the forest, then, one must venture into the forest, touch the rotting boughs, smell the damp earth and taste the fetid air; these fleeting sensory interactions reflect our transient existence. One moment to the next is a regenerative cycle of transformation. Dylan Thomas contemplates this transformative process in his 1934 poem *The Force That through the Green Fuse Drives the Flower*:

> That through the green fuse drives the flower
> Drives my green age; that blasts the roots of trees
> Is my destroyer.
> And I am dumb to tell the crooked rose
> My youth is bent by the same wintery fever.

Thoreau and Thomas's concerns relate to self, place and time. The investigations are existential in nature and raise questions which are essentially unanswerable; nevertheless, they are important because they hint at a deeper meaning, a knowing and understanding just below the surface of things. It is necessary to provoke the medium, to test the boundaries to make the unknown known, the invisible visible. For these reasons I believe that it is important to understand entropy in the digital environment, or at least to have a sense of what this process means in our understanding of the digital image and what lies just below the surface of that understanding in the creation of meaning. For the research enquiry, it is necessary to investigate the transformative process of decay through the digital film medium. It requires a reflective examination of the data losses within the digital environment, the image capture and transmission systems, and a recognition of the visual aesthetics of entropy across the digital landscape. Digital convergence (Jenkins 2006) and the digitisation of image capture devices promised faithful reproduction, where a clone would be a perfect copy of the original artefact. Digital entropy evident in the still photographic images (*Woodworm*, *Holes*) belies the notion of digital fidelity and mirrors the organic decomposition detailed in the *Garden* film. The Super 8mm film introduction

sequence in *The Garden* is reminiscent of a home movie, evoking an idealised remembering of the past. The celluloid film grain and handheld camera operation constitute a nostalgic signifier, authenticating another place and time. Decay, it seems, is an inevitable consequence of digital synthesis and the interconnectedness of digital mediums. It is essential, says Cubitt (2014, p.251), for the cinematographer to "gather as much information about the light as possible" because "information begins to degrade from the moment of exposure". It is a common misunderstanding, Cubitt contends, that digital files can be copied an indefinite number of times with accuracy; in practice, "multiple compression-decompression cycles" and the "vagaries of transmission" introduce anomalies. Digital medium anomalies can present in a wide variety of ways as visual artefacts, including video noise, glitches, aliasing, poor definition, limited tonal range, colour aberrations and pixelation – all contributing to a distinct visual aesthetic. Artefacts in the carrier medium can be seen as an unintended corruption or, conversely, as intended signifiers of specific modes of production. Balsom (2017, p.87) notes that, with new technologies promising "iconic fidelity", filmmakers are now searching for "smudgier ways of seeing". As advances in digital cinematographic technology afford the cinematographer the potential to step ever closer to creating an exact likeness of the original, there is an opposition, a creative resistance, where the cinematographer desires to maintain a visible separation. The crafted cinematographic image is not a quest for duplication, or exact likeness, but rather a creative interpretation that lives alongside the referent, be it bigger, brighter or smudgier.

**8.5 New Technologies**

It is interesting to note here the progress of new image construction technologies associated with VR and VP capabilities in film, television and gaming that have developed during the research investigation, and as discussed previously in Chapter 2. New VR and VP image technologies and the techniques employed in the computer animation industry have been considered out-of-scope for this enquiry, although, at the time of writing, technological advances are now offering creative cinematographic opportunities, driven by

economic advantages and the need to reduce carbon emissions due to the climate emergency, as identified in the United Nations Sustainability Goals. The impact of convergent cinematographic technologies will be discussed in the conclusion, Chapter 8. In this current chapter I have sought to present the findings of the research enquiry by reporting on the practice research films and exhibition. The significant findings identify insights pertinent to the field of cinematographic enquiry to take forward and consider in the concluding chapter.

**Chapter 9: Conclusion**

**9.1 Conclusion to the Research Question**

In this chapter I will review the research findings and present the significant insights and thoughts for development in the field of the research enquiry.

**9.1.1 The Latent Signature**

The research identifies the cinematographer's approach to filming, as revealed in the connection between the referent and the medium, the image and the mode of image creation. It is evident that the way we do something affects the way we see something. The approach is integral to the artefact. In effect, the image carries the latent signature of the cinematographer in the disparate components that contribute to the creation of the image and imbue meaning. The methodology employs a triangulation of methods to analyse the practice outcomes. In *Outside In*, the adaptation of hybrid lightweight filming technology is apparent in the rendering of the adjacent twin images. In filming *The Garden*, the affordance of a loose production hierarchy realised creative thinking in action. The recontextualisation of the digital medium in the *Digital Visions* exhibition provoked an energetic audience engagement. The outcomes in these research situations contributed to a re-evaluation and elevation of the image, to enable new meaning and deeper understanding. The accumulation of many small acts and creative decisions by the cinematographer imprints its mark on the visual artefact, in the same way the artist's brush leaves its trace in the finished oil painting. This knowledge made explicit is an aspect of cinematographic practice, a prerequisite to being a cinematographer. The cinematographer is the creator of the image. In this regard the cinematographer is the 'first viewer' of the image, the first viewer to bring conscious meaning to the captured image. Discussing cinematographic cognition, Flaxton (2013, p.1) considers "that which looks, as being as important as that being looked at". The cinematographer's view is distinct. The image does not exist until selection by the cinematographer. Tacit cinematographic knowledge, categorised in Chapter 2 as Image Knowing the Visual Realisation Cycle, Cinematographic

Immediacy and Technical Agility, recognises the embodied role of the cinematographer in the image creation. It values the characteristic attributes of hand, eye and body coordination and the assimilation of technology and craft. It acknowledges the cognitive processes and creative mediations employed to bring meaning and to contextualise understanding. Benjamin (1936) considers the correlation between visual awareness and conscious analysis:

> "The camera introduces us to unconscious optics as does psychoanalysis to unconscious impulse" (Benjamin 1936, p.16).

Furthermore, it is evident that the interconnecting spheres of new digital technology, agile working and cinematographic craft knowledge afford opportunities to examine meaning and understanding in contemporary cinematography through experimental practice events in this research enquiry. The intersection of the spheres (technology, agility, craft) generates an energetic practice hub where craft knowledge and craft experience are key. For optimum creative outcomes, one can envisage the spheres operating in harmony. A visual model of scales illustrates this balancing act, supporting technology on the one side and agile working on the other. The fulcrum, representing craft knowledge, is positioned to maintain the perfect balance. The introduction of new technologies without the required depth of experiential craft knowledge must inevitably lead to imbalance and introduce a greater degree of trial and error into the working practice, thereby reducing confidence in creative production outcomes. The research establishes the necessity of craft knowledge and real-world experience as essential competencies to enable cinematographic creative inspiration to flourish.

### 9.1.2 Meaning and Understanding, New Ways of Seeing

The cinematographer Conrad Hall considers how cinematography offers opportunities to make connections in a language with infinite possibilities, although "Figuring out how to speak that language is a lifetime job" (Hollyn 2009, p.169). Champetier (2011) proclaims

that film projection is 'bigger than life' it permits the viewer to "see more, further, better, it reminds us of something from our own experience" (Maddock 2021, p.5). It fulfils a need, she says, to share our human experiences. This interconnectedness of people and things is important as it reflects core values. The *Digital Visions* research event examined consequential factors relating to the digital synthesis of media and systems, including agile ways of working based on established craft principles. Assigning value in this process of research discovery tests the marketisation premise where success is aligned with consumption, and where value is assigned to the artefact. The research enquiry offers an alternative assessment where value is integral to the process, rather than to the end product. The artefact is a significant indicator of time, energy and creative endeavour employed in the process of discovery. This revaluation of the cinematographic endeavour attributes new meaning to cinematographic practice and enables new ways of seeing and understanding. Craft knowledge and experience is essential in the successful acquisition of new technologies. However, the affordance of experimental research methods has enabled chance and spontaneity to inspire novel thinking and drive creative collaborations. Reflecting on the research methods employed, I propose that it is creatively energetic to unlearn or disassociate enquiry from embedded disciplines, at least for a moment, to free creative discovery and reset the trajectory for creative cinematographic potential. This resetting permits new ways of seeing, enabling new meanings and deeper understanding.

## 9.2 Looking Forward. New Ways of Working

Manovich (1996, p.6) accurately predicted the crossover of cinematography and animation disciplines: "Shot footage is no longer the final point but just raw material to be manipulated in a computer." The "real construction of the scene", he asserts, would take place in a postproduction environment. Mateer (2014, p.1) proposed that digital evolution would degrade the role of the cinematographer: "The cinematographer has become more of a data-capture specialist than a visual artist." Over two decades later, Deakins seems to confirm these predictions, saying:

"Animation and what was live action are going to merge, there will be less and less live action. Live action will be smaller films, but most Hollywood films will be done in a computer very soon" (Deakins 2020).

However, the reality of the situation in 2023 is very different from that proposed by Manovich (1996) and Mateer (2014). Computer processing power and associated technological developments have enabled unprecedented advances in VP capabilities, signifying a paradigm shift in the way that live-action films will be made in the future. However, one of the significant differences, explains Measure (2023), is that the cinematographer is now recognised as one of the lead creatives in this revitalised field. The cinematographer "still has complete control over the final image that is put out". The development of light-emitting diode (LED) video wall technology for virtual backgrounds has seen the emergence of LED volume stages to record live action. The term 'volume' refers to: a) the volume of light emitted by the LED wall, and b) the encapsulated live filming space within the stage. Convergent digital technologies are developing at a rapid pace, impacting on all areas of VP. Rather than relegate the cinematographer to the role of a technician, the cinematographer's role has been elevated. The cinematographer has access to new digital technologies designed to enable significantly greater image control at each stage of the image production process. However, instead of digital image modifications taking place in remote postproduction facilities (as they have until recently), the compositing of virtual and real components transpires as live-action events in an LED volume stage.

This is an interesting development, which in many ways goes back to how films were originally made, with visual effects performed live in the studio, as in Melies' *A Trip to the Moon* (1902). This turning back has empowered the cinematographer. It is a powerful change, says DOP Greig Fraser (2020): "You are not allowing somebody in postproduction later on, to make decisions for your framing." VP is "an exciting jump forward", says Fraser; "it gives the DOP and the director more power on set" (2020). The cinematographer now has an array of tools and specialist support teams to control a range of visual attributes in the studio volume. The affordance of VR capabilities includes virtual and real live-action

events. For example, the cinematographer, in collaboration with the virtual art department (VAD) and the live-action production team, can add lights or light sources to a virtual background and match these to physical lights on set, in the live-action volume. "The lighting all marries together because it is all true," says Fraser. He continues: "You can't get any more real than shooting on a volume" (2020). Furthermore, the light intensity, colour, size and placement can be adjusted by the virtual specialists to suit the cinematographer's requirements. Likewise, the virtual environment can be modified by the VAD in collaboration with the production designer to suit not only the narrative drivers but also to accommodate the cinematographer's design plans. The implications for cinematographic VP capabilities are far-reaching. For the cinematographer, this requires a realignment of responsibilities regarding the conventional modes of production. Conceptual design and detailed forward planning are required at the pre-production phase; typically, postproduction modifications are introduced earlier, in the production phase. It is necessary, says Measure (2023), for the cinematographer to understand the world of VP and the new roles and responsibilities. This requires an appropriate upgrade in education and training, as identified by Guerberof (2022, p.42): "The lessons I learnt included how to match LED background to scene." The individual pixel size (pitch) has a direct correlation to the LED volume resolution and, for these reasons, "the distance from the actor to the wall needs to be carefully measured" (2022, p.42). As Measure (2023) explains, the cinematographer needs to acquire a whole new VP vocabulary and an understanding of the specialist disciplines and their respective responsibilities. The Virtual Production Glossary website provides an extensive reference resource of definitions and terms, supported by the Visual Effects Society, the American Society of Cinematographers, Epic Games and Netflix. Pennington (2022, p.8) identifies some of the main VP roles and departments. The following is a guide, as there is no standard hierarchy or nomenclature at present.

- VP Supervisor (VPS)
- Virtual Art Department (VAD)
- VFX Supervisor
- Brain Bar
- Camera Tracking

- Digital Environment Technical Lead

- IT Lead

- Compositor

- LED Engineer

- Technical Director (TD)

- Colour Scientist

In addition to the roles listed, conventional roles are still required. Pennington (2022, p.8) asserts: "Conventional filmmaking roles continue in virtual production, albeit with each job impacted in some form." He contends that the DOP's camera department "still includes the regular gaffer, focus puller, camera operator, and grip" (2022, p.8). During pre-production, pre-visualisation software permits the cinematographer to develop conceptual design capabilities. Wearing VR headsets, the cinematographer can recce the virtual world to select shots and plan designs. Measure (2023, p.60) explains how virtual location scouts now accompany the cinematographer, traversing the virtual space to find "the best locations within that environment to shoot in". Shots can be selected, lens focal lengths aligned, and depth of field calculated, all of which can now be accurately planned in advance, says Measure (2023), saving time in the live-action volume production. While it is feasible to travel through the virtual landscape, much like a video game, it is unlikely to be visually complete and will exist for the most part in skeleton form as a wireframe design. It is economically valid to render only the 'frustum', the region of the virtual world that the camera sees. Virtual environments replace chromakey backgrounds, cycloramas and back-plates to permit accurate live-action mapping employing real-time engine computer processing. Locations, real and fantasy, are manipulated in LED volumes for live-action filming. Furthermore, the options for remote global filming capabilities offer sustainable production advantages by reducing air travel and logistical challenges. In postproduction colour grading, it is possible to reference camera colour LUTs used on set and on location to achieve the desired grading results with confidence at speed. Inevitably, strategic production planning must accommodate ever more complex workflows with the required

commensurate technical knowledge and support. Considering these advancements, the findings support the conclusion that the application of new digital filmmaking technology in VP necessitates an agile approach to practice, where tacit craft knowledge is an essential prerequisite in the creative cinematographic endeavour. It is evident that the adoption of new technological processes associated with VP inexorably led to new ways of working, underpinning new meaning and understanding in cinematography. New creative horizons are difficult to predict with accuracy. However, although technological advancements maintain cinematographic supremacy for the cinematographer as the lead creator of the moving image, they introduce a fundamental shift in how work is performed. There is a shift from body to mind. The shift in creative engagement is subtle and may seem insignificant when compared with the cinematographic tools and teams of specialists at hand to render sublime visualisations. However, the research identifies why this shift is important and the profound implications it has for the role of the cinematographer. This shift in practice represents a gradual move from body to mind, from an engagement with the tools and the materials of a craft, knowledge-based discipline to a more disembodied creative engagement that is head bound, navigating visual constructions in a virtual space. Throughout the journey of enquiry, the research has identified the varied nature of embodied practice and the importance of agile working with new technologies that encompasses a flexible attitude of mind and body. Distinctive mind and body actions signify human endeavour at the heart of image creation; departure from this core represents a slide towards machine conformity, or rather computer algorithmic conformity. For example, in a conventional live filming situation, a cinematographer will regularly make small, incremental adjustments to the camera framing and lens focus to follow the dramatic action; these may include predictive adjustments based on the cinematographer's experience of what they might expect to happen next. The accumulation of the cinematographer's many small actions contributes to a personalised style, a distinct way of doing something that results in a particular look. In a VP environment shot decisions are, to a high degree, pre-planned; this eliminates visible elements of the cinematographer's latent signature, the trace of human interaction that signifies authenticity. Interestingly, VP creatives value the realism attributed by such visual anomalies and have the software capabilities to simulate the cinematographer's hands-on adjustments across a range of

visual cinematographic elements, including lens focus and zoom controls. The resulting look, while convincing at first glance, can reveal a conformity that undermines the intended personalisation and instead draws attention to the synthesised actions. VP technological advancements have led to a new cinematographic look, a polished, highly stylised visual aesthetic that is more acceptable to an audience growing up with computer games. The research enquiry identifies the importance of embodied craft knowledge evident in the cinematographer's latent signature and considers how technology is intrinsically tied to ways of working to create a distinct visual aesthetic. Cinematographic work is imprinted, as it were, by the prevailing technology of the age, as evident in the lurid colours synonymous with the 1950s Technicolor film process, or the grainy black and white images associated with the 1960s New Wave films shot on 16mm compact film cameras. The new cinematographic look associated with VP owes much to computer games technology and the algorithms developed to synthesise cinematographic components. The research enquiry has sought to question what it means to be a cinematographer now. The methodology adopted has interrogated the interplay between digital filmmaking technology, agile practice and tacit craft knowledge, with the aim of better understanding the contribution to meaning and understanding in contemporary cinematography through this research practice enquiry. The enquiry has addressed important questions regarding the craft role of the cinematographer in a digital age and, in doing so, has identified where new research needs to take place. It is of interest to explore how existing VP roles might develop and how the cinematographer will fit in, in these new creative hierarchies. How will the role of the cinematographer change as VP technologies continue to advance and converge with artificial intelligence? How will cinematographic image meaning and understanding be impacted by VP advancements? To answer these questions with thoroughness requires further in-depth research. This research has identified the profound implications of VP technologies for cinematography and for the role of the cinematographer, which we are only now beginning to comprehend. It is evident that VP presents important research opportunities and exciting new avenues to investigate in the next phase of cinematographic development.

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**Appendices**

**Research Interview Transcripts**

**Contents**

**Interview: Geoff Boyle, NSC, FBKS. 14ᵗʰ June 2016.**

**Cinematographer, Founder of the Cinematography Mailing List.**

**MB.** In what way do you think visual aesthetics of moving image has changed from celluloid film to digital capture?

**GB.** It has and it hasn't. What's happened is the change in technology has given us a freedom that we haven't had in the past, so where the lightweight 35mm cameras which came in in the mid '70s changed the style of shooting because people could move cameras in ways they couldn't previously. The sensitivity of digital cameras and the ease of movement, because they got lighter and smaller, in some cases too light, but that's another matter … It's meant you can use different technologies to move, different technologies to shoot. The cameras have become much more sensitive, they've got much wider dynamic range, so you actually are lighting for what you want to see now, rather than lighting around technical issues with the format you're recording on. A lot of the times with film you are lighting shadows up to the film to resolve it. You didn't want to light those shadows up, but you had to because otherwise you wouldn't see it at all. We went through a progression of lower contrast film stocks like the XTR 250 and then the 'stonewashed 87' and the Fuji 400, all designed to have a much wider latitude, and then of course digital came out, and the latitude is getting bigger and bigger again, which gives you choices and gives you more freedom when you're shooting.

**MB.** Is it possible to describe a particular aesthetic that's changed, a look, or texture?

**GB.** Not really. I think the lighting has become more natural, because of the changes in technology. That of course has led into, in some cases, a loss of storytelling ability with lighting, because it's 'I can see it, so I'll shoot it'; well, that's not the job. The job is to influence people with the lighting, it's to convince people that they're seeing something they're not, it's to help them along a storyline. You manage to convince them with the images that's what they really want, and the use of light, shade, contrast and framing and

so on, so that hasn't really changed. It's become easier in a lot of ways, but the core skills are the same.

**MB.** When HD first came out, it was so sharp, and electronic, that cinematographers were using filters to soften the image. To what degree is the cinematographer degrading the digital image, to emulate film?

**GB.** When the first HD cameras came out, they were oversharp, but they were engineered oversharp, it's not that the images were naturally sharp. They had a huge amount of detail correction in them, because they were designed by engineers not by people who make pictures, so detailed correction is a foul, horrible thing. If you have sensors that are inherently sharp enough, you don't need to add detailed correctional sharpness, and it gives a much nicer, smoother look. There is no actress that's going to thank you for making her look incredibly sharp. Everyone I know … I used to shoot commercials on 35mm before any of this digital technology came out, and I was using nets on the back of the lens, and double fog filters, classic soft on the front, anything to take the edge off the image, because your job isn't to shoot reality, your job is to shoot pretty pictures, and taking a raw camera image in the early days of HD, they were not pretty pictures, they were harsh, unpleasant pictures. And so, a lot of work was done in softening them off. Now the manufacturers are recognising what we as DPs want and are producing cameras which produce good pictures. I think the first one to do that was the Alexa, and it's interesting for me that it's a company with a film background that's gone that route. I like Canon, which is funnily enough a company with a film background, and just the way they make images is more pleasing to me. I don't have to work so hard with them.

No actress will thank you for shooting a raw HD. You will always need to use some method to soften it off. When I was shooting 35, I always used nets, double fogs, Schneider classic softs. I have several different hundred diffusion filters of different kinds. I have what was at one time the entire stock of Selfridges Dior black silk stockings 10 denier. Because of EU regulation, they had to add fire retard to them because we know across Europe women keep bursting into flame when their legs rub together, so they had to add fire retardant. That wrecked the visual qualities of them, so I rushed out and bought every pair that

Selfridges had. I know another DP who rushed out and bought every pair that Harrods had. And at one point I had 250 pairs of Dior stockings 10 denier – didn't matter what size, I just bought everything. I'm now down to about 50 pairs, under 50 pairs. Probably enough to last me the rest of my career, but I would not dream of filming someone like … For a certain period in my career, I seemed to specialise by accident in women of a certain age. So, I filmed Margaret Thatcher's party politics, I filmed Marianne Faithfull's 25th anniversary of Island Records' 'As Tears Go By'. And, of course, Joan Collins. So I know how to soften off the images to make those people look attractive. The cameras inherently were at that time way too sharp, and you had to work hard at them. In a way, it's the difference … When I started out in the '60s there was always an argument between Japanese lenses, Nikkor particularly, and Leica, and which one was the sharper. Now, in reality, the Leica were sharper in terms of measuring lines per millimetre, but they didn't look as sharp because they were lower contrast. The Nikkor weren't sharper but looked sharper because they had a higher MTF – a higher contrast – and a lot of the problems with digital cameras when they first came out was the sharpness was enhanced, and so they weren't sharper, they were just electronically boosted to look sharper – very unpleasant.

**MB.** How do you think the advances in image capture technology have impacted on the role of the cinematographer?

**GB.** It's interesting that the changes in technology have both had a huge effect on the cinematographer and none. And it's a real split, in that the inherent skills of framing, lighting are the same. And they are all the basis of how you tell a story. Whether you're selling a can of soup or telling a heartbreaking story, the skills are the same. However, the changes in technology have meant the way that you can do it has become easier in a lot of ways. You can use camera movements that at one time you had to get a Titan crane, which was hideously expensive and difficult. Then you've got the Jimmy Jib, you've got Steadicam, all running through all that period. The problem is people are flying around all over the place without thinking about why they're doing it, but that's just a phase we'll go through and we'll get over that, and we'll use them more. So, that change in technology, the weight of the cameras and the stabilised camera system has been revolutionary in the way we shoot.

The ability to manipulate colour and contrast has changed the way we work. Because when I started, grading was a choice of do you want the red, the green or the blue to be darker or brighter – that was it! And the idea of going back to a photochemical process is something I'd rather poke my eyes out with a sharp stick – it's just a horrible idea. I mean, now, it's not just that I can adjust the red, the green and the blue and mid tones, shadows, and highlights, but I can adjust the curves of different parts of the image differently, I can do huge manipulations to the picture. And I can do them, I don't need a man in a white coat to do it. Now, I've worked with some brilliant colourists, and I've worked with some bad colourists, and the brilliant colourists I always want to work with, but if I'm on a job where we can't afford or get a brilliant colourist, then I would rather do it myself, because I know what I want the pictures to look like. And the technology is developed enough to make it easy for me to do that. And it's really exciting to be able to do that, and show a director on set, very briefly on a low-budget shoot, very quickly, this is how we think it should go, and to see how they react, whether they get excited or go 'oh no', and 'well, how about this instead', and then you shoot with that look-up table applied to the image, so you see what you're shooting as you go. It means no longer do wardrobe and makeup must be guessing about the effect of the grade you're going to do later. What's it going to do to their clothes, what's it going to do to their makeup, which in the past can be a real problem. Now they know what's happening because they can see it on the monitors.

When I started it was important for you to understand the lab process, or at least a basic knowledge of the lab process. I worked in a lab for a year and a half, I had to … to get the union card. When I started it was the whole catch-22 situations: you couldn't get a job without a union card, and you couldn't get a union card without a job. And the only way I could get a union card was by working in the labs, and at the time I was unhappy about that, but it helped me enormously as a cinematographer, because it's allowed for me to understand the whole process. And by having that first interest, I've followed through, and I've followed through learning how all the grading systems work. In the final meeting I had with the director, where I knew I wasn't going to get the film, we were talking about the look of it, and I just flipped my laptop open in a coffee bar we were in, loaded up a still image and speed graded and went 'well, like this', and he went 'no, a bit browner than that,

more like that, and bit more contrast … bit more', and I got the film, because I could show him exactly what he wanted, whilst we were sitting there, and he was amazed to come across someone who could do that. Now, at that time, very few DPs could. Now, I think you'll find the majority can, to one degree or another. Some rely on DPs to do it for them, some prefer to do it themselves. In an ideal world, I will sit down with Seamus at the Mill, or Gary Zarper, who's still grading. You know, there are people I would love to have do my work, but the reality is colourists who call themselves colourists now really aren't very good. They don't have the experience. They play with Davinci Resolve for a couple of years and say I'm a colourist. No, you're not – come back in 10 years. And so, I do a lot myself, and the film I'm just starting now, I've generated look-up tables with the film director and, well, not look-up tables, one look-up table, which will be used on the dailies and on set. Now, when it comes to the online edit, will that look-up table be used for that? That will be the basis of the grade, but I'll then trust the colourist to take it somewhere else. Because I want their input, the same as I want the input from a gaffer, and operator, and so on. It's a collaborative process, and if your colourist is capable of collaborating like that, then it can be wonderful.

Well, I think, once you've learned something like Resolve, you can learn something like Baselight, it's not a hard programme to learn, and I'm really excited by Prelight. Baselight, Prelight, Daylight, it's all the same, it's the control you have that is natural, the images move in a beautiful way, it's easy to get a great image out of them. Now, am I great at tracking power windows and all of that? No, but I can do, and one short film that I graded myself, I made the mistake of saying to a makeup artist that the lead actress had highlights they hadn't got rid of, and I said 'don't worry, I'll fix it in post', thinking no one will ever notice, forgetting the makeup artist lived with the director, and we came to the first cut, the first grade, and she went 'yep' and fixed the hair, so I then spent two days, tracking windows around the lead actress's head, to remove the highlights in her hair, and I learnt a lot about tracking in that time. But it's great fun to do that, and because it's my machinery I'm using, and it's my time, it's not costing anyone anything. And I'm learning, and for me that's part of what you are as a cinematographer, you try and learn everything. I make pictures, and any part of the process which makes pictures, I want to know about. 25 years ago, maybe

more, I was working at Moving Picture Company shooting commercials, and we were starting to use Maya to make 3D objects, within a commercial. So I put a 12 by 12 soft light up there and a bounce there, and then I realised, it doesn't have to be 12 by 12 soft, it's not real, I can have a 100 by 100 foot soft light, and it was like 'wow, this is SO cool', and I had great fun doing that, and I lit quite a few commercials which were part real and part digital CGI. And of course, the CGI artists learnt how to light, in the process, so I let myself out of a job [laughs] … but it was a brilliant process and I really enjoyed it because that's my job and my job is creating images.

**MB.** That's interesting. In a way, I don't think you have put yourself out of a job. Look at animation films, Pixar and companies like that. They see the value in hiring a DP.

**GB.** Yeah, it's because you understand how to create the images, and it's if you know how to light a car, then lighting a CG car is fast. The guy who's created the image doesn't know how to light it, it's an experience of lighting, and you know it applies to everything.

**MB.** So, the cinematographer must now understand the entire digital workplace?

**GB.** The changes in the technology and the changes in the post workflow have been significant. Because when I started, in an ideal world, theoretically you printed a 25 across, RGB 25 25 25, and if you'd exposed it properly, that's what you got. Now it may vary from that across labs. It may be 27 28 30 across, but once you got the lab base lights, you had a reference, and if there was any argument about what the pictures looked like, you would say 'print a base light and see what the image looks like'. If at base lights the image looked really rubbish and awful, it was your fault. Very simple. If at base light the image looked fine, then what was happening was somewhere down the chain. I tended to expose at 5 to 6 printer points over, because I like the look of slightly overexposed images, but all you did was say to the lab 'print it down 5 points' and it was simple. We then moved to scanning and no more prints, you scan off the neg, but at least then you still have telecine alignment film from Kodak, where Kodak gave you a neg they had perfectly exposed. When we went fully digital, it suddenly became the Wild West – nobody knew what was right and what was

wrong, anybody could adjust your pictures and it suddenly became 'it's his fault', 'no it's not, I shot it properly!' And I know references. And the wonderful thing about ACES is that there's a sheriff in town, you've got a standard, and if you just apply an image transform, that is the standard for C300/2 daylight balance, does the image look good? If the answer is no, it's my fault. If the answer's yes, it's my fault. And if it goes wrong, it's someone down the line, you've got a reference point again. And so, we've gone through a whole process of post which has been a nightmare for a cinematographer, where you can try and shoot reference charts, but they chop them all off and throw them away, and you know, no one looks at them, and everything wanders all over the place. Now we have standards again, and it's absolutely wonderful.

**MB.** How do you think this new way of working has fed back and influenced production process, particularly the way films are planned, lit, and shot?

**GB.** It hasn't affected … the changes in technology have not affected the way I approach a film so much, but it has affected the way production companies approach a film. They tend to leave things until the last minute, and they do less testing, and allow us to do less testing, and fix things in post, or screw them up in post, and it's made people more indecisive, people defer decisions, all the way down the chain. I've been asked about can we shoot with an LUT applied and record with an LUT, and the answer is absolutely yes as far as I'm concerned, but you do realise that means no one is going to be able to change their minds afterwards. Are you happy with that, Geoff? Totally! But the director and the producer won't be, and I've offered to do that several times, and no one has taken me up on it. People don't want to commit, they want the chance to change their mind all the time, it drives me crazy. But it varies from director to director. The director I'm working with now is willing to commit to the look from the very beginning, which is brilliant, because he knows I'm going to light it with a look-up table in mind, and if he doesn't use that general approach, then things can be a bit hard.

**MB.** Talking about working practice, and how things change, you showed me this new bit of software. What is it?

**GB.** What I have here is a complete remote control for that camera on my iPad. So, I can select … you should be able to see it, that it's focusing on my face, auto focus, and there should be a little box around my face. I can actually tap the screen and focus anywhere on the screen. I've got control of exposure from this, I've got control over shutter angles, the ISO we're shooting at, I can alter just about anything in the camera from here. And so, this gives me total control. It's on a Wi-Fi link, there are no strings, and I can walk along. It changed the jobs, it changes people's jobs, it doesn't mean you don't need an AC or a focus puller, but it gives the focus from a different tool, and that's what's really exciting. And it means if you've got a rapidly moving camera, or you've got an interviewee who's doing this, which has always been a nightmare, it'll hold focus for you, and this is not going to vary the focus, you know the focus. Well, it is going to vary, but it's going to follow me, and hold it. And it's just remarkable. It's not replacing anyone, it's another tool for you to use. Now, you can run several of these, you can run two of these at a time, and you can go into … that mode, which looks similar, but this could be running on a second tablet, with a script supervisor making notes as you shoot, which is just … and that's then stored in the metadata, in the rushes. So, then all your camera notes are stored, in the rushes. I could stop recording if I wanted and, by pressing … whoops, the red button. You know, just amazing.

**MB.** What is it that a top cinematographer brings to the production, to create something which is extraordinary, that something, that extra 1%?

**GB.** I think what a cinematographer brings is the understanding of the language, there is a language of images, and you influence people, with that language. Now, it's kind of like learning French, or, as I am at the moment, learning Dutch. Which is a hell of a language. You can learn it, effectively you can learn phrase book French reasonably quickly, but to fully understand the language, and to be able to speak comprehensibly, and write comprehensibly in a language, takes a long time, and the same goes for cinematography. You can learn the phrase book images very quickly, you can use the automation to simplify things, but you don't necessarily understand why things are happening, they just are. And

… when I shot *About a Girl,* the short which won a BAFTA, we planned for three months before hand. There are photographs of me, in those days it was a palm pilot, but every frame in that film had been pre-planned to manipulate the audience. I had worked with that director in commercials for 15 years, and the 15 years of manipulating people in commercials, we used to manipulate them in the film. So … the phrase the director used … I did a presentation for the BSC and the Directors Guild which the director couldn't get to, he was meant to. I flew back from Denmark, and the one phrase he said, would you please, if they ask for a message from him, to say what we did was 'fuck with your heads, the same way we do on commercials'. And there were lots and lots of subliminal cues all the way through it, manipulation of the audience without the audience being aware, and I was asked to talk about it before we showed it, and I said not – 'I want you to watch it and then I'll talk'. So, we ran it, and then I described how I had photographed it and how I'd done it, and everyone went 'no you didn't, I didn't see that', and it was describe again what I had done, and then everyone said, 'you did!' and no one had noticed. So, we started the film with long lenses, with double colour correction, so there were no blues, the backgrounds were out of focus and there's a girl walking over the canal, and over the course of the 8 minutes we went wider and wider and wider, and so you saw more of it as it moved towards us, and so her size didn't change. We then went from double correction, corrected back to normal, to no correction, corrected back to normal. So we had started with no blues and lots of reds and then you ended up with no reds and lots of blues. We also went from 120% saturation down to 20% saturation. And doing that, if you cut from picture one to picture 8 minutes in, the difference is huge. But if you do it slowly, over the course of 8 minutes, nobody notices it's being done to them. And the whole thing was to set you up for the shock that comes next, when you haven't seen red for a great chunk of time, and suddenly BOOMF! That saturated red hits you in the face, and we manipulated the whole thing, was to designed to, as she described her world getting worse, you saw more and more of the destroyed rubble, and burnt-out houses behind her. And it all started very nicely, bricks in the background, and out of focus and gorgeous, and then suddenly you saw more and more prams in the canal and burnt-out houses and all kinds of stuff, and suddenly her world was revealed to you, as you did it, without any change in her size. And … that took a lot of planning. But it had a huge effect, at the end, we started off with a desaturated, and as the

crane comes up as she's walking away, we go up to full saturation, in fact more than full saturation, because she's got rid of her problems, and we wanted to finish in Kodachrome, using the images to manipulate the audience, and … or rather to tell a story with the images, the height you pick, the lens you pick, the focal length you pick, the … There was so many elements, that come to make up an image, and it takes a long time to learn that.

**GB.** Once you've been doing it for a long time, you don't think about it, it's … I remember on one shoot we had a student, who's now a doctoral student on film theory, kept asking the motivation for lights, and … There was a night sequence up on the Yorkshire moors, and it's two women, they've got the body of a guy they've killed in the boot of their car, they're opening up the boot to go to his pockets and then they go to burn the car with him in it. And it's 3 quarter back light from an HMI up the mountain, that's moonlight, that's not questioned, there's no motivation of where the moonlight's come from, that's accepted, which I found odd, but I had a little LED in my hand and on a battery belt … and looking at the actresses to see where the shadows were, and I'm just putting a tiny kick in just out the frame, and what's the motivation for that light – what? Is that the boot light? Well … no? Well, what's the motivation for it? The motivation is it's 1 o'clock in the morning, I'm [shouts] BLOODY freezing, there's sleet and rain coming in sideways, I want to [shouts] GET OFF THIS BLOODY MOOR, the producers will [shouts] FIRE me if we can't see the actress, [shouts] THAT'S MY MOTIVATION [laughs]. And it's just … Sometimes you do it because you're telling a story, and sometimes you're doing it to tell the story, you know, just to get it done. And a lot of the times what you do is instinctive, because you've done it for so long, and there's one thing that's nice about doing workshops is – lighting workshops – because people will ask you 'why have you done that?' Well, because … I always do … AHHHH … hang on a minute, ok. And it's also, I've had students, I've been taking light readings and I've gone '3.5' and they've all gone, 'why 3.5?' Well, that was never on your meter … then anything BUT 3.5 … No, that's the right exposure … and you think why? And because you're integrating the shadow readings and the highlight readings, whatever. But you're not doing it as a conscious process, your T,3.5 and it's just ... experience. And it's with any – this is where I get into arguments with people – any art done properly you have to learn the craft first. The great Dutch painters didn't come in and start slapping paint on a canvas, they

learned how to stretch canvases, how to prepare canvases, they learnt how to mix paints, they worked as trainees, they learned the technology of their craft, they learned the craft first, then they applied that to the art, and I think it's really important that you're able to visualise something, that for me the actual shooting of a film, I've finished by the time we're shooting it. In a way I wish I could just pull this plug out and, you know, hand it over to the crew and walk away because I've done my job, I know what I want before I go on set. I've read the script, I've worked out how we're going to shoot it, I know what lenses I'm going to use, I know the colour it should be, I know the lighting balance I want to use, I know what the look-up table is going to be, and when I get on set it becomes a mechanical process, of reproducing in front of me what's in there, and that's the challenge. Now there are cinematographers around who are seen as artists because they move things around and struggle, and 'no, we'll just try that over there', and you know they're people who haven't learnt their craft, but that's just a personal feeling. I think it's important you know what you're doing, how to do it.

**MB.** As technology has changed, how do you think the relationship between the colourist and the cinematographer has changed?

**GB.** That's a great question. As technology has changed, how do you think the relationship between the colourist and cinematographer has changed? It's better and worse. That initially colourists were basically VT technicians, and were not the most creative people in the world, then you got people who were really great creative colourists, and I've worked with some brilliant people, but as the technology has moved on and become easier to use, more and more people call themselves colourists, so there's a tendency for cameramen to become colourists themselves. That then can result in some conflict, but equally a great colourist is a great colourist.

**MB.** What are your thoughts about colour effects filters on location, or are you going to make that change in post?

**GB.** Now we have the dynamic range we have with the cameras I tend not to use colour filtration at all. I'll still use polars, I'll still use diffusion, and in some cases I'll still use grads,

simply so I can enforce where I want the sky to go, and know they can take it out if they want to [laughs]. What they can't change is polars. It's difficult anyway, and control of diffusion, I'll happily do in post, there's really not an issue with that now. If, on the other hand, I don't trust the post process, the colourist, the producer, I will try and force the images as much as I can in the direction I want it to be, but there's a great story here. I did a commercial a few years ago, for a deodorant, where they wanted it to be contrasty, grainy and blue, and I shot it on 16ml reversal stock, 'tungsten balanced' in daylight,  and cross processed it. It was as contrast grainy blue as you could possibly get it, which is what they wanted. I then went away for 3 weeks on holiday. I came back and I saw on air, and it was low contrast, desaturated, and I phoned up and said 'GARY, WHAT THE—', and he went 'oh, they changed their mind, Geoff'. It was a bit of a bit of a struggle but I managed to get it back, and I thought, if you pull that back, there is nothing I can do to make it the way I want it, so what I have to do now is build in the lighting that I want, and they can alter the framing, the lighting's harder to alter, and build up strong relationships with colourists. So make the best you can, be friends with the colourist, don't see them as your enemy, because they're not. They can take things in directions … You're used to seeing something and you think 'that's what I'm going to do', and you get a fresh pair of eyes, and they go 'have you thought of looking at it like this?' and you go 'WOW, I'd not thought of that, that looks amazing, that works really well', and sometimes you do things like … I remember a car commercial I did, and I sent my colourist, I wasn't able to get to the grade, and I sent him a series of grades that I had done, and they're of snaps from a holiday with my wife standing outside of a car in Death Valley, and to show him this is where I started, this is the next stage of the process, now continue that thought pattern. And it was great, he actually got exactly from that process what I wanted, where I was going, and did continue it, and took it to a much better place, and it was wonderful to work like that. And in another film where the producer didn't want me to go to the grade, and made everything impossible for me to get to the grade, I actually set up a website of my grades, that only the colourist had the web address of, and they were able to go to that and look at it, go 'ok' and then look at something similar to that. Producer walks into the grade and goes 'yeah, just like that, great!', and actually that's a film that came out more than I wanted it to look than any film I've ever made.

**MB.** How will the advent of UHD impact the role of the cinematographer?

**GB.** I don't believe that UHD will have any impact on the cinematographer. Your job is the same, it's just a bit sharper. The big issue coming is HDR, and high dynamic range has the potential to change the way we work totally. However, in the intermediate stage, where we are going from standard dynamic range to high dynamic range, there is going to be chaos for a number of reasons. The three different types of HDR display, which one are we going to use? Are cinemas going to use a different HDR display to television? Because we know inherently television is going to go for the lowest common denominator, it's just the nature of the beast. Are we going to light for HDR, or SDR, because we've got to bear in mind people with legacy sets, you know, the same way we ruin images now for cathode ray tubes? Why are we ruining our sets for cathode ray tubes? Ahhhh, because granny's got one. Well, you know, screw granny. I'm sorry, she's half blind anyway, she doesn't notice, she turns the colour right up, the contrast right up, you know. What we do is irrelevant to granny, and so my approach would be throw SDR out, and just go totally HDR. It's not going to happen, there's going to be compromises all along the way, and, as I say, the next 3 to 5 years are going to be a mess. But out of that will come something wonderful.

**MB.** Do you envisage a time when the role of a cinematographer will be downgraded to that of a digital capture technician, with creative work done in post?

**GB.** I can see a time now, when producers and post people want to downgrade the role of the cinematographer, to make us capture, which they then manipulate everything in post. There are a number of reasons why that doesn't work. As I said, the language, the way we frame, the way we create pictures, has nothing to do with capturing data … It's to do with telling a story, it's to do with influencing people. Now, is there a possibility, if I use a camera like Lytro, of being able to capture it, then change the perspective? Yes, but you need my skills in the post house. So, the skills of the cinematographer will still be required, whether they are used in the data capture stage, or in the post stage. The storytelling image skills are still storytelling image skills – the actual technology used to create those images is irrelevant. And you will have to be involved on location, because you still have to

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manipulate the lighting, you can't do that in post yet – in some stage down the line I'm sure you can, but it's going to take longer than people think – and the idea of getting rid of the person who tells the story with pictures is just crazy because that's what cinema's about. If you don't do that you may as well go to the theatre or listen to radio.

Things like HDR have come in a lot faster than people think, and there's a huge confusion with HDR, because people think in terms of stills HDR which is a capture process. HDR in motion pictures is a display process, because we capture enough dynamic range. At the moment we have to force it into a limited dynamic range, by using power windows, and … and tracking windows across things, whereas once we are at HDR, we can grade faster, because we can actually show what we intended to show, without the limitations of a display media, which to me is really exciting, but equally it's going to involve compromises in the crossover period.

**MB.** Do you think it's possible to see a distinct visual aesthetic for each of the *Wallander* series?

**GB.** To a degree, yes. You can define a different visual aesthetic from a different series, in that the … There were two Swedish series made. Well, two different *Wallander*s, in Sweden, and one was made by Yellow Bird, and that ran into three series, and the other one didn't run that long. The first series by Yellow Bird was shot in 16mm, the other *Wallander* was shot at 16mm. I came in at series two, in the transition to digital, and it was really important to me that, in the transition to digital, we kept a film aesthetic as it were. So when I was establishing the work pattern, the workflow for it, I bought in as an AC someone who had never shot digital before, because he was a really good AC and I know I was going to shoot a lot of it at low light level, and I needed a good AC for that, and it was interesting. We gave him 3 days at the camera rental company, in Stockholm, whilst we were down on location, and he came in after a day and a half and went 'alright, I got it', and this was with the Red One, and he came in and held up a compact flash card and said 'that's a mag', and I said 'yeah', and he said 'yeah, that's all I needed to know, it's a mag', and the whole workflow on that was based around a film workflow, in that we had a person from a post house, in our production office, he was the post house, and we sent him boxes of compact flash cards

at the end of the day, probably lunchtime and at the end of the day, and he then dealt with them – nothing to do with us, they went to post. There was no DIT on set, we had two looks that we used on the shoot, one for day and one for night, they were built into the camera, and that was it! All exposures were set with an exposure meter, 5 … 6, cameras matched, we checked the cameras matched, we had done tests with them, and we shot it very much … It was very important to me that when I did that programme, that to me … I'd only read one of the books, and it actually happened to be one of the episodes I shot, which was just a fluke, but for me the essence of it had to be establishing where it was. I thought the countryside was as important as the characters, and it was important to show the characters in their environment, so I shot most of a wide angle lens as close to people and move around them, and kept the camera moving, and very much made it a documentary style, because I thought, as a detective series, using a documentary style shoot would make it feel more real, and I think that did work. All the locations, because of speed, a lot of the time you make decisions based on the aesthetic, decisions are: Have I got time? Have I got budget? Have I got equipment? No no no, so I'm going to light it through the windows and diffuse the windows, get big soft through windows or shafts of light through windows, with little kickers inside. That then defines the style, but then that lets you have freedom in a room, I can't move, you can't move around there, because there's a light there and a light there, and if it's all coming from outside, you've got the freedom of movement, that you haven't got otherwise, and so we move the camera a lot, on *Wallander* series two, and that became part of the style. Now, the Branagh series did evolve more towards that, but when it started, it was all shot with long lenses and out of focus backgrounds, and close-ups of Branagh. Well, for me, that was the wrong thing to do, and, as one reviewer said, it could have been shot in Birmingham, which I loved, but the whole thing there was I think they made a mistake. I don't think *Wallander* as a series is about Kurt Wallander. It's about him, the people he works with and the environment he's in, the whole, the complete thing, whereas the BBC Branagh *Wallander* started off being about Branagh as Wallander, not about the complete thing, and for me that's why I never enjoyed them, and it was just like 'uh, there's another shot of Branagh … oh, another shot of Branagh … another shot of Branagh, ANOTHER close-up of Branagh' and, you know, it wasn't telling the story.

**MB.** How did you find the Red One?

**GB.** The Red One was notorious for being noisy in the blues, so if you colour balance for tungsten light, it got incredibly noisy blues, and the answer was you put an 80B filter on. Well, you lose two stops then, when you're filming, when you're lighting at a level with t 1.3 Super Speed anyway, there's no way you can afford to lose that. I persuaded the director that, what would be a really good look to this was, that all the interiors we would light incredibly warm, to make the night stuff look cosy, and you felt safe and secure indoors, and when you went outdoors it was much colder, and he liked that as an approach. That meant I didn't have to colour balance and correct the reds, and bring the blue noise up, so I got round the technical problem, with an artistic choice, and they were fine to work with, they had a reasonable dynamic range. They didn't have anything like the dynamic range people claimed, but then people are always somewhat optimistic about dynamic range and cameras, but I didn't have any problems shooting with them, I enjoyed shooting with them. Physically they are a nightmare, because we had to hang a lot of boxes on them, and we were shooting totally hand held, and it was only 2 weeks in – Element Technica sent me a prototype of their Mantis-1 shoulder mount – that I was able to shoot comfortably, and the difference it made is staggering, and I know watching the episodes, I know where the change was in the mount and I can see it in the pictures.

**MB.** As a cinematographer, you have knowledge about workflow, and about the variation in cameras, lenses, and ways of filming, but you also must be an engineer, and adapt equipment?

**GB.** I think the role of the cinematographer with equipment has changed a lot. You would, 30 years ago, get a camera, put a lens on, go and shoot. Now, you put a jigsaw together, the … Everything is modular, everything is made and the problem is that there is an optimum design if you're going to shoot handheld, and the optimum design was the Aaton 16mm, made in the late '70s, and no one's made a better camera. If you're shooting on tripods, dollies, cranes, the shape of the camera doesn't matter a damn, and the idea of it being a computer with a lens on is what we actually have now, and that's fine, a little box with a

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lens on, but we then end up ... Well, I want you to shoot handheld and you end up with all these things where it never works, it's too high, it's too front forward, it's just ... it's horrible. They're actually too light as well, that unless you've got a camera that's at least 10lbs ... you can't ... You need that mass, and I prefer something that's the mass of twice that weight. I don't want to go to four times that weight, which is where I started, but around 10 kilos is a good weight for a camera because it makes you think about it, but it also has that mass that stops you from doing bad moves, but that needs to be properly designed, and whilst it's fashionable to shoot everything handheld, we should have cameras which are designed for shooting handheld, and we don't. The cameras we have now are great on gimbles, they're great on any mounted system, but actually rubbish if you want to shoot handheld.

**MB.** I would just like to hear your thoughts on the Canon 5 D mark II.

**GB.** Canon 5 D mark II is a wonderful thing and is a dreadful thing. It was originally conceived at the request of Visnews and UP, I think, as a camera that would shoot video, in news locations, their still photographers who would shoot video to go on their websites ... It's bloody brilliant at that. The trouble is that people realised they could make reasonable pictures with it, easily. Now, for students, that's brilliant, it's great way of them being introduced to good quality moving images. However, it then became fashionable to use them for commercials and films, and it's – not – good – enough. The image quality is [emphasis] NOT good enough. And it doesn't matter how much you try and tweak it and how much you say 'oh, it's really good'. No, it's not, [loud] IT'S CRAP. And you have to be upfront about that. There is a certain level of data you need, to get decent pictures, and you have to get over that data threshold, before you're getting decent pictures, otherwise you're using high levels of compression and the compression at any level above 2.7 to one is visually lossless, not mathematically lossless. Visually lossless means someone has decided they can't see, the images being thrown away. The people making the visually lossless decisions are mathematicians. If they were visually aware, they'd be cinematographers, NOT mathematicians, so you've got blind people making decisions about what's visually lossless. I'm being unfair there, but you're using visually illiterate people to make those decisions. Now, there are two significant cameras that changed our industry.

One is The Red and the Red One pushed digital cinematography in a way that it moved years forward, it reduced the price of stuff, it forced Sony to do stuff earlier than they would have done, and at much lower prices than they would have done, and it's been brilliant for the industry. Stuff Red have done, I've hated at times, but there is no denying that Jim Jannard changed it completely, for good and bad. He got people obsessed with numbers, rather than pictures, which is the bad side, but he pushed the technology forward. As a side to that, Canon, their camera they produced for news photographers, that then got used by film people to shoot stories, made them realise there is a market for moving images which led to the camera we're using now, which has come a totally different route to the cameras that came, so this has a stills origin, and it's still a very uncomfortable form factor, but the images out of it are brilliant. And so, those two manufacturers did a brilliant job. We were working on terrific digital cameras but they were big, heavy, the ARRI D 20, the D 21. I worked with them on the breadboard original, but it was before that base 35mm, and the Alexa was a revelation. I think the Alexa would have come out before it would have done, and even though it's expensive it's lower than it would be at the Red, and faster than it did, because of the Red, but it is by far the best digital camera out there, closely followed by this one … A Canon C300/2. The … I'm still unhappy with people using the 5D to learn, but please accept it does have limitations. It's only an 8-bit camera, it's compressed to hell, you cannot produce the best images with it; however, it allows people who would never, ever been able to produce images, to produce images. When I was 15, I got a standard 8mm camera, but I had to really think about what I was shooting, because the cost of film and processing was horrendous, and I could shoot very little, and I had to be very cautious about what I shot. Something like a 5D lets you shoot much higher quality, and freely, and the more you shoot the better you should get … so … it's been tremendous for that. But in terms of using it for real work, no, please. You know, I race in Formula One, and a Ferrari Formula One car is made by the same company that makes a Fiat 500. They're NOT the same. 'Oh, I'm using a Fiat 500, I must be able to race Formula One.' No, mate, it's a Fiat 500. And the 5D is a Fiat 500.

**Interview: Professor Terry Flaxton, RWA, FRPS, PhD. 26th April 2016.**

**Academic, Artist, Cinematographer.**

**MB.** I was interested in an article you wrote in 2011 about HD aesthetics, when you speak about the role of the DOP in cinematography. You said high definition was meant to give a signal, a trend, standard digital video, to new technology as film, more of a sense of quest.

**TF.** It's an interesting issue. The idea that you need a guiding mind in a shoot, not just that you need a guiding mind, you need two guiding minds, or more actually, that's what's happened … So the idea that the cinematographer has to engage in a degree of elitism, there was always … It was born at the very beginning, when the cinematographer, even if they were called that, they probably wouldn't have been called that, cinematography, god knows … But way back when, when film didn't have a rating, and you'd actually literally have to get a piece of film, and you'd have to go and develop it and look at the imaging and go 'ah, I need to give it more f stop', or you wouldn't have even called it f stock at the time, you would just have opened it up or closed down … the idea that somebody has to take a competent position, in relation to reassurance, of everybody else on the shoot, that something's being obtained. So on a technological basis, the first broker of the cinematographer would have been to have given confidence to everybody, is kind of significant that, you know, if a big movie is going bad, then the cinematographer will get it first, even if they've done nothing wrong. But the idea that an elitism was required in its best sense came from the very beginning, but somehow, then it kind of bifurcated, so you've got technology on one level, but you've got money, 'cause it takes money to do these things, even on an artistic level, even if you've bought your own iPhone and you're doing stuff, it takes, as everything's become commercialised and commodified, that label that you put into it is money but is bifurcated between, the idea of brokering between, with money, but also brokering with the art. So here's a technologist that has to, at the same time, have as much of their mind attributing to the art of technology, and with a mind as to what is going to keep the money happy. I suppose the reference you've made there, on the piece of writing that I did, argued that the digital had to get to the point where it was partaking in this elitism with film. Film always had that, because of a very simple thing, which is that

you develop it. Actually, you don't develop it, you shoot it, and only the cinematography experience has an 85% chance of having an idea of what's going on, because nobody else does, and the 85% chance is that 15% of things can go wrong. The digital needed to bring along some of those things that were attributable to film, into this domain, and now we've got it. So that's the issue, that's where I was getting to.

**MB.** Can you tell me as a practitioner/academic, in what way has the visual aesthetic of moving image changed from celluloid to video to digital?

**TF.** When I was first taught about cathode ray tubes and the capture of an image, I was taught by Ron, and Ron was 80 years old. He had known Marconi and he wore a brown coat, and he attended the cameras which had turrets. So the issue of what's changed between the analogue capture to video, the electronic capture to the digital capture and the film capture, I suppose, in this whole time, is actually the paraphernalia of behaviour around it, rather than the thing itself, because in the end, there's this thing called cinematography, and cinematography wants to barter with light and reality to present a captured image for display, and I think it's more about … You know, we used to say, what's the difference between film and video? Well, the dirt went down screen on film because the film was going through the projector that way, and on the dirt of analogue video went that way because they were doing that. So there was a palpable material difference. There was quite a lot of contempt around the material for a long time. Coming from the film domain, people realised that they could make good images with it, in other words things that were basically cinematic, then all that stuff stopped. But really it's the behaviours around and about each of the bits of paraphernalia: how you had to carry a piece of crappy kit that hurt your back, or whether or not you had a big 35 mm film camera on your shoulder that you couldn't pick up because you would do your back in, so that two people had to do it for you, or this just heavy digital kit.  I don't think there's a lot of difference. Occasionally when you see a piece of American cinema, in the cinema, that looks like it's really video because somebody's got their shuttering a bit wrong and they kind of throw you back into reality, they throw you right into television space and you don't want to be there. So on that level the digital capture of images has taken on a film aesthetic.

**MB.** To what degree is the cinematographer degrading the digital image to emulate film?

**TF.** Ok, so the issue of how to make a digital image more filmic, apart from certain behaviours you do with the shutter and how you give it the distance of film, has come up very recently, and I'm going to take a leap here and I may well be wrong. For instance, with *War and Peace* recently, which I thought was a fabulous production, I would guess that trying to obtain an image that meant something for a late 19$^{th}$ century audience, so that we could receive it and enjoy a cosy drama, meant that the cinematographer, they went after some '70s lenses that they put in front of the camera, and the reason I would argue that is, when you looked at the pans that were happening, across the wide frame, that two places on the side of the frame distorted. In other words, if a person stood here and walked across, their head elongated as they went through frame, the glass deficiencies of '70s glass technology, if not of '60s glass technology, so I think there is a need that cinematographers are finding to mess up the image in certain ways to give it atmosphere.

**MB.** That's interesting, because a modern wide-angle lens has minimal distortion.

**TF.** Well, if I'm right, and I do know from one or two cinematographers that they are seeking out old lenses to give them that. In this search for authenticity, real, but not too real, the … at the end of the cinematic side, the film stage – got to get my terms right, the film stage – the film was far too clean, and cinematographers were also trying to muck up the image a bit to give it some dirt, some atmosphere. It's parallel to what cinematographers are doing with the digital right now, in 2016.

**MB.** That's very interesting, that's a very interesting point, I think, which is often overlooked, and I think people forget that the projection changed with digital. I just want to read something back to you that you wrote. You're talking about the visual fascination with the image, and it says this evidence of switching between two types of suspension, with disbelief, at high definition, listing more visual fascination, what's really interesting to me as an artist is the balance between the two states. And then, later on, you talk about

the idea of a user and a doer, and a maker and a knower, of our world, and as you make the transition between old and new states. Could you explain what this boundary is between these two states? What is it that you're driving at?

**TF.** I did a 3-year study on the impact of resolution on audience engagement, and it was specifically not a scientific study, very specifically not that, because I don't think science has much to offer in that area, because of the psychology in engagement. But in terms of more resolution, it's kind of a no brainer really, that more resolution had more engagement for audience. I did a very simple test. I projected that dinner party on a table, which I shot in standard definition, and I noticed the forks. The fork prongs in standard definition were quite merged. In other words, the chromatic aberration between the ends of things, not so much the differences, but the chroma differences were such that the image was merging, and it was very clear that high definition imaging with the same thing, we could gain full separation. Now, when you've got full separation, you can see me through there, you can't see me … you can see me through there, you can't see me through there, so the engagement is about being able to look through to the reality as psyche perceived reality, by having more detail. It's a very simple thing and we did some experiments with how long people were engaged. With one instillation, which would be the standard definition, and one with the high definition. Surprise surprise, it's the old, square hole basically which is … you get twice as much engagement but with four times resolution. I mean, that's what we're basically, roughly, finding out. I mean, I wouldn't claim that in a scientific journal, but I witnessed that time and time again,

**MB.** Do you mean that people spend longer looking at it?

**TF.** Yeah, twice as long, for a multiple of four, in terms of resolution, but that was within the tonal domain that we're in at that time, and now we're in a higher dynamic range, so I think the frame weight and are the same dynamic resolution moving, they're a set of … It's like putty: you squeeze it and it pops out between your fingers. If you increase frame weight you decrease resolution, all of those things are going to have different levels of engagement, so that's what's happened, fundamentally, concerning what's happened

between the aesthetics, if you like, of film and digital. Well, it's such that because the digital has enabled an expanded set of parameters, then we make a bit of a mistake and when we think some things are filmic, because they were never filmic in the first place, effectively, so what we're engaging with now is a new nostalgia, effectively, for something that never really truly existed.

**MB.** You use the term 'physically engaged'.

**TF.** Well, we are. It would be a mistake to, erm … Where can I go with this? … uh … if you take a person into an experimental environment, and you deprive them of emotions, they are going to be insane within a very short time. So, even if you're a complete materialist about the way that you look at the world, you know there's a set of balancing factors that gets the person through the day, so consequently even when engaging with images, it's not just a retinol … uh … retention, or any of that stuff. It's that stuff PLUS whatever the hell the overarching governing structure is, as a materialist speaking – I'm not materialist, but speaking as if I was a materialist – there is a sense that there is a set of governing factors that you would be a fool to neglect, the psyche … the 'psyche' … as a factor in that, and that's an aggravation of, you could argue as a materialist, of a certain step of materialist things, that speak about technical engagement, but they sure are there.

**MB.** Yes, that's very interesting, your article, I can't remember which one it is, but it was another one where you talk about the engagement with the pigment, you know, the way you engage with the plasma screen.

**TF.** There is something going on, isn't there? You know that … it's impossible to define it. Have you seen LEDC screens – I'll speak for my position – with early D technology, there's a clear distinction between LED and LCD, even plasma, and they've finally got to where CRVS are, with dynamic range, and cathode ray tubes, but LEDCs provide the black that you would need [laughs] as opposed to the grey that you get with most other forms. You need the blacks to resolve, I mean, you know this is an issue … Conrad, who will talk about if you've

got a grey, then you've got to supply a bright, that's as above black is, as a grey would need to be, to excite psyche. I've got to go there again. I'm just saying psyche for the overall thing.

**MB.** I was listening to an article on the radio the other day, and they've invented a new black pigment. It's the blackest black, and Amish Kapoor has the sole rights to use it. And apparently, by all accounts, when you look at this black and then you have an ordinary black next to it, the ordinary black is like mid grey.

**TF.** Well, there you go, that's the thing about the realist projects and the whole thing. Everything has got a relationship, it depends which band width you're applying, when you're talking about cinematic aesthetics.  Every time, mixing film aesthetics, and film aesthetics … well, it depends what you're displaying, it depends how you've captured, it depends on the mind of the viewer, it depends … I mean, it's all so related,

Ok, I was talking about not being fascinated and being fascinated, if you talk about how a line of old-fashioned analogue video comes across the screen, on black, and it has to switch over to white, or grey, you're always going to get trouble around the edge. So if you're talking about fascination and non-fascination, then it stands to some kind of reason that there would be a boundary position, and the boundary position, if you blow it up, would have huge depth, so for the artist working in any area, the most interesting thing is, yeah, you can fascinate people, you can … It's the problem with art, it's spectacular behaviour, for me, where the change happens is, and why the change happens particularly there is, wherever it is, is a place of great richness for people, on a different point, or the same point effectively, the difference between non-fascination and fascination is that, for the cinematographer that has got the touch, and the cinematographer that hasn't got the touch. For instance, Storaro might be crazy in his language – I like it, it's crazy stuff – but in his doing, the man's got it, the man has got it in spades, and yet you've got 100,000 cinematographers that haven't got 'IT', so for me it's like 'what the hell'.

**MB.**  How has the development and the advances in image capture technology affected on the role and the working practices of the cinematographer?

**TF.** How, basically, if the question is something like, how have things changed for the cinematographer in a period of time whereby the technology on one side and digital technology on the other, I think it's a game that's going back to the same issue of elitism, and control, I mean elitism in a good sense, and where someone has to have control of the image. So what does the cinematographer in a different landscape have to do, because the landscape changes, what do they have to do to maintain their own innocence of control so that they can deliver? What everyone else is asking them, deliver. And I don't think cinematographers have ever been stable EVER, from EVERY decade. That person has to be totally agile, and, you know, 10 years ago that person would be … well, I say 10 years ago, everything's 5 years ago now, every cinematographer had to hold the hand of a videographer, who was then called an IT, who was then … the ITs became refined so that they were only dealing with digits and numbers and all the rest of it, but actually it was the cinematographer's job to try to make sense of the changing landscape. So yes, it's changing all the time. But, hey, you know, man up, as they say, or I should say woman up! [laughs] – whatever the correct term is for taking it on the chin and saying yep, ok, I don't think there's an issue really.

**MB.** The cinematographer now understands the entire digital workflow. What opportunities and challenges does this offer the cinematographer?

**TF.** Ok, so there is a group led by a guy called Uri Layman in Los Angeles called the Global Cinematography Institution, and he partnered up with Vilmos Zsigmond, who did brains on *Deer Hunter*, yeah, that stuff I think, and it was their proposition, quite rightly, that the cinematographer must understand the capture and display of the moving image from front to back, doesn't matter what domain you're in, whether it's digital or whatever it is, the exigences of that behaviour, of that need, leads to different behaviours, but remind me of the central point of this.

So there's this outfit in LA that argues that the cinematographer should do as they have always done, which is to try and understand the behaviour of capture and display. The problem is the economic necessities are leaving the cinematographer out of the back end,

so unless they give their time for free or they're a really big cinematographer, they're not going to be in the grade. So if you say what opportunities does it allow the cinematographer, well, then actually, in the majority of cases, it's probably not very much, because there's a new thing growing up – I'm not saying whether it's good or bad – but the colourist now has responsibility, and now you've got to have with cinematographers the grader with a touch. If they haven't got the touch you're going to have prosaic images even if you've served up good images. So, it's as full of traps as it is opportunities.

**MB.** As the image capture technology advances, the visual aesthetic evolves, for better or for worse, cinematographers' crafts and responsibilities have changed, in line with these changes. How do you think this new way of working has fed back and influenced the production process, particularly the way films are planned, lit and shot?

**TF.** For the cinematographer it does get problematic, the opportunities are … It's like walking across a landscape. There's one where the stalk has to throw nuts across the landscape, and with a handkerchief so it can learn where the gravity holds on, because I think this is a very difficult landscape to negotiate. I mean, the world is full of … I brought my light meter in today, I don't know why, probably as a comfort device, but I brought my light meter, but I've got my app on my phone that can read pretty accurately, but my phone is full of apps, tells me all sorts of stuff to do, so I think it depends what you think a cinematographer is. Are they the ones with the touch or are they the great mass of people who produce the daily bread of shooting which is the news shows, the Netflix, the 10 partners, where is the province of the question?

Ok, there's a great problem for the cinematographer that really wants to be in Hollywood, but can't be because it's already so crowded and you only get one in a thousand who gets there, but they do have access to the means of production, to generate the same kind of images, for instance a BBC drama, but quite often you've got the production mentality that surrounds a major feature film and a production mentality that surrounds a BBC drama are entirely different. I've been told to stop it on BBC dramas in the past, because it was looking … well, nobody said too good [laughs], they say that it's looking too American, and what I

managed to do is achieve a look that was not dissimilar to something like … Think of a shiny … I don't know, like a *Star Trek*, I got a shiny going, and it was like 'stop it'. So what I'm really arguing here is that the cinematographer exists within a context and they may have ambition to be Hollywood, and when I say Hollywood, you have to be in Hollywood to be allowed to do what Hollywood does. If you're in other worlds of context of production, often the tide is against you, and often the will may be there for that to happen but the budget is not there, so the cinematographer exists within a context, and that's the problem, that's their problem, that's where you've got to be agile.

**MB.** How have changes in working practice affected the visual aesthetic of the moving image, or have changes in the working practice of the cinematographer affected the visual aesthetic of the moving image?

**TF.** Ok, have the changes that the cinematographer has had to embrace, within the changing landscape of technology, has that affected the moving image? BOY, has it! In the sense that, because the monitor, the display on set, was really a big problem before, in the sense that everyone had an opinion of the cinematographer, and what the cinematographer was doing. 'Bit of light in here,' says the makeup person. So everyone had a vested interest in what they were looking at. But now, the bit you could see on really big displays, on set, on a drama, enables the cinematographer to self-teach themselves, by practice, into producing Hollywood-level work. Before, so there's not only something's happened, in the environment of production, that's enabled the ambition, not just the ambition of production, but the ambitions of being a big cinematographer, but the ambition for the images to be quite good as well, has gone up too, I think, within the previous argument, which was the context, I think actually, arguments about what is good and what's not good has gone up, upscale, and people are producing a lot better. Television drama is a lot better, these days. It used to be pants.

**MB.** How do you think the relationship between the colourist and the cinematographer has changed, say, over the last 20 years?

**TF.** The relationship between the cinematographer and colourist had changed, in the early days before we got to telecine, the effect of adding light in blue or red or whatever happened, so that was a kind of master and servant thing. 'Add a few more to it!' [laughs] You know, that's what it was, then telecine started coming in and we got the digital in the media. Before digital in the media, I'm talking about when we were telecining for TV and I was involved in a few situations and I was thinking blimey, I'm shooting on film here and this guy can, this colourist can dig out what if, effectively, what is a complete mess! I don't even have to get the exposure right, I can just spin the dial and I'll get something out of it. Of course, within that there's an aesthetic, and by the time we got to the digital in the media, then power started going towards the colourist, and, I mean, if you were left out of the grade, then you had no power. You couldn't say 'I shot this for this reason', you've got 'oh no, look what you've done to my work', but now I think we're more on a par, and we understand the grader. As I said, the grader has the touch, and everybody's aspiring to do the best shooting, and the best grading, so I think there's a more of an acknowledgement, they're creative people in their own right, and they too have a voice, so how are we going to negotiate this? So what's changed, effectively, how the negotiation happens.

**MB.** What are your thoughts about filters? There's this argument about should you use a filter at production stage, or you can do that in post?

**TF.** Ok, I think that the use of filters, there is something that's a holy gesture coming from probably, like, the 9<sup>th</sup> century, where – this is not substantiated by anything, this is just me being daft basically – but there is something iconic and holy about … there's something important about using a filter with a camera, something important about … Christopher Nolan argues this, doesn't he? Do it in camera, don't do it in post. Because when grading first started to happen, I could tell, and I often still can, and it's something to do with David Hockney's modular lens, to the use of which artists have been engaged with since the 13<sup>th</sup> century. David Hockney can see, and I can now, when a picture has been painted by looking through a lens. You can see it, you can see the lines and perpendicular and all that stuff … not the right reference, but hey. When you look at a graded image, I can tell when the patterner of post-production has happened, so referring back to the question, which is

what's the use of filter in post or in camera, it's something about affecting the materiality of light with the filter, as opposed to affecting the materiality of the digital, with a post-production software filter. They're two entirely different things, incredibly nuanced and hard to see, but sometimes people who stare at images all the time can see when a post-production thing has happened as opposed to a production thing.

**MB.** Do you envisage a time when the role of the cinematographer will be downgraded to that of a digital capture technician? And all creative work will be done in a post-production environment?

**TF.** Ok, so, cinematographers are those that are drawn to cinematography, are a completely agile person/type. I would argue that the cinematographer type is a particular kind of character, not so much in a Freudian sense, but in a sense of a perseverance about the behaviour that that type shows, to achieve art and broker science and money, and I think that they will be agile sufficiently to maintain their role. Having said that, the role of the cinematographer will be affected by certain elements, affecting us right now, which is like Lytro cinematography. We have a development on our hands which is basically akin to sonar. You spray data into an environment, you collect it and you should be able, without using a camera, to take a shot anywhere in a room, any resolution, any frame rate, any dynamic range, and once more should be able to then manipulate that view point you've taken, and record it over time to any other position, and effectively Lev Manovich is coming right in his argument that all of this stuff is going to end up as animation. I hope we can have a good old punch at that one and maintain the position that it's not, but it would seem that that's the case. Now, if that is the case, then, I mean, Lytro doesn't spray data into an environment. What it does is, it collects data about what reflectance is, and it comes out, if I understand it correctly, it comes out of Pixar's ray tracing, some form of engine that computes the way light bounces off stuff, and they use Maya, but they've extended it, and they can now, basically, collect information about how light performs in an environment over time. So as I walk closer to this thing, the reflectors on my skin cast and so on and so forth, and the cinematographer in that circumstance is like a DIT on steroids, but they would still have to have a mind for the art. So even at the furthest reaches of the daftest behaviour

that we can construct to collect images, such as not even having a camera on set, even in those extreme areas of production where you go to the edge of cinematography, a person will have to barter our finance and technology, to produce an image. You might disassociate and have a grader, a producer take more of the role of, and all the rest of it, but fundamentally they'll be a nexus point, where it all has to turn on. Whether the cinematographer is the taker of that space I'm not sure.

**MB.** Very interesting. This probably answers my next question, how the advent of UHD, or HDR, will impact on the role of the cinematographer.

**TF.** Let me tell you something about HDR. So, how will current developments like UHD, 6k, whatever …? I do believe that somebody was on a non-disclosure. Do I stop? I won't say it … I know the military are working 128k and it's just, like, off the bloody scale, which is where you … It's totally madness. Oh well, I was told by a friend you can suspend a drone sufficiently stably enough to shoot 128k, and you can see what's on your piece of paper? Well, if they would, they could. In relation to contemporary developments such as UHD, and 4k or 8k or super high vis, whatever the Japanese call it these days, and high dynamic range, what will it mean to the cinematographer? Will it mean they'll have to become more technical? Yes, they should do, they should try to understand what's going on, but they have to have the same physiological understanding of how to construct an image, in that space, so to know how to operate it, like any art. I could say a lot more.

**MB.** You talk about resolution and time and consciousness. Can you please expand?

**TF.** Ok, ok. I was having an epiphany at the time, you realise. So, I was basically … I did a 3-year study of the effect of resolution on human engagement, how much do we engage if resolution increases. So I walked around Soho looking for a gallery to support video art in '78, '79, and we used to exchange tapes with the '_____' video, and one turned up from a certain Bill Viola, however you say it, and Bill Viola has got it, I never know what it is actually, he has this statement which is: duration is to consciousness as light is to the eye. And the proposition there is that, if you endure a visual image, as Tarkovsky uses images, you will

excite something other than boredom. Most people have an attention span that will switch off, but for those who are prepared to put the attention and energy in, then it will be repaid by coming up over boredom, and engaging in a different way, which is about the duration of the image. And I was thinking about what other things would happen if you increase resolution and duration together, what will happen. So it struck me that resolution would be, using metaphors, as luminance to the eye, luminance excites the eye, resolution excites the eye, in a different way from no resolution, the more there is, if you look at a tree and go wide vision, with the trueness of things, so it struck me that resolution was at play, in the mix, besides duration, but also as duration and resolution go together. I mean, you're looking at a photographic image, if you're looking at it past one nano second then you're in time, so simply, resolution for me at that point had to equal time. I don't know if that's sustainable now, as an argument, but it got me to the point where – I'm slowing down in talking because my brain's going on one – I had to look at what goes on in a cinematographer's mind when they're not thinking, and it was significant to me that whilst I was trying to engage with the meaning of resolution as conscious is lightness to the eye and all that stuff, but I get very close to space when I first come into a room, and I – this is after 30 years on the road – and I take it to be the same case as other cinematographers, and what you do not do is think about the room, until you've taken the room in, you've got to bathe yourself in the environment before you go in, and ok, I'll put a 10k up there and I need a bounce board there, and all of the paraphernalia that you have to … the cinematographer has to not think for a moment, they have to breathe, listen, taste, some synthetic use of words to engage with the space, so when I was trying to come into language, to talk about time is resolution, I'm trying to find effectively poetic ways to talk about what it is that a cinematographer inhabits. It's that little space before they make a decision, to light in a particular way.

**MB.** It is fascinating when you film something that is … that has a boredom threshold to it, you carry on filming and then it becomes interesting again.

**TF.** I mean, I'm very conscious of not being remotely academic today, because … people forget that the semantic paradigm is one hundred thousand years old, we've only had a

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voice in our head and a voice coming out of our mouth for, like, a 100,000 according to neurosciences, so we would have been doing something different, entirely different ... Well, all of it's the same, you know, the moving image, it's a hundred years, you know.

I think Conrad Hall is very important to cinematography, not the least because of his shooting, and in a latter point in his career, we were looking at things like *American Beauty*, that's right, yeah, what was important early on was his ability to, with very limited technology, I mean the technology of film back in the '60s and '70s, was to introduce the notion of sunlight, in the medium that's required, you know, basically couldn't show the best blacks in the world, and found a way to show sunlight. I think Conrad was important for lots of discoveries that he's made for the kinds of shooting that he did in the latter part of his career, but he had this line on the idea of the photographic moment, which was as distinct as Cartier-Bresson's definitive moment, which was an editorial gesture. It was the moment where the kid is jumping through the air, and Cartier-Bresson caught him, and that is the defining moment of that shot. So Conrad Hall's photographic moment, it's interesting he uses the term 'photographic', his proposition, was that in any shot, in any film, every single frame should be a photographic moment quality. So what was he talking about? He was talking also that if you had a shot between two people and you panned from one to the other, and it's clearly dead space in the middle, how the hell can you have the photographic moment, inside that space? He was convinced that how you panned, how you framed, as you moved between into dead space, could still produce, in that out of focus world, you could achieve by internal behaviour, effectively, how beautiful that could be, and if you were unmindful of that, you wouldn't achieve that beauty. So, I think that Conrad Hall's point about the photographic moment is about your internal space, and engagement with the medium that you are in, and that your attention alone can pull up beauty in those moments.

**Interview: Professor Guy Walker, PhD. 18th October 2016.**

**Academic in Human Factors.**

**GW.** I'm an associate professor at Heriot-Watt University and I work within our School of Energy Geo Science Infrastructure and Society, but film and media are a side research topic of mine.

**MB.** You've written a film about human factors. Could you tell me what human factors is?

**GW.** That's a very good question. Well, the textbook definition is human factors is all about designing stuff from smallest of artefacts through to the biggest of infrastructures, designing all that for human use, and the reason we want to design stuff for human use is to make systems perform better, easier to use, and often cheaper to build and use.

**MB.** So is the study of ergonomics and human factors the same thing, or is it different?

**GW.** It is the same thing, the terms are used interchangeably, but I think people often use the term 'ergonomics' to refer to the design of office chairs and things like that, but in actual fact, human factors is about not just design for the physical world but also for the kind of mental, cognitive world.

**MB.** In your book you look at the operation of boiling a kettle of water to make a cup of tea. What's that process? Is there a name for that … that process, the method you use?

**GW.** Yes, generically it's referred to as task analysis, and that specific method is hierarchical task analysis, that method is basically all about asking, what are the fundamental user needs, what are the outputs to be achieved, and then, what are all the individual tasks and subtasks, and specific operations that need to be performed?

**MB.** To meet those higher-level goals, do you think it would be possible to apply task analysis to the use of video or film camera or stills camera?

**GW.** Absolutely, yes. You definitely could. I mean, I … It might not be the ideal analysis for all research questions, but absolutely you can apply task analysis to literally anything.

**MB.** I'm interested to understand how a camera such as the Canon 5D mark 2, how that has influenced the working practice of the cinematographer. Fundamentally, it's designed as a stills camera, but became very popular for filming moving image. And ultimately it has led onto producing the C300, which is a professional digital cinematography camera. What are your thoughts on that process?

**GW.** It's interesting. We see this kind of process in a lot of products and systems, whereby a piece of technology is introduced and perhaps the manufacturer of that technology has one particular outcome in mind, but actually users themselves discover new and interesting uses that technology can be put to. And that in turn changes the design in subsequent products. There's been a lot of examples in that, in all sorts of things actually.

**MB.** What examples?

**GW.** Well, mobile phones is a classic one. With text messages, no one conceived that any user would want to send a 160-character text to anyone else. It was mainly for, sort of, service and engineers, but obviously we know how that story went, and, you know, a whole new market erupted for this facility, and you see that a lot. And the fundamental underlying process we refer to is called product design, co-evolution. It's the idea that we might twist the user's arm to use the device in a particular way, but in turn the user twists a bit of the method of the device to use it in the way they want to use it. It then reaches into the market, sort of saturation, and then it declines again. Instead of a nice, neat curve, it goes around in a sort of spiral, with users discovering new things they can do with the technology, the manufacturer adopting to respond to those needs, then further needs, and it goes on. Perhaps it goes back to Canon itself. I mean, let me ask you, this camera seems like a camera 50 years ago looked like this. Why does a camera look like this, do we know?

**MB.** I suppose, traditionally, that would be a logical design. You need to expose a roll of celluloid film one frame at a time. The lens is in the centre of the camera body, directly behind the lens. You have a shutter, which exposes each frame of film. That model has been continued in the digital domain, because essentially that's what photographers/camera users were used to. The same is true if you look at professional broadcast camera, when they transitioned from film to digital.

**TW.** Well, it's interesting. I don't know who invented the first SLR camera, but I don't imagine they would believe it would be conceived as filming moving images in the way it is today. I mean, that represents that sort of spiralling co-evolutionary design effect.

**MB.** When I bought my first 5D mark one, a stills camera, and I liked it so much that I bought the 5D mark two and then I ended up using that camera on two documentary films, and I paid for the whole camera system. The idea that I could pay for a camera system by using it on one job is remarkable.

**GW.** I've seen American tourists use them. This is kind of interesting because I guess, if you were re-thinking how to design a camera, a 21$^{st}$ century camera from first principles, like you say, you don't need a small box. Or shutter to require to be this shape.

**MB.** But although we talk about shutters, there isn't a particular physical shutter. It's just in the electronics.

**GW.** I suppose I would be looking at … The analysis I've got in my mind is, almost like looking at what features these devices enable, certain user behaviours, and what features constrain those behaviours, and I think how we've described how these things are used. I supposed the physical shape of this, previously on your shoulder, and perhaps like this, might encourage certain ways of using it, and discourage others, and I would imagine that would have quite a profound effect on the type of films you would make with these different devices and how they would look. And, over time, it would build up user conventions – and

this is a pure guess – but different languages for how films should look. I'm probably using language in a lucid kind of way or term than you would use.

**MB.** In a way you'd be looking for the best tool for the job. Each of these cameras is a different tool and will give you a different result, and in fact, although the image may be similar, the way you handle those cameras and the way you communicate with the production crew will vary.

**GW.** So, in some ways, going back to the task analysis, it's going back to the goals or outcomes you want to achieve are the same, but the actual tasks and activities you would achieve to perform that goal would be different depending on the technology, and the working practices and so forth would be wrapped up in those tasks and operations, I guess.

**MB.** So, when you mention higher-level goals, what's a higher-level goal?

**GW.** I suppose if the very top-level goal of your task analysis was to capture some scene or other, and then I suppose underneath that, to capture that scene, you would have to … I don't know, use a certain language or narrative, sort of higher-level things.

**MB.** Like a hierarchy?

**GW.** Yes, that's right. So, in that hierarchy you'd have, right at the bottom, under certain conditions press this red button, and then under another condition press this red button, and another one here, you know, the very nitty gritty of how this is all working. But then, further up, you're dealing with the fundamental reasons of why you would press that button: it's to capture an image, it's to, I don't know, adjust certain parameters, to get a certain quality of image.

**MB.** That's interesting, because I interviewed Geoff Boyle a little while ago, who shot one of the very first episodes of *Wallander* on digital film. Before that point it was mainly captured on celluloid film. The Swedish producers produced a series on the Red One digital

camera system and they persuaded the BBC and Branagh to use the Red. Geoff Boyle was telling me the way he used the Red camera, because it's a modular system, a computer with a lens on the front, he couldn't get on with using it handheld. It was too front heavy and wouldn't sit well on his shoulder, so he ended up having to adapt it, changing it so he could use it more physically. That's an example of someone having to use equipment they are less familiar with and applying their craft knowledge and practical engineering skills to adapt it, adapting it for ease of use and to achieve a particular visual aesthetic. So, would that allow you to look at that process in terms of task analysis and human factors and ergonomics?

**GW.** Yes, you could, and again we see those kinds of hacks and bodges happening all over the place to help people use what they're given. For example, the nuclear power industry, they had a bank of controls, all looking identical, so they fitted beer taps to the most important ones, and it all reflects back to this principle: that actually, the design doesn't stop when you release something into the market. You know, the way your colleague there bodges and hacks something, he's redesigning it, and I guess, if enough people do that, then perhaps the next situation, the camera will make that change or have it built in already, who knows? But I guess this idea that design is a continuous process, and users are very much involved in that and are actually very successful, companies can capitalise on that and, yeah, design flexible open products people can use and adapt in flexible ways.

**MB.** Could Canon have foreseen the impact that large sensor stills cameras would have on moving image?

**GW.** Yeah, I suppose they could have said no, this is a stills camera and we're not interested in taking this any further forward, and yeah, clearly they seemed to respond to that need, and I guess they've done well out of it. [laughs]

**MB.** I always associate ergonomics with equipment. Would you, with human factors, consider the wider system?

**GW.** Yes, very much so, and that's kind of where the cutting-edge research is in our field, and you're right, perhaps it started off just looking at the thing or bigger stuff, but this bit of stuff links to a whole range of different tasks and activities.

**MB.** Would you mind looking at the C300 and telling me what you think?

**GW.** I suppose my initial thought is, I'm intrigued to know did they do any user testing, did they find out what you as a camera person wants and requires, and to what extent the shape and functionality of it does match your requirements? I suppose, why this shape?

**MB.** I think there's a lot of people in the industry that would equally question that shape. There's a lot of professionals who thought the modular design wasn't going to take off. And that it wouldn't continue. In fact, the opposite is true, it has become popular and has influenced other manufacturers.

**GW.** And is this easy to use as a professional in this domain?

**MB.** It is, it's a very simple camera to use.

**GW.** Because I guess that idea of modularity, it kind of allows a product to evolve and, like you say, have stuff added on, and bolted in, and for it to kind of cope with user needs that perhaps they can't anticipate at this moment in time, but may evolve in the future. Again, perhaps there's more sort of industrial systems which use this sort of modular approach to confer maximum flexibility and a long product life cycle. Yeah, it's interesting.

**MB.** It is interesting. That model has gone through four changes that I am aware of so far. In 3 years there's 4 different models.

**GW.** I suppose, coming back to mobile phones, it isn't a fixed thing anymore, you can upgrade it, you can put in different apps, it's very much sort of a more open architecture, and if it wasn't open it wouldn't be as successful as it is now, it couldn't cope with the fast

rate of change, in how people and society use phones, they … Stick with phones again, you think again the phone part is secondary, it's a kind of mobile computer now really, and the more flexibility the better, I guess.

**MB.** I have a particular relationship with the cameras, and I use them in different ways.

**GW.** Yes, that's interesting.

**MB.** So, if I try and bring this back to the discussion on the cinematographer and the emergence of new digital technology, how that affects their working practice, craft, and language of filmmaking, if you were looking at this and you were trying to analyse what tasks were relevant, in your hierarchy what might you look at?

**GW.** I suppose what you'd do in looking at task analysis, you'd probably spend a lot of time with camera people and getting them to talk you through what you're actually doing, and you'd sort of build up the task, so what things are they using and at what stage they're trying to achieve with the way they're using it. So you'd probably construct analysis like that. What are the fundamental human needs this kit is trying to service? And, like I say, a camera might be one way of fulfilling those needs, but there might be a completely different technology that could fulfil it as well. I guess these sort of human-centred analysis can help to discover what those alternatives might be. I suppose as well, if you're looking at how customs and practices change, and you're looking at, you know, like a hierarchical task analysis of the camera person tasks, you could probably trace over time how operations have changed, and you could probably also I see how those operations are reflected back to you in terms of types of films and end products that are being created.

**MB.** That is interesting. It's so broad, isn't it? Because you could go off in so many different directions.

**GW.** You could. Quite often with big task analysis – and I'm pretty sure the camera person's analysis is big – you would want to constrain it in some way, perhaps to a particular genre or type of filming. So yeah, you would sort of constrain it within certain bounds.

**MB.** And when you construct this hierarchy of tasks, what would be right at the bottom?

**GW.** It would literally be, if this condition is active press this button. It's literally at the point of button pushes changing the angle and orientation, the focus, every little minuscule detail of how this would be interacted with physically.

**MB.** If you were looking at the task analysis of how a cinematographer would work with the Arri Alexa set-up, I guess that would be very different from how one might approach working with a C300 or a 5D.

**GW.** Well, not as different as you might think, because I'm guessing the user of this [Alexa] has probably similar higher-level goals as the user of that [C300/5D]. I guess, basic level, they want to capture images and, you know, make certain big decisions about how it's going to be used, but I guess it's when you get down into the detail, that there will be certain operations and practices in that camera that will be very different from that camera, to that one. I guess linked to that is the idea that those operations on that camera will be easier than on that one, or more likely to generate a better outcome. And again, you could analyse that in a structured way if you were doing a proper task analysis of it.

**MB.** When you look at these systems, what might you be able to tell us?

**GW.** It strikes me, off the top of my head, there seems to be three main things. I suppose the first one is we can probably learn by applying these methods, we can learn an awful lot about what are your fundamental user needs as a camera person, and we might be surprised at how little actually we know about them or that is made conscious to us, and if we know that then perhaps we can get a much better understanding of how design affect the different outcomes. The second thing is that we are able to analyse these and there's

two concepts, one called constraints and affordances, so there's certain aspects of this design that will afford or make it easier for certain types of user behaviour to happen, but there will also be things here that will limit your behaviour, and understanding those boundaries will give some insight into, again, what outcomes might be more likely when you're using one device or another. And the third thing is, which I may have forgotten, which is fairly profound … Ah yes, there is this idea of this separation between … I think it's important is task analysis is what we call normative analysis, that's how the task should be performed, or how it normally is performed, but there is also a formative element which is how task could be performed, and there are more cutting-edge human factors which you could look at, where basically all the features that are incorporated in this camera are, for example, what do they currently enable the user to do? But then you could also speculate and say, well, what could they enable the user to do? And, as we've seen here, users have discovered all sorts of new things they can do with it, but there are methods which allow us to understand that in advance, potentially, so … a particular method called cognitive work analysis, it's a bit hard core but … So I think it comes back to the point, when you think about it, if the fundamental goal of the camera person is to, I don't know, capture a scene or whatever, a camera might be one way of doing it, but maybe there's some sort of technology or solution that could give us another way. I don't know.

**MB.** Lidar, a space measurement tool used in the world of architecture, is now being used creatively in experimental virtual work.

**GW.** I guess you could motion capture the actors and do what you want with them as well.

**MB.** You talked about constraints and affordances. Is that the same as craft? In other words, having a deep knowledge about the development and the application of equipment.

**GW.** Yes, it probably does in a way. I suppose as a master technician or a master in your field you'll have an intimate knowledge of the kind of domain landscape and all the constraints and affordances that it might contain and where you might want to explore different opportunities.

**MB.** You said you would be quite surprised. Give me some examples of how I might be surprised.

**GW.** Well, I suppose, going back to the cup of tea task analysis, it's quite surprising the decisions one has to make and the intricacies of the tasks that have to be performed for even that simple task. When looking at other everyday tasks, like driving a car for example, there are things we do that we don't even think about, that have become a skill, but because they're so well practised we don't recognise these skilled elements, but when you break it down, you begin to reveal that kind of craft aspect to it, you know, what are the details of everything that is happening. It's quite a lot in those details that the human factor analysis you can reveal things about hidden problems with safety issues, or human error, all the negative things, but also all the positive things, kind of human capabilities that need to be there for the task to go well.

**MB.** It's absolutely fascinating. I could talk about this for ages.

**Interview: Tim Waller. 13th May 2016.**

**Colourist.**

**TW**. I've spent 32 years grading. I started grading at the time when film transition into postproduction was turning into video based. I have graded all genres of TV and film. I've graded 70+ feature films in the last 12 years, I've done high-end BBC dramas including *Silent Witness*, *Little Dorrit*, I've done a lot of commercials in my time, with the Moving Picture Company and now currently specialising in factual entertainment.

**MB.** What's the difference between the grader and the colourist, or are they the same?

**TW.** They are more or less the same. A grader was kind of the term given to … a lab-based history if you like, colourist was given the name some … where are we now? … 15 or 20 years ago. Up to that point we were called telecine operators, the name is ever evolving. Senior colourist is the latest one. It all works the same thing, there's only really one mode of grading now, whether you use the Baselight, DaVinci the new coder. I'm still being asked what I want on my credits and I always say colourist.

**MB.** Can you tell me what the role of the colourist is?

**TW.** A colourist's role is to make pictures look, photography look, the best it can ever be. When a shoot is taking place, the production may be unlucky with weather conditions, camera issues. Our job is to bring it all together in one consistent piece and with a consistency of grade and a consistency of look through a piece of film, whether it's a commercial or a full-length feature film. It's enhancing the photography and making sure the photography looks the way the production had intended it to be using digital technology as we are now, in days gone by at the lab they would use filters, and it is really manipulating the images to make them the best possible result.

**MB.** And when you're looking at those images, what are you analysing and what are your options do you have when you're considering changes in the grade?

**TW.** In the first instance, whatever we do is totally dependent on what we're given in terms of photography, so if we're given a super piece of photography, perfect exposure, perfect focus, we can bend that round to whatever we want it to be. We are looking at contrast levels, levels of saturation, how bright the piece is. We are optimising the photography, so again, as I was saying, we are looking at the quality of photography in the first place. There is no point trying to create something we are never going to achieve, by pushing technology beyond its boundary and creating digital artefacts which are not pleasant to look at and which are actually … you'll find difficult in some instances to get that through quality control through to broadcasters, so we are really there to optimise everything that we can.

**MB.** To hire a colourist in a grading suite is an expensive process. Why don't we just let the DP sort the grade out? Why use a colourist?

**TW.** In the first instance, I would say it's the understanding of the technology that is available in order to achieve those results. They are very different job roles, although we are achieving the same results. As a DP, it is about setting up the shot, aesthetically, so that everything is in the right place, characters, practical lamps, the whole thing. Obviously they're creating exposure, lighting to make the picture look the best it can be. When it comes to in this current era, we can help and assist the DP by creating our own light sources by creating flagged areas and helping him do what couldn't be done on set on the day because of expenditure in terms of taking too much time to set things up, we can quickly do that in the grade. In days gone by, the DP would do that, they would shoot in a way that, once it went to the laboratory, they could print what he sent and that would be the result. I made that sound very simplistic, and it wasn't. However, the lab couldn't create certain window effects or flag certain areas of the pitch, they couldn't create vignettes, they couldn't create electronic grads, it had to be the photographer at their best to achieve the best result. We can now emulate all of that but I'm a big advocate for DPs still doing as much as they can on set so that all we're doing is enhancing the already nearly perfect picture. In terms of the expense of doing that, going to a grading suite is very expensive, so you really want to spend all your time being creative not being corrective, and all the time a colourist is fixing things it's wasting your money. It's much better that you can present the colourist

with a nearly perfect picture, so ideally all we're doing is adding some brightness, bit more colour and the job's finished.

I think the skill of a good colourist is somebody who can be given a brief at the beginning of a session and be left to complete the piece and make it consistent and, based on the relationship with the DP, understand what they are trying to achieve and then, when they've gone through and they've made this consistent change, to present it and hopefully have no comments made – that would be the ideal relationship between DP and colourist. And I think, from a DP's point of view, if you can have a good relationship with your colourist, you are always going to have the best possible result.

**MB.** In what way do you think the visual aesthetic of moving image has changed from celluloid to analogue video to digital film?

**TW.** I think [pauses] the images are becoming better now. I think there was a lot of fear during the time when film was not being used so much and digital acquisition was being used more, that the image was not the same and the filmic image was going to be lost, and companies are spending a lot of money trying to make sure they can create the filmic feel. As time is going by, technology improves, it is being achieved, and now that you're able to shoot raw, and the C log image that we're being presented we can create through grading very close images as far as the way it looks in comparison to film, and it will only get better. I think CCD capture of images, the technology of CCD capture was nowhere near as precise as it is now, and I think the earlier days of film acquisition, that was its biggest problem, the technology wasn't quite in place but the intent was, so we went through this era where we were not getting the sorts of images that we would hope for. That period of time didn't last terribly long in fairness, we moved from that period to where we are now, looking at 10 years maybe, and you think where we are now there's a whole different kettle of fish, especially with the onset now of 4k UHD, and that whole arena.

**MB.** So could you just remind me how the image looked different, say, from film to analogue video and then digital video?

**TW.** Ok. Because analogue videos capture was at the technology stage that it was, you ended up with a very flat-looking image, there was no real detail in low light shadow areas and it was very quick for highlights to clip and overexpose, and that's because of dynamic range wasn't available at that time. As soon as you try to grade that kind of image, to become what you wanted it to be, you are pushing the boundaries of what it was able to do, and as a result all you could really do was polish it, you couldn't create the sorts of images that we can now because the flexibility wasn't there within the image, in the first instance.

**MB.** And do you think we are now at a stage where digital cinematography is as good as celluloid? In terms of the aesthetic?

**TW.** I think there's room for improvement. I think everyone will accept that. It is much closer, and with the images that are being captured, with a much higher dynamic range of low light versus high light, we can manipulate it to a point where we can recreate what potentially a film image would have been captured in days gone by. The raw images are ones people like to use a lot because they have complete control over that. There are reasons why, especially with 4k acquisition, you wouldn't want to do that from a capacity point of view and from storage, but nonetheless, as technology moves on it becomes cheaper and so we can do that more and more.

**MB.** Let me put it to you another way: to what degree is the cinematographer degrading the digital image to make it look more like film, to emulate film?

**TW.** No, I don't know if I do agree with that. I don't think they do. I think everyone, it's in everyone's interest to make the picture look the best they can. Some people say, 'Shall I shoot half or stop under, will that help?' Well, actually, it doesn't make a lot of difference. Half a stop in digital terms makes no difference at all, and in actual fact it's probably better not to do that because we can recreate that in the Baselight, in the grade. So, I would always say shoot to a perfect exposure as you can and bring us the whole image. I don't mean the

whole image itself, but the acquired high light and low light, give us all the detail and we can create from that what you want.

**MB.** Why do you think higher resolution is more visually fascinating?

**TW.** Ok. Well, I think the fascination of being able to see more and more detail appeals to everybody and if, for example, you were to be shooting something on board a ship, perhaps on a war ship where there is a massive amount of detail to be seen, I would imagine it's nice to see everything that is available, rather than … It is an interesting thing, because when you look a picture that is shot high definition, you're seeing it for what it is, you're not seeing it split screen with something which is at a lower resolution, so how does a human eye know that's a higher resolution or not? So that does lead me to say that it's a natural thing everyone likes to capture in their heads, as much information as they can, from an image they're looking at. And perhaps it's the same as going to an art gallery and looking at a painting and thinking, *I wish I could see more of that face as it was painted in 1824, with a paintbrush made of whatever it was*. If that was photography now, I could see all the details, I could see everything that was there.

**MB**. Ok. So if I go back, the question was: why do you think higher resolution is more visually fascinating? And again, where I was going with this was, when talking about higher definition, we're now beginning to see detail where we wouldn't normally see detail, so what's that about?

**TW.** Ok, [long pause] I think it's human nature to be able to obtain as much information as possible about anything, and given a visual image which clearly has a lot of detail in it, I think people are fascinated to see that. In days gone by, where you couldn't see everything quite so clearly, there may have been a desire to see more but you can't because of the way it was captured. For example, if something was a home video captured on a VHS, for example, and you're watching it today, you may be thinking, *Oh god, look at that, it's all fuzzy and hazy. I knew there was stuff going on but then I can't see what it is.* You know, in 15/20 years from now, we'll be looking at home-captured images at 2k resolution and thinking,

*Oh great, look at that, that's fantastic*, or will we be thinking, *But I've seen better than that.* Now, you know, the Reds are already shooting 6k for example, so time moves on. You never get to see an image shot in 6k versus the same image shot in much less resolution, so you don't get the comparison, but I think it's human nature to want to see as much detail as possible within an image that you're currently looking at.

**MB.** You reflected on oil paintings and the image of a face. Do you think we've got to the stage now with the grading, with the colourist, where you are able to manipulate pixels like an artist in the 17th century?

**TW.** Yes ... I would never be so bold as to say we can do exactly the same. However, the tools are available that we can manipulate contrast levels that already exist through the photography, but to improve the way they are perceived on a monitor, in other words, if we have head and shoulders to camera like I am now, and however the light is hitting my face, if we decide that because of the way that person – me in this instance – is telling a story, it may be better for me to have one side of my face slightly less lit, then we can really quickly create that, and seamlessly so it can't be seen. In the same way that if we grade interviews for a factual piece of entertainment on the TV, usually it will be just like this head and shoulders against a background, and the way that it's lit, it may be that the face looks too two dimensional in relation to everything that's around it, and by creating a shape around the face, and maybe a luminance key, we can create a false sense of contrast which creates the difference between the headshot and the background in order to bring it forwards, using that technique in conjunction with the vignette. Then we can absolutely make sure the viewer is looking at the right side of the screen.

I think, as a colourist, as you gain more experience, you and observing other colourists, looking at pictures around you and with the tools now available, it's very quick and simple if you have that level of knowledge to create images the way you want them to be. So rather than taking a bit of cinematography and increasing the contrast and sticking a load of saturation into it, by itemising parts of the picture and bringing them up in brightness terms or saturation terms, or picking on a colour, whether it's a tree-lined background or the sea or the sky, just doing something separately, you can build up a three-dimensional image,

albeit it's a two-dimensional picture, but you create that depth which potentially wouldn't of been there before. I think with C log acquisition it's easier to do that only because you've got a blank canvas to start with. It works incredibly well just increasing the contrast and the saturation. But at the same time it is down to the experience of the colourist to know that, by creating a shape in one corner and perhaps making it a little more high contrast, that the rest of it … you're creating a depth which otherwise may not have been perceived. Some people may say it's creating a false sense of what was really there, but if it is ultimately making a nice picture, then ultimately that's what we're here to do.

**MB.** The cinematographer today must now understand the entire digital workflow. What opportunities and challenges does this offer the cinematographer? Particularly in post-production colour grading.

**TW.** For DPs, I think it's important that they understand as much as they can about the post-production chain of events because ultimately for them it will be a better result. Traditional DPs who shot film for years and years and then had to make the change in working in a DI environment, where their film was being converted into digits and then post-production was just dealing with the digital version of their filmic scan, was a very difficult one because a lot of them didn't have the technology background to understand exactly what was happening and there was an element of fear there. The other end of the scale now is we have a lot of students coming out of their courses who have no experience at all but have money and go and buy a lot of equipment and call themselves 'DPs'. So, they have no real experience with cinematography, but they have a lot of experience with technology and what they can achieve there. Post-production is a very difficult and complex area, and depending on what you're shooting there will be a different chain of events that takes place, but to be simplistic about it all, the technology there is to help and the best thing to do is not to try and cover up your lack of knowledge by being gung-ho with what you're trying to achieve, but to ask the question of the post-production house to which you are going to be putting your work through, because they will always help, because it's in their interest to make sure you understand what's going to happen. They want to achieve a nice result so that you come back and give them more custom. It's almost impossible for someone in

production as a DP to fully understand what goes on in a post-production house. It changes monthly. In terms of the amount of file formats, size of files, way that it's imported into editing systems, the way it's imported into grading workflows, it's impossible, so always ask the post house if you have any worries about it.

**MB.** So, I mean, if I understand you correctly, now, as students, they've got more knowledge about the digital environment, but less experience of cinematography.

**TW.** It's all about the experience.

**MB.** So, are they better placed now? Or is it just a different set of problems?

**TW.** It's a different scenario. It's not a problem that is going to go away now, technology is so much cheaper than it was before. It's easier to pick up a camera for less than 20 grand, and I know by the time you've loaded it with lenses and so on, that you're looking at a lot more money, but that was inconceivable 20 years ago, it just wouldn't happen. So, it isn't a problem that's going to go away. It isn't necessarily a problem, but understanding the technology is a huge part of what is needed to be understood now, and if they come away now from university understanding that, then they've got a great steppingstone already. It would be nice if, like, an apprentice-style system could be in place, where they could shadow a DP, to understand how it was done. Because, you know, when we get colourists coming forward today, saying that's what they would like to do, I do urge them to find a shooting-based film course so they understand how it used to be, because grading film was a whole different experience, the latitude of grading from film was different to now, and it doesn't matter if you're grading or colouring with a set of crayons, or half a million pounds' worth of equipment, the aesthetics and the way it works is exactly the same. But that doesn't mean to say you have to be an artist to be able to do that, it's just a want to see nice pictures, but understanding the technology will help you do that. I think if a cinematographer working in today's era, the challenges are the same, but the ability and availability and solutions in post-production are far greater to help you out with that

problem. Whether it be a lighting problem or the camera. Any number of things, there is usually technology available to help you out depending on how big your wallet is.

**MB.** In an ideal world then, a student shadows a cinematographer. What would they learn from looking at celluloid?

**TW.** It's not so much looking at celluloid, it's looking at the way, perhaps, a set would be lit, or the way that flags are used, whether it's a positive lighting scenario or negative lighting scenario. There was an interesting story I heard through the DP on *Downton Abbey*. Graham, who I've done a few jobs with, he shoots and lights in a very positive environment. He then had to share the shoot with another DP who lit in a very negative way, and as a result the two lighting structures didn't meet in the middle, and they had to decide which one they were going to use. It's all about the way lights are used, flags are used, not so much about the photography itself. It's all about the skill of lighting on set.

**MB.** When you say positive and negative, do you mean lighting approach?

**TW.** Yes, exactly, the use of natural light with flags or the use of electronic lights as a positive structure.

**MB.** That's interesting. It leads me onto the next question, really. As image capture technology advances, the visual aesthetic evolves for better or worse. The cinematographer's craft and responsibility has changed with these changes. How do you think this new way of working has influenced the production process, particularly the way films are planned, shot and lit?

**TW.** Interestingly, if it has changed, it's often not in what they can and can't do, it's because of time constrictions, because of the cost of doing it. So, whereas before, if a cinematographer wanted to add an extra light somewhere, or had wanted to put up a flag somewhere else, just to tweak what he was seeing through his lens, he would have done it. But now, time and money is so precious there's a tendency to say, 'carry on, I'll put a flag in

the grade, we can do it later'. So from that point of view techniques are changing a little. And you know, there's a whole tendency of conversation which says 'why don't we just leave it wide open, shoot all day long and reposition if we need to?' Well, that comes back to my point earlier where I was saying I would hate for the loss of the artist in cinematography to happen. Because it is a skill, and it is an art form. Without sounding biased about it, it would be terrible if it all came down to just what could happen in post-production. It needs to be created in the camera, the initial image, so the more that it can be done in camera, the better in my eyes.

**MB.** I completely agree with you. I mean, because the way we're going, the Lytro camera is basically a camera that loads a little lens and then it measures the way lines are reflected, and the position and depth of light in the room. So if you take it to the extreme, the idea that you basically take the image of a room and then you construct the light characteristics in post?

**TW.** It doesn't work quite the same, though, does it? I mean, you can add a light source by creating a … by putting a shape onto the image, and say the light's coming from here, but there are other factors, you know. And from a grade point of view, if I was sitting here, just as we were saying earlier, and I drew shape around my face and made it brighter, it's a two-dimensional lighting source, and the nuances of shadows and lines and chins doesn't show up in quite the same way, not necessarily in natural light source, but even artificial light source. The contours of the face would pick it up in different ways, which is why we pick it up in different ways, which is why we spend a bit of time keying interfaces in order that we can create the contrast where it should be. There's a very clever tool on the Baselight called a 'hue angle key', and what that does as a keying system, it'll work out where the lights and darks happen, and when you apply your correction, it'll work out how much of your correction it wants to apply to any one area, based on what's already there, and it works very, very well.

**MB.** So, following on from that, is it better to apply that filter in post or is it better to put that filter on in production?

**TW.** Again, it depends on the brevity of the person operating the camera, if they are committed to what they want to do and they are happy that that's going to be kept, then absolutely, do it on set. If there's an uncertainty, or if any member of the creative part of the production are uncertain about it and it's likely to cause further problems, leaving it to be applied during the grade is going to be a failsafe solution because you can choose then whether you want it on or whether you want it off. Depending on the strength of the filter that you use, of course it could be possible that it is graded without. But again, you are compromising the image there. Because any filter is going to compromise the way in which the image was captured. Even a light Tobacco filter is going to create a yellow cast no nuances or skin tone then will be lost. Now, you might be able to grade it out to a degree, it's not the same as not having the grade in the first place, but perhaps putting it on later in the grade, where you can control precisely how much of a yellow feel you want across your image.

**MB.** It's very interesting that you recognise what the cinematographer brings to the filmmaking and the point of production. And it's very difficult to quantify that, isn't it?

**TW.** It is all down to the experience of the DP, and I was very specific about what I said earlier, with the relationship of the DP and the colourist, because I went through the era in the early '80s where the relationship between DPs and colourists was terrible, because as the technology of electronic grading came through they saw the colourist as a terrible threat to what they had been doing, the artistry of what they had been able to create was potentially being destroyed. In the first instance, DPs were never invited to the grade, it was just the agency more often than not would come in, in a commercial environment. It was only after a while they realised they could make a difference that they would start to attend, the DPs that is, and as that started to happen, technology increased hand over fist in a very short period of time, until we were able to present the DP with the tools we had available, and then they were starting to enjoy going into the grade because they knew they could fine tune and tweak what they had shot into something they really wanted on the day and was perhaps the likes of something they weren't able to do, for any other reason. And as time has gone by, it has evolved to DPs having good relationships with their colourists.

Depending on the genre of work that those DPs are in, will vary depending on the type of work their doing. So, for example, people who shoot factual entertainment, these days a lot of them are self-shooting directors. You tend not to have that type of involvement because they had to go and shoot the information they had been told to capture and bring it in, and we deal with it the best we can. The other end of the extreme is for the feature film where it is such a long-winded process, and one that is so loaded with financial consequences, being so precise with how you capture those images is so important. So, the more technical involvement you have with a post house being involved the better, and more relaxed the DP will be on the day, because he's loaded with information of what he needs to try and achieve.

**MB.** And do you ever work with DPs where they are pushing you more than you think you can get away with? So, for example, you think, well, I'm going to do this, and they say let's just bring that out a bit brighter or degrade that a little bit more.

**TW.** It's definitely in the interest of the production, whether it's the DP or it's the director, that the colourist always says if they are concerned, the way it's going is possibly going to have x consequences or these consequences because the colourist also has their name on the credits at the end of the day, and the work they present is the difference between getting the next job and not. So, by doing a certain … by performing a certain function within the grade, as a colourist, hopefully you'll understand what consequences that will have on transmission for example, or if it's a theatrical release on cinema screens that's 40 foot wide and it's worth just saying, look, if you create this vignette to be that heavy you are going to see that very clearly. It isn't as subtle as perhaps you are imagining it would be. Or if you're pushing the Chroma saturation on a particular area, much too far, you know, you need to use your experience to not tell them they're doing it wrong, but that these are the consequences, do you still want to go ahead with it. It's down to the colourist to be a part of the conversation, of stylising a piece of film. If it's definitely going in an area which is going to cause problems further down the line, whether it's a 40-foot screen as a theatrical release, or in transmission at home, then you have to impart that information, because it might be that something that the DP has overlooked, or isn't aware of. At the same time, a

DP will mostly come into a grading environment knowing what they can and can't get away with, and will usually stay within those boundaries.

**MB.** DOPs that are at the top bring some extra special quality. I don't know what it is, but they are outstanding.

**TW.** Yes, absolutely, that's why they make the big bucks. And I agree, and I don't know quite how, it is absolutely down to their personal life experiences on shooting on many different types of film format, digital format, types of different show, understanding what they can and can't get away with, and that goes back to our other part of the conversation, where we can say anyone can go out and buy 20 grand piece of kit but they won't necessarily know how to use it the way that other people can, so it's down to experience entirely.

**MB.** How did the advent of UHD and HDR impact on the role of the cinematographer and the colourist?

**TW.** It shouldn't impact too much, the way in which things are shot should remain. The advent of UHD shouldn't change the way in which images are shot, but it will benefit massively the result. The way that UHD works enables it to capture much more colour and light than ever before. If you were to do a split screen between UHD and an HD picture, it really is day and night in terms of what you are seeing. The human eye can capture … Let me put it into a percentage scenario. If the human eye captures light and colour at one hundred per cent, HD is capturing it at about twenty-five per cent.

The advent of UHD really shouldn't change the way in which an image is captured or the way in which the cinematographer captures the image, but the benefits further down the line are enormous. The ability for the extra capture of light and colour is literally the difference between day and night. To put it into perspective, the … Let's just say, in percentage terms, the human eye will acquire light and colour at one hundred per cent, so the human eye's capture is what we're trying to achieve, all the time. So let's say we're capturing it at one hundred per cent, that's our benchmark. HD will capture the same colour and light in the video environment at about twenty-five per cent, UHD is probably seventy-

five per cent, or eighty per cent. Now, the difficulty that we have is therefore not the creativity of what UHD brings, it's how do we store it and financially make sure that our budgets are equal to what we are able to perform. The reason being, at 4k resolution, storage is much more expensive because you need much more of it, and there's a tendency now that image is captured at 4k, is for longevity of the life of that production alone, because even now, images being captured at 4k or productions working at 4k are actually still only delivering an HD version, which means the benefits of the extra colour and light through the course of that production are lost, only to be left to wait for a future date. But the way in which we work on it will not change.

**MB.** That's the case, then, is it?

**TW.** It's a bit of a nightmare with this different tiers of delivery at the moment. It's tier one, two, three. At the moment, most broadcasters are saying we want tier one, so they'll capture at 4k and deliver at HD. There's no benefit. The only difference is that they're having massive amounts of storage issues coming into a post-production house, we've got storage issues, the speed in which we can move data around is slow so everything is much slower. It would be much better … It's all because, obviously the end user, viewing boxes, televisions, are only working at 2k resolution, so they've got no reason to broadcast any higher at the moment. But it seems a terrible shame, seeing that the colour gamut that UHD permits, that we are not able to use that. I mean, it's frightening really. I could show you a chart, so shall I show you a chart so you … that you know what I'm trying to talk about? The advent of UHD should not and will not change the way in which images are captured, but what it does do is to capture much more information in terms of location and light. Now, to put it into perspective, the colours that we're seeing here are the colours that the human eye will capture. At the bottom, here, if I hold my hand over this part, what you are seeing now is the HD equivalent of what we can finally show. If I move my hand away even further, that's what we can capture in UHD. And that's what we want to be able to use. Now, the deliverables are telling us that we must work in HD even though we've captured 4k. Ultimately, we're only able to use a small part of what is available, and it seems a terrible

shame. But the way in which a picture is constructed doesn't change, it's just the amount of information that's available, that's now on camera.

**MB.** Do you envisage a time when the role of the cinematographer will be downgraded to that of a digital camera technician and all the work will be done in a post-production environment?

**TW.** I believe that the creative role of filmmaking will always stay the same, regardless of how technology moves forwards. The creative element of any production is the human desire to create art and to create the images which are going to tell a story. Technology will only assist in moving along pictures in a way that you want them to be in terms of editing, colouring, visual effects. The creativity of how that image looks must come from an individual's aspiration and creative ability. I don't think the role of the cinematographer and colourist will disappear. I think the creativity behind all images will have to come from the human desire to be creative. As technology moves forwards, the ability to manipulate and create images with the technology will still only be as good as the creative mind behind it. So, no, I think we will always have DPs, colourists, visual effects artists, editors. It can't be replaced by technology alone. Post-production houses are very much governed by the budgets for which productions work to. We can only provide facilities based on budgets we are offered. There is now a progress in technology which means technology is becoming very cheap. On occasion it's now necessary for production to have their own technology in house so they are finishing their particular projects at a very much lower cost level than going to a post-production house. Grading technology is readily available to download offline for free. All post-production houses are working depending on budgets, production companies must produce any one project as budgets decrease for productions, so our ability as post-production houses changes to meet those demands. The demands for editing, grading, visual effects remain the same but with far less money, so some producers are now realising this, and technology freely or for very cheap can now complete their projects in their own buildings. Grading technology is free to download today, as is editing technology. It may not be to the same level and standard in a post-production professional environment, but they can still produce and create the work that they want. We are at a

point now in the industry where we have a bit of a divide happening – bulk producing low-end low-quality programmes and producing visually impressive images for productions. As time goes by, I strongly suspect post-production houses will change the way in which they work. There will be a lot of outsourcing, possibly people working from home because communications are so much better and the whole face of post-production will change. It's why ridiculously so many post-production houses are north of Soho, Oxford Street, because we can't afford to stay in Soho anymore, and I think, as we're cutting a feature film over in Bloomsbury, and the production's in Sweden, in Stockholm, and, you know, communication for moving data around is so good, there's no reason why not, you know. And I think, as a colourist, we're probably the one element of post-production will always have to be in a grading suite because of the environment that it's in. Also, traditionally TV and film is being in the centre of town, and people want to come into the centre of town, and they want to experience the filmmaking they still want, that I think that's a big element to it, but I think … yeah, a lot of audio, syncing of rushes, all the preliminary part of the audio process is done out of town.

**Interview. Sam Measure. 16th March 2023.**

**Virtual Production Technologist.**

**MB**. What are the significant technological components? What are the primary new techniques?

**SM.** Whereas a lot of people will call in-camera VFX virtual production, like, where it's just LED in-camera visual effects. So, it's just really defining those terms. Netflix has a good glossary of terms around virtual production.

**MB.** Manovich in 1996 accurately predicted the crossover of cinematography in animation disciplines, and what he said was shot footage is no longer the final point, but raw materials to be manipulated in a computer. The real construction, he asserts, would take place in a postproduction environment. Are we now seeing a reverse to this process, where postproduction modifications are now taking place in production and pre-production?

**SM.** Yeah, that's correct. Obviously, that's not all productions currently, but it is where we were with film, as the visual effects and so on were all prepared in pre-production, animatronics or costumes and prosthetics and so on, and they were heavily involved in production before we came to the point where we were doing effects in computers. It was previously done in *Jurassic Park* and it's more that we're switching back to how we used to do it, rather than creating a whole new way of doing things.

**MB.** Matter in 2014 noted that the cinematographer's role would be diminished to that of a data capture specialist.

**SM**. I disagree with the fact that cinematographer's role is diminished to that of a data capture specialist because they still have complete control over the final image that's been put out. Doesn't happen in every production, but a cinematographer is in the preproduction phase overseeing the content creation and so on. That's all being put on screen and during

the production stage, all the assets are already there, and they can light to it rather than lighting to a previsualization. Reacting to it on set rather than trying to plan what's going to be in the background and lighting to that. So, it's taking a lot of guesswork out, it's really.

**MB**. What extra control does it give the cinematographer in preproduction?

**SM.** Because they can previsualize the whole scene with characters and then bring in elements for virtual scouting and it's there for the director or the cinematographer or both, they can put on headsets and get into the virtual world, and block out shots prior to filming. They can plan angles, lighting around the environments that are going to be built.
They're not final renders, but the environments that are going to final renders. So, they've already got a very good idea of how it's been looking in post going forward.

**MB.** You mentioned the animation in *The Jungle Book*. Was that shot in a real forest environment?

**SM.** It was heavily reliant on virtual backgrounds. It wasn't shot with an LED background. It was mostly blue screen and green screen. But again, virtual productions kind of does involve blue screen and green screen as well, and whether that's for on-set visualization, which they can do. They can do live visualization on set taking out the backgrounds and replacing them with the virtual environments that are made so that they can see the final image, but also in the previsualization stage set, putting on headsets and scouting that location virtually. It can be a headset, or it can be an iPad or whatever. They can act as a virtual camera, and they can set the focal length and F stop and so on and we have virtual characters in frame to block around. Then we have a fairly accurate visualization of how lighting might behave before real-world lights go in. So, blocking the show for lighting from a pre-light. And for framing. And they can do that virtually beforehand and save them a lot of time by planning it properly.

**MB.** So, the director and the cinematographer put their headsets on and can enter that environment. Is that how it works?

**SM**. Yeah, exactly. So, think of it like a virtual reality kind of experiences where people put on headsets and walk around a space. It'll be very similar to that. And you'll have even virtual location scouts and who will walk around that area and find, like, the best locations within that environment to shoot in. They can encode dollies and encode wheels so that operators can operate in the virtual environments and use lens coding so that focus pullers could use the kit in a virtual space.

**MB.** Although they're putting on headsets, it's still 2 dimensional?

**SM**. No, it's 3 dimensional. When you're creating a virtual environment, it's in a 360-degree virtual space. It's creating it as if it's a complete world so that when those environments go against it or onto LED, that you … you're getting correct parallax. You wouldn't be able to do that with a 2D world.

**MB.** So, for the preparation and the planning you're seeing everything in 3D, but obviously then the final film ends up 2D.

**SM**. I mean, it's not 3D in the sense of, you know, you're wearing glasses in the cinema, with 3D objects coming out of you, but it is 3D in the sense that the cameras are tracked so that as the, as the cameras move, the backgrounds will move correctly with it and that you're getting the correct parallax from that 3D environment that's been generated for the background replacement.

**MB.** It means that the cinematographer then can do a huge amount of work in that environment prior to filming?

**SM**. Yeah, it wouldn't always necessarily be a specific person doing that job. It may be the cinematographer and director scouting and blocking in the virtual environment because they've got direct input with the virtual art department to then add things and make notes and so on to create that exactly the way they want it to be.

**SM.** You wouldn't be able to see round objects like you would in the real world. There's depth and layers to what you're creating and … 'cause it's a full 360-degree worldwide space. They can create environments up to, like, 60,000 kilometres or something crazy. So yeah, imagine that's your virtual world and you're dropping a camera within that.

**MB.** So, shots and framing and focal lengths. They've got the ability to move in one direction or another. They can alter the lens heights, they can do all these things as they're talking, can they?

**SM**. Yeah, they can.

**MB.** Well, let's take an example. It's a jungle and we say, OK, we want to go nearer to that tree, and we want to pan left a little. Who makes that happen?

**SM**. I say that would be whoever has created content, whether that's from the VFX team or it's the Brain Bar. That would fall under the virtual art department.

**MB**. So, the conversation I'm having, say, with the director, we've got these other people in the conversation as well. Are we in the same room as it were?

**SM.** Ideally it would all be in the, in the same room and you'd have an artist in the room. The artist may fall under the virtual art department.  And as the director is saying something they would be making notes to make sure everything's happening that they need to happen. It becomes more of a collaboration in preproduction to make sure that the environments are correct so that everything's set before they get to the shoot.

**MB.** And then, of course, once you've done all the previsualization work, you then, in production, you're combining the live elements with the virtual world?

**SM.** Yeah, I mean that the main advantage is there for the cinematographer so they can see and interact and get shots in in real time. As if the environments are already there.

On set you know the locations and the background, and you've got the ability to manipulate that background live, and because you'll have the virtual art department on set, you know they can make changes, whether it's VFX, there and then. So, if you needed to slightly rotate the background, then the cinematographer has that input.

**MB.** In the virtual, when you're working in the studio in the production with the virtual environment, can you then make changes to the virtual environment? Like, could you say, for example, I want to reduce the light in that area or increase the light?

**SM.** Yep. So, it's real time global illumination is what it's called in the engine. But you can make changes. You can have added lights, or you can remove lights. If you think, there's a physical light on set and you can also add in virtual lights to the background. I mean, you can even use parts of the LED to increase the lighting like you may want. OK, that that part of the LED's not in shot. So, we'll turn it white and add an extra bit of light there or whatever, but there's a lot of control in terms of what's in the virtual background. If you needed to say all that area is a bit dark and we brighten it up, you can add, like, a virtual point light or a source light. You could, say, change the angle and position of the virtual sun. So, then you're creating different atmosphere light. So, you've got a lot of control over how that lighting interacts with the background.

**MB**. And could you, like, put flags in things like that in the virtual world?

**SM**. Yes. With some software. So, say you've created a virtual rectangular light, it's got in in the settings for that light. Once you've created it, the size of the flag, the angle of the flag, and so on. So, you can bring in flags from the left and right. Or you could put a physical panel, you know, in front of, in front of that virtual light, like a, like a, like a vertical square. Or something like that to then block part of the light completely. So, there's lots of different ways that you can do it, but yeah, you've got a lot of control.

**MB**. What about postproduction? How is it changed, postproduction?

**SM.** Number one is it's already there, it's already composed. Now obviously there are potential problems, technical issues, things like scanlines which can crop up every now and again, or if they're not happy with the background completely, then it's a, you know, it's a harder job to rotoscope it than it is to just replace the background in a key.

**SM.** There are still times, a lot of times, where an LED volume might not be right for a specific shot. You know, if the backgrounds are not interacting with the character or you're not looking to get those reflections. These times it can still be beneficial to shoot on green screen and blue screen.

**MB**. There was the fear that the cinematographer might be excluded from this process, and it would all be done by VFX designers and other technicians. But what I'm hearing from you is that the cinematographer is very much included in this process from the planning stage.

**SM.** Yeah, I mean, in my opinion, and I think in many people's opinion, the cinematographer should have ultimate decision on the final look of … One of the problems, and as a head of, head of department for camera lighting, they should have ultimate control, and really it's the effects team that should be aiding the cinematographer earlier in the stage rather than … and bringing in those discussions, and ultimately that should lead to a better final product. 'Cause yeah, there's input from more teams early on. And the cinema cinematographer in that regard should then have been aided by more experts instead of making decisions in post when it's already captured, they can tackle any potential issues either in preproduction or on set, which is a better place to have done it rather than trying and fix things later.

**MB.** For a novice cinematographer, what's the most important thing for them to do? How do they get this knowledge and how do they develop these skills?

**SM.** So there are, there are simple apps. There's like a game on called Tracer, which you can get. Cinematographers can learn to block out virtual environments and light pre-lighting in in a virtual space. So, the more cinema cinematographer understands about how these

pieces of software work, like, the better. But it's also cinematographers that also advise on animated films.

**MB.** So, when you talk about a game engine, that's essentially the big computer that manage all the visuals, is that correct?

**SM.** Yeah. So, in terms of the live real-time compositing, bringing this all on to set, it's a necessity right now to do it in engines that have been optimized to do it in real time.

**MB**. And so, going forward, how do you … how do you see the role of the cinematographer developing as VP advances?

**SM.** With advances in post-production and a lot of budgets being pushed into postproduction rather than the actual shoot, it's moving us all back to how the films were made in the '70s and '80s and early '90s and bringing everything forward again, so that the cinematographer is much more involved in the planning stage and has as much of a say in production. But at least they're involved in more stages of the production than they would have been wherever it's a virtual production shoot for green screen or LED volume.
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**MB.** It concerns me is that as the cinematographer may become more disembodied with the camera equipment.

**SM**. I don't think they'll be disembodied with the equipment. You know, they will tell a gaffer to go and put a light somewhere they want. I know some cinematographers will jump in and operate on a physical camera. I don't think that this will bring everything fully virtual, it's just an animated film, right? And so, there's, there's still a massive physical component to this, there's physical cameras, there's still an eyepiece. And if it's on LED volume they can see that whole background through the eyepiece. So, they'll be operating within that environment, with the physical environment in front of the virtual environment. I don't think it really changes how they'll interact with the physical equipment and, depending on the cinematographer, on how involved they get with that equipment, they also have a

virtual department, which means they'll be in control of on set, adding physical lights here, but also virtual lights there to match that. So, and now there are. I mean, if there's no coherency between those people, the virtual art department and gaffers and lighting department, then backgrounds are not going to match the foregrounds and the cinematography is going to get looked at for not doing the job.

**MB.** So this idea of the cinematographer being quite technically agile, you know, being able to use lots of different sorts of kits and lots of different situations, but in a way, what you're telling me, this process of technical agility can still operate in this environment in a virtual environment where you are actually trying things out and you're still being able to get your hands on and, you know, manipulate the lighting, manipulate the background.

**SM**. I mean, yeah. I've met different cinematographers. There are very technical ones that will jump into this and take it by the horns and try a lot of things themselves. And there's obviously cinematographers who are very creative that need an A-Team around them and usually they have a first AD that knows the camera inside out and an operator and that can handle all of that for them. A DIT that can handle all the image chain for them and the virtual art department assisting them on a, on a virtual background. Now I'm not saying … and a super technical cinematographer will take all those roles, but at least they might have, like, a greater on the understanding. Not everyone will need to know all this stuff, because ideally you'd have the crew there that can operate it. I mean, that's what the brain bar's there for on set in terms of making sure everything's working, and usually you will have a virtual art department, the member of the virtual art department on set to generate and create assets. So that they're the people pretty much running the engine. So, you know, if you needed, OK, that wall needs to be a slightly different shade of colour, they can have their team there to change that. They can operate the engine, they can operate everything to do with the engine on set and it's kind of a mixture between a technical and artist, because they've got very technical understanding of how the engine works.

**MB.** Within the world of film and television, we've become used to the, you know, data wranglers and DITs. They are handling huge amounts of data and that then becomes their

specialist area, and the cinematographer may not need to know in-depth technical details about that data, they just know it's all been managed, that all the right data is going to the right people within the production workflow.

**SM.** The Brain Bar will sit like that, that, so they'll handle the technical aspects of camera tracking and so on and technical aspects of making sure that images get out correctly to the LED volume. But it also includes, you know, the artist as well, so that if there's any changes that need to be made to those virtual backgrounds from a creative standpoint, they can also manage that. So, the Brain Bar would be kind of like the team. They're also collaborating with people like the DIT. There's a big collaboration going on between these departments to make sure that the final image is coherent and correct.

**MB**. When you're in the production environment with a virtual surround and you change lens, then that automatically would change the focal lens in the background as well. would it? How does that work?

**SM.** Yeah. So, say basically the frosting being created on an, on an LED background is the camera's field of view. So that would need to update when you change lenses to make sure that you have the right perspective from right magnification or parallax. Generally, you'd map your lenses before the shoot. You create calibration data for what lenses you're going to use, and then, as you change your lens, you just update the lens in the software and all that data is already been established and created. Whether it's a calibration between the real-world camera and the LED screen and the nodal offsets as well as compensations for breathing and distortion, and so on. A map for each lens so that everything looks correct.

**MB.** That makes sense. The idea is you've really got to do your preparation beforehand. So, as you've done all the correct mapping and, you know, you know roughly what the shots are, the camera angles, the framing, what lenses you're going to be using, and the more of that you do in advance and map and prep, the more prepared you're going to be on the actual production day when you got the talent in.

**SM.** Yeah. And it's very similar to traditional green screen work, where you'd shoot grids in advance, and you'd still be doing that. It's just you'll be creating that mapping of the lens will be using for the, for the live capture data as well as any post capture data if you, if you needed it.

**MB.** In your live environment, if you've got a real gaffer and you just want a warming gel on the lamp to make the light a little bit warmer, can you correspondingly, then, change the virtual environment so you get … you can warm up just one area in the background?

**SM.** Yeah. So obviously if, say, you've got a spotlight in the physical world and a virtual spot, you just go to that virtual spot and change the colour temperature.

**MB.** Absolutely fascinating. It just makes me realize how much I don't know and need to get up to speed with. Do you think it's going to change the way we see and understand images?

**SM.** You know, the creation of digital humans live and being able to have digital extras and movement of those people, and it's not quite there yet, for everything in terms of, like, a real-time capture. A lot of the effects I still think would rely on renders, you know. Processing will get quicker, and it will get better and it's just that I don't really know at what point it will be completely acceptable to everyone.

**MB.** In a cinema the projected image is quite soft. You know that, that the detail is not there, but we've grown used to it.

**SM.** Even the real-time effects now, like, when I look back at some of the movies from the, from the '90s and look at the computer-generated effects from those, we've come a long way to be able to do this in, in real time. I was watching one of the *Matrix* sequels the other day and you just can tell all the background people are fake.

**MB.** It's like when HD first came out, it was too too good in a way, you know, too sharp, and then cinematographers had to find a way to soften the image to make it more like film.

**SM.** I know that well because I used to work for Red. Seen this all with the 4k debate, I was quite heavily involved in. But that was more about camera technology advancement, and this is a little bit different in that.

**MB**. At what point do the backgrounds become real enough and environments become real enough?

**SM.** I think in certain situations that we're kind of already there. It depends on what you're trying to put in the background. You know there's things that can improve, like the particle effects engines. You know you have creations of fire, of water and the movement of people and you know how atmosphere is generated. One of the big complaints of LED filming effects now is that the depth doesn't look quite right. But there's things that will be continually improved until this does hit a point where it's accepted that you can get great image, but the great image is very dependent on the quality of content that you're putting on to the background. So yeah, I think it would take some time to really shift to that and some more time spent on content, improve production, the better it's going to be. It's a big shift in the way of thinking compared to current production.

**MB**. The cinematographer would still be viewed as the creator of the moving image, the guardian of the moving image.

**SM**. And I don't think that should or would change.

## Canon EOS 5D Mark II.

**Digital SLR Camera**

The Canon EOS 5D Mark II succeeds the EOS 5D, launched in October 2005, which marked the first digital SLR camera for advanced-amateur users to incorporate a 35 mm full-frame CMOS sensor and enjoyed lasting market acclaim. The EOS 5D Mark II features a newly developed full-size 21.1-megapixel CMOS sensor that not only realizes outstanding resolution performance and rich gradation expression, but also offers an expanded standard ISO sensitivity range of ISO 100-6400[1] which, in extended mode, can be expanded to ISO 50, 12800 and 25600, enabling optimal performance in a diverse range of shooting situations.

The EOS 5D Mark II incorporates the next-generation DIGIC 4 image processor, which enables the high-speed processing of the increased amount of data generated by the high-pixel-count image sensor. The technology supports high resolution imaging performance while making possible a continuous shooting speed of up to approximately 3.9 frames per second[2] and bursts of up to approximately 310 shots.[3]

Other features facilitating optimal shooting performance include a newly designed high-performance viewfinder that realizes approximately 98% coverage, and a high-speed, high-precision AF (AutoFocus) system with 9 AF points + 6 Assist AF points.

Making possible the recording of full HD (1,920 x 1,080 pixels) video at 30 frames per second (fps), the EOS 5D Mark II is the first model in the EOS series to offer a movie function, which also includes a standard recording mode (640 x 480/30 fps). Also, further expanding the boundaries of digital SLR photographic expression, the camera incorporates a Live View function with three AF modes — Quick Mode, Live Mode, and Face Detect Live Mode — and a lens peripheral illumination correction function that compensates for light falloff around the image perimeter in response to the characteristics of the type of lens used when shooting.

The EOS 5D Mark II is equipped with a 920,000-dot, 3.0-inch Clear View LCD monitor with a multi-coating that reduces reflections and resists smudging and smearing. With enhanced color reproduction performance, the LCD monitor delivers natural image display, supporting improved image verification, even in bright sunlight.

Canon's EOS Integrated Cleaning System, a comprehensive dust-reduction system, combines measures for preventing and eliminating dust. On the EOS 5D Mark II, the technology features an improved Self Cleaning Sensor Unit that includes a fluorine coating on the surface of the low pass filter, which realizes further protection by minimizing dust adhesion.

The EOS 5D Mark II backs up high performance with strength and durability. The camera's rugged shutter unit boasts an impressive 150,000-cycle shutter life while the body features a highly rigid magnesium alloy exterior that ensures reliable performance in the face of challenging shooting conditions. Additionally, the EOS 5D Mark II's new Battery Pack LP-E6 realizes 1.3x the battery capacity of its predecessor, providing users with higher levels of mobility.

In addition to the EOS 5D Mark II, Canon today also announced the introduction of the Wireless File Transmitter WFT-E4/E4A, which enables the transfer of images to a server or computer via wireless LAN or Ethernet.

*1 Recommended exposure index

*2 Based on CIPA standards

*3 Based on Canon test standards using a UDMA memory card and shooting JPEG/Large images at ISO 100. The counter in the camera only displays up to 99 shots. Approximately 78 shots when using non-UDMA memory cards

## Canon EOS 5D Mark II. Specifications

| | |
|---|---|
| **Type** | Digital, single-lens reflex, AF/AE camera |
| **Recording media** | Type I or II CF card, UDMA-compatible |
| **Image sensor size** | Approx. 36 x 24 mm |
| **Compatible lenses** | Canon EF lenses (except EF-S lenses) |
| | (The effective lens focal length is the same as indicated on the lens) |
| **Lens mount** | Canon EF mount |
| **Image Element** | |
| **Type** | CMOS sensor |
| **Effective pixels** | Approx. 21.10 megapixels |
| **Aspect ratio** | 3:2 |
| **Dust deletion feature** | Auto, Manual, Dust Delete Data appending |
| **Recording System** | |
| **Recording format** | Design rule for Camera File System 2.0 |
| **Image type** | JPEG, RAW (14-bit Canon original) |
| **RAW+JPEG** | simultaneous recording possible |
| **Recorded pixels** | Large: Approx. 21.00 megapixels (5616 x 3744) |
| **Medium: Approx.** | 11.10 megapixels (4080 x 2720) |
| **Small: Approx.** | 5.20 megapixels (2784 x 1856) |
| **RAW: Approx.** | 21.00 megapixels (5616 x 3744) |
| **sRAW1: Approx.** | 10.00 megapixels (3861 x 2574) |
| **sRAW2: Approx.** | 5.20 megapixels (2784 x 1856) |
| **Create/select a folder** | Possible |
| **Image Processing** | |
| **Picture Styles** | Standard, Portrait, Landscape, Neutral, Faithful, Monochrome, User Def. 1 – 3 |

| | |
|---|---|
| **White balance** | Auto, Preset (Daylight, Shade, Cloudy, Tungsten light, White fluorescent light, Flash), Custom, Color temperature setting (2500-10000K) |
| | White balance correction and white balance bracketing features provided |
| | * Color temperature information transmission enabled |
| **Noise reduction** | Applicable to long exposures and high ISO speed shots |
| **Automatic image brightness correction** | Auto Lighting Optimizer |
| **Highlight tone priority** | Provided |
| **Lens peripheral illumination correction** | Provided |

**Viewfinder**

| | |
|---|---|
| **Type** | Eye-level pentaprism |
| **Coverage** | Vertical/Horizontal approx. 98% |
| **Magnification** | Approx. 0.71x (-1 m-1 with 50 mm lens at infinity) |
| **Eye point** | Approx. 21 mm (From eyepiece lens center at -1 m-1) |
| **Built-in dioptric adjustment** | -3.0 – +1.0 m-1 (dpt) |
| **Focusing screen** | Interchangeable (2 types sold separately), Eg-A standard focusing screen provided |
| **Mirror** | Quick-return type |
| **Depth-of-field preview** | Provided |

**Autofocus**

| | |
|---|---|
| **Type** | TTL secondary image-registration, phase detection |
| **AF points** | 9 plus 6 Assist AF points |
| **Metering range** | EV -0.5 – 18 (at 23°C/73°F, ISO 100) |
| **Focus modes** | One-Shot AF, AI Servo AF, AI Focus AF, Manual focusing (MF) |
| **AF-assist beam** | Emitted by the EOS-dedicated external Speedlite |
| **AF Microadjustment** | AF Microadjustment possible |

**Exposure Control**

| | |
|---|---|
| **Metering modes** | 35-zone TTL full-aperture metering |
| | • Evaluative metering (linkable to any AF point) |
| | • Partial metering (approx. 8% of viewfinder at center) |
| | • Spot metering (approx. 3.5% of viewfinder at center) |
| | • Center-weighted average metering |
| **Metering range** | EV 1 – 20 (at 23°C/73°F with EF50mm f/1.4 USM lens, ISO 100) |
| **Exposure control** | Program AE (Full Auto, Creative Auto, Program), shutter-priority AE, aperture-priority AE, manual exposure, bulb exposure |

**ISO speed**

| | |
|---|---|
| **(Recommended E. I.)** | Full Auto, Creative Auto: ISO 100 – 3200 set automatically |
| | P, Tv, Av, M, B: ISO 100 – 6400 (in 1/3-stop increments) settable, Auto, or expandable to ISO 50 (L), ISO 12800 (H1), or ISO 25600 (H2) |
| **Exposure compensation** | Manual and AEB (Settable in combination with manual exposure compensation) |
| **Settable amount:** | ±2 stops in 1/3- or 1/2-stop increments |
| **AE lock** | Auto: Applied in One-Shot AF mode with evaluative metering when focus is achieved |
| | Manual: By AE lock button |

**Shutter**

| | |
|---|---|
| **Type** | Electronically-controlled, focal-plane shutter |
| **Shutter speed** | 1/8000 sec. to 30 sec., bulb (Total shutter speed range. Available range varies by shooting mode.) |
| | X-sync at 1/200 sec. |

**Drive System**

| | |
|---|---|
| **Drive mode** | Single shooting, continuous shooting, 10-sec. self-timer/remote control, 2-sec. self-timer/remote control |

| | |
|---|---|
| **Continuous shooting speed** | Max. approx. 3.9 shots/sec. |
| **Max. burst** | JPEG Large/Fine: Approx. 78 shots (Approx. 310 shots), |
| | RAW: Approx. 13 shots (Approx. 14 shots), |
| | RAW+JPEG Large/Fine: Approx. 8 shots (Approx. 8 shots) |
| | * Figures are based on Canon's testing standards (ISO 100 and Standard Picture Style) using a 2GB card |
| | * Figures in parentheses apply to an Ultra DMA (UDMA) 2GB card based on Canon's testing standards. |
| **External Speedlite** | |
| **Compatible flash** | EX-series Speedlites |
| **Flash metering** | E-TTL II autoflash |
| **Flash exposure** | |
| **compensation** | ±2 stops in 1/3- or 1/2-stop increments |
| **FE lock Provided** | Provided |
| **PC terminal** | Provided |
| **Live View** | Shooting |
| **Shooting modes** | Still photo shooting and movie shooting |
| **Focusing** | Quick mode (Phase-difference detection) |
| **Live mode** | Live face detection mode (Contrast detection) |
| **Manual focusing** | (5x/10x magnification possible) |
| **Metering modes** | Evaluative metering with the image sensor (still photos) / Center-weighted average metering (movies) |
| **Metering range** | EV 0 – 20 (at 23°C/73°F with EF50mm f/1.4 USM lens, ISO 100) |
| **Silent shooting** | Provided (Still photo shooting) |
| **Movie** | MOV (Video: H.264, Audio: Linear PCM) |
| | Recording size: 1920×1080 (Full HD), 640×480 (SD) |
| | Continuous movie shooting time: Full HD approx. 12 min. SD approx. 24 min. |
| | * Based on Canon's testing standards using a 4GB card. |

**LCD Monitor**

| | |
|---|---|
| **Type** | TFT color liquid-crystal monitor |
| **Monitor size and dots** | 3-in. with approx. 920,000 dots (VGA) |
| **Coverage** | Approx. 100% |
| **Brightness adjustment** | Auto (Darker/Standard/Brighter), Manual (7 levels) |
| **Interface languages** | 25 |

**Image Playback**

| | |
|---|---|
| **Image display formats** | Single, Single + Info (Image-recording quality, shooting information, histogram) |
| | 4-image index, 9-image index, image rotate possible |
| **Zoom magnification** | Approx. 1.5x – 10x |
| **Image browsing methods** | Single image, jump by 10 or 100 images, jump by screen, by shooting date, by folder, by movie, by stills |
| **Highlight alert** | Overexposed highlights blink |
| **Movie playback** | Enabled (LCD monitor, video/audio OUT, HDMI OUT) |
| **Built-in speaker** | |

**Direct Printing**

| | |
|---|---|
| **Compatible printers** | PictBridge-compatible printers |
| **Printable images** | JPEG and RAW images |
| **Print ordering** | DPOF Version 1.1 compatible |

**Customization**

| | |
|---|---|
| **Custom Functions** | 25 |
| **Camera user settings** | Register under Mode Dial's C1, C2, and C3 positions |
| **My Menu registration** | Provided |

**Interface**

| | |
|---|---|
| **Digital terminal** | For personal computer communication and direct printing (Hi-Speed USB) |
| **Audio/video** | |
| **output terminal** | 3.5mm dia. stereo mini jack (NTSC/PAL selectable) |

| | |
|---|---|
| **HDMI mini OUT terminal** | Type C (Auto switching of resolution) |
| **External microphone input terminal** | 3.5mm dia. stereo mini jack |
| **Remote control terminal** | Compatible with remote control via N3 Type |
| **Wireless remote control** | With Remote Controller RC-1/RC-5 |
| **Extension system terminal** | For connection to Wireless File Transmitter WFT-E4/E4A |
| **Power Source** | |
| **Battery** | Battery Pack LP-E6 (Qty. 1) |
| | * AC power can be supplied via AC Adapter Kit ACK-E6 |
| | * With Battery Grip BG-E6 attached, size-AA/LR6 batteries can be used |
| **Battery information** | Remaining capacity, Shutter count, and Recharge performance displayed |
| **Battery life (Based on CIPA testing standards)** | With viewfinder shooting: At 23°C/73°F, approx. 850 shots. At 0°C/32°F, approx. 750 shots. With Live View shooting: At 23°C/73°F, approx. 200 shots. At 0°C/32°F, approx. 180 shots. |
| **Dimensions and Weight** | |
| **Dimensions (W x H x D)** | 152 x 113.5 x 75 mm / 6.0 x 4.5 x 3.0 in. |
| **Weight Approx.** | 810 g / 28.6 oz. (body only) |
| **Operation Environment** | |
| **Working temperature range** | 0°C – 40°C (32°F-104°F) |
| **Working humidity** | 85% or less |

Canon Global: https://global.canon/en/c-museum/product/dslr800.html

## CANON EOS C300, Detailed Features

### 8.3MP Super 35mm CMOS sensor; Full HD

An 8.3MP Super 35mm CMOS sensor, designed and manufactured by Canon specifically for video capture, provides 3ch RGB processing for Full HD recording. Canon's sensor technology delivers superb high-resolution images with high sensitivity, low noise, reduced rolling shutter artefacts and low power consumption, along with typical large sensor benefits such as beautifully shallow depth of field.

### Interchangeable lens (EF mount)

The EOS C300's EF mount brings the optical heritage of Canon's interchangeable EF lens system to a dedicated video production tool – expanding creative options through a huge range of affordable and unique lenses. 3 electronic built-in ND filters increase shooting versatility.

### Compact, modular, lightweight

The EOS C300 is ultra-compact, with a basic recording set up that weighs just 1669g (without lens). Removable grip, handle and multi-angle control panel components ensure maximum manoeuvrability, whilst the robust, splash resistant body features magnesium alloy components for additional rigidity and toughness.

### 50Mbps MPEG-2 MXF to CF card

Record broadcast-ready MPEG-2 MXF files at 50Mbps (4:2:2) to two CF memory cards – relay and simultaneous recording options are available. Industry-standard outputs include HD-SDI, along with Timecode, Genlock and Synch terminals for multi-camera shoots.

### High sensitivity, low noise

The EOS C300 features enhanced sensitivity: low noise images can be captured at up to ISO 80000, allowing use in almost any shooting conditions.

**Canon Log Gamma**

Extensive image customisation includes built-in Canon Log Gamma, which delivers neutral image quality with wide dynamic range (800%) for maximum freedom in post-production. Adjust more than 90 image variables and store as Custom Picture profiles in-camera or on SD card.

**24.00p for movie production**

PAL, NTSC, and 24.00p modes are included as standard, offering frame rates from 23.98p to 59.94i. Adjust slow and fast motion in 1fps steps for creative flexibility.

**Wi-Fi remote control**

Wirelessly control camera settings such as ISO, focus, aperture and ND filters via a notebook, tablet or Smartphone, using a simple browser-based user interface. (Optional wireless adaptor required.)

**Seamless workflow integration**

Integrating seamlessly with existing workflows, EOS C300 movies are compatible with most widely-used professional NLE software packages.

**Dual Pixel CMOS AF via service update**

Your EOS C300 can be updated to incorporate Canon's unique Dual Pixel CMOS AF, which offers incredible ease of use and creative control over focusing. It's simple to track subjects continuously at the centre of the frame, keeping them in sharp focus. An AF-Lock function allows extra control. One-Shot focusing with enhanced accuracy and speed makes it just as easy to focus on off-centre subjects.*Requires a chargeable service update at a Canon service centre.

## Specifications in detail

**Camera**

| | |
|---|---|
| **Sensor** | Super35mm type CMOS |
| **System** | RGB primary colour filter (Bayer array) |
| **Total pixels per sensor** | 9.84 megapixels |
| **Effective pixels per sensor** | 8.29 megapixels |
| **Minimum illumination** | NTSC Mode 0.3 Lux |
| | F1.2 lens , 24 dB, 29.97P mode, shutter speed 1/30] |
| | PAL Mode 0.25 Lux |
| | [F1.2 lens, 24 dB, 25.00P mode, shutter speed 1/25] |
| **Sensitivity** | NTSC: F9 |
| | [1920x1080/59.94i , ISO640 (0dB), 2000 Lux, 89.9% reflection] |
| | PAL: F10 |
| | [1920x1080/50.00i , ISO640 (0dB) , 2000 Lux, 89.9% reflection] |
| **S/N Ratio** | NTSC: 54dB (Typical) |
| | [1920x1080/29.97P, Canon Log base sensitivity ISO850 (Dynamic range 800%)] |
| | PAL: 54dB (Typical) |
| | [1920x1080/25.00P, Canon Log base sensitivity ISO850 (Dynamic range 800%)] |
| **Dynamic Range** | During normal shooting: 300% |
| | With Canon Log gamma: 800% |
| | (ISO 850 or above/gain 2.5 dB or more) |
| **Horizontal Resolution** | Up to 1000 TV lines or more (1920 x 1080i mode), depends on lens used |
| **Lens Mount** | Canon EF Mount |
| **Focal length** | Equivalent to 1.53x the focal length of EF lenses; |
| | As indicated for EF-S lenses and Canon cine lenses |

**Peripheral illumination**

| | |
|---|---|
| **Correction** | YES (dependent on lens used) |
| **ND filter** | 3 glass filters in camera body: 2 stops; 4 stops; 6 stops. Operate via body or wireless control |
| **Focus control** | Via lens, wireless control or wired remote (dependent on lens used) One shot AF with EF Lenses (Not available with CINEMA lenses) Continuous AF available with EF-S 18 -55mm f/3.5 -5.6 IS STM or EF-S 18 - 135mm f/3.5 -5.6 IS STM Lens[1] DAF update optional (extra cost) |
| **Iris control** | Via body, grip, wireless control or wired remote. Push AI available with EF lens (Not available with CINEMA lenses) Continuous AI available with EF-S 18 - 135mm f/3.5 -5.6 IS STM Lens[1] 1/2-stop, 1/3-stop or FINE control. Possible to maintain constant F-number during zoom. |
| **Image stabilization system** | Depends on lens used |
| **Type** | DIGIC DV III |
| **Recording** | |
| **Video storage media** | Type 1 Compact Flash memory cards (2 card slots) |
| **Type** | UDMA4, 30MB/s or faster (40MB/s or faster for Fast/Slow recording) |
| **Recording time** | 64GB CF card: Up to 160mins (1080/50i @ 50 Mbps) |
| **Recording file format** | Material eXchange Format (MXF); OP-1a pattern |
| **Recording format** | MPEG-2 Long GOP 50Mbps CBR (4:2:2) MPEG-2 422@PHL; 35Mbps VBR (4:2:0) MPEG-2 MP@HL; 25Mbps CBR (4:2:0) MPEG-2 MP@H14 |
| **Recording frame rate\*** | 50Mbps: 1920 x 1080/59.94i, 50i, 29.97p, 25p, 24.00p, 23.98p; 1280 x 720/59.94p, 50p, 29.97p, 25p, 24.00p, 23.98p. |

|  |  |
|---|---|
|  | 35Mbps: 1920 x 1080/59.94i, 50i, 29.97p, 25p, 23.98p; |
|  | 1440 x 1080/ 59.94i/50i |
|  | 1280 x 720/59.94p, 50p, 29.97p, 25p, 23.98p. |
|  | 25Mbps: 1440 x 1080/59.94i, 50i, 29.97p, 25p, 23.98p. |
| **Slow/Fast motion** | YES |
|  | 720p: 1-60fps in 1fps steps |
|  | 1080p: 1-30fps in 1fps steps |
|  | (available options may differ according to recording mode selected) |
| **Interval Record** | YES. 1, 2, 3, 6, 9 or 12 frames, 25 time intervals |
|  | (available options may differ according to recording mode selected) |
| **Frame Record** | YES. 1, 2, 3, 6, 9 or 12 frames |
|  | (available options may differ according to recording mode selected) |
| **Pre Record (cache record)** | YES (3 seconds) |
| **Relay Recording** | YES |
| **Double Slot (simultaneous)** |  |
| **Recording** | YES |
| **Scan Reverse** | YES. Up/down, left/right, up/down/left/right image inversion |
| **HD->SD conversion** | NO |
| **Internal Data Transfer** | MOVIE: Yes (CF card to CF card) |
| **Photo storage media** | SD/SDHC memory card |
| **Still quality** | During video recording: 1920 x 1080; |
|  | During playback: 1920x1080, 1280 x 720 |
| **System** |  |
| **Size** | 10.1 cm (4"), 100% view |
| **Dots** | 1.23 million |
| **Image quality adjustments** | Brightness, contrast, colour, sharpness, backlight, black & white |
| **Adjustable** | Up/down/left/right according to camera configuration |

| | |
|---|---|
| **Waveform Monitor** | Waveform Monitor and Vectorscope |
| **Focus Assist*** | Peaking; |
| | Magnifying (25 points selectable); |
| | Edge Monitor (using waveform display) |
| **Peaking** | Peaking 1, Peaking 2 (Colour, Gain, Frequency customisable for each) |
| **Zebra** | Level 1; Level 2; Both |
| | Output via HD-SDI or HDMI |
| **Markers** | On/Off (Aspect ratio, Aspect marker, Safety Zone Area, Safety Zone, Grid, Horizontal, Centre) |
| **Size** | 1.3cm (0.52") |
| **Dots** | 1.55 million |
| **Image quality adjustments** | Brightness, contrast, colour, sharpness, backlight, black & white |
| **Adjustable** | Vertical tilt |
| **Correction lens** | + 2.0 to -5.5 diopters |
| **Audio in** | XLR inputs with 48V phantom power (x2), 3.5mm microphone input jack |
| **Headphone output** | 3.5mm stereo jack |
| **Video monitor output** | YES (BNC, SD output only via Synch terminal) |
| **HDMI** | YES (Type A, output only) |
| **IEEE 1394 (Firewire)** | NO |
| **USB** | NO |
| **HD/SD-SDI output** | YES (BNC, output only, embedded audio and time code) |
| **Time code** | YES (BNC, switchable input/output) |
| **Genlock** | YES (BNC, input only) |
| **Synch** | YES (BNC, output only, 5 modes: HD Sync, HD-Y, SD blackburst, SD composite, Off) |
| **Component out** | NO |
| **AV terminal** | NO |
| **DC input** | YES |

| | |
|---|---|
| **Remote Control Terminal** | 2.5mm mini jack |
| **Wireless Control Terminal** | YES (optional accessory required for wireless control) |
| **Colour Bars** | EBU, SMPTE, ARIB |
| **Tally lamp** | YES |
| **Accessory shoe** | YES (cold shoe, 3 locations: top of body, top of handle, front of handle) |
| **Custom key** | YES (15 assignable buttons; select from 30 functions) |
| **Shooting functions** | |
| **Exposure Control and** | |
| **Metering\*** | Manual exposure determined by shutter setting, iris setting, ISO/gain setting and ND filter setting. |
| | Push Auto Iris/Continuous Auto Iris metering options: |
| | (i) Standard (Centre-weighted metering) |
| | (ii) Spotlight |
| | (iii) Backlight (compensation) |
| | Continuous Auto Iris (Canon lenses with 'stepping motor' (STM)).[1] |
| **Exposure compensation\*** | YES in Auto Iris mode. AE Shift function +/-2, +/-1.5, +/-1.25, +/-1.0, +/-0.75, +/-0.5, +/-0.25, +/-0 |
| **Auto Exposure mode\*** | YES. |
| | Push Auto Iris available with EF lens (not available with EF Cinema lenses) |
| | Continuous Auto Iris (Canon lenses with 'stepping motor' (STM)).[1] |
| **Push Auto Iris\*** | YES (EF and EF-S lenses. Not available with EF Cinema Lenses.) |
| **Exposure Lock** | NO |
| **Auto Gain Control setting** | NO |
| **ISO Sensitivity\*** | 1-stop display: 320[1], 400, 800, [850][2], 1600, 3200, 6400, 12800, 20000 25600, 51200, 80000 |

|  |  |
|---|---|
|  | 1/3rd stop display: 320, 400, 500, 640, 800, [850]², 1000, 1250, 1600, 2000, 2500, 3200, 4000, 5000, 6400, 8000, 10000, 12800, 16000, 20000, 25600, 32000, 40000, 51200, 64000, 80000[1] |
| **Gain setting*** | NORMAL: -6dB, -3dB, 0dB, 3dB, 6dB, 9dB, 12dB, 15dB, 18dB, 21dB, 24dB,27dB 30dB; Extended Range ON: 36dB, 33dB, 39dB, 42dB FINE: 0 dB to 24 dB (0.5 dB increments). |
| **Control Modes** | Off; Speed; Angle; Clear Scan (CS); Slow Shutter (SLS) |
| **Shutter speed** | 1/3 to 1/2000 depending on frame rate and Shutter Control Mode |
| **Shutter Angle** | 11.25º to 360º depending on frame rate |
| **Slow Shutter (SLS)** | 1/3, 1/4, 1/6, 1/8, 1/12, 1/15, 1/25, 1/30 depending on frame rate |
| **Clear Scan** | 59.94i/p: 59.94 - 250.27Hz; 50i/p: 50 to 250.78Hz; 29.97p: 29.97 - 250.27Hz; 25p: 25 to 250.78Hz; 23.98/24p: 23.98 - 250.27Hz |
| **Stored Configurations*** | 9, including 3 presets (CINEMA, Wide Dynamic Range (Wide DR) and EOS Std) |
| **Storage Medium** | D/SDHC memory card (all customisation data and metadata), up to 20 Custom Pictures per card |
| **Gamma** | 8 profiles |
| **Canon Log Gamma** | YES |
| **Master Pedestal** | -50 to +50 |
| **Master Black** | -50 to +50 for each of R,G,B |
| **Black Gamma** | Adjustable Level, Range and Point |
| **Low Key Saturation** | -50 to +50 adjusts colour saturation in low brightness area |
| **Knee** | Adjusts over exposure characteristic, start, slope, saturation |

| | |
|---|---|
| **Sharpness** | Adjustment for Level, H Detail Freq., Coring, HV Detail Balance, Limit, Select, Knee Aperture and Level dependent sharpness |
| **Noise reduction** | Off, On (1 to 12) |
| **Skin detail** | Off, Low, Middle, High / Hue, Chroma, Brightness, Area, Y Level |
| **Selective Noise Reduction** | Off, Low, Middle, High / Hue, Chroma, Brightness, Area, Y Level |
| **Colour matrix** | Phase, Gain and RGB adjustment, in tandem with Gamma selection |
| **White balance** | -50 to +50 white balance offset for R,G,B |
| **Colour correction** | Area selection / area revision of two areas |
| **Setup level** | -50 to +50 On/Off |
| | |
| **Press** | |
| **Clip 100% IRE** | Limits output to 100% after setup adjustment |
| **GPS Information** | |
| **(Optional Accessory)** | Latitude/Longtitude/Elevation, Coordinated Universal Time (UTC) |
| **Auto** | NO |
| **Preset** | Daylight (5400K), Tungsten (3200K), Kelvin (2000K-15000K, 100K intervals), Set A, Set B |
| **White Balance Shift** | YES. -9 to +9 (Daylight and Tungsten only) |
| **Black balance adjustment** | YES |
| **Countup system** available f | Regen, RecRun, FreeRun, External, Hold (Drop frame or some frame rates) |
| **Start value setting** | "00:00:00:00", Set/Reset selectable |
| **Recording** | 16-bit 2ch (48 kHz) linear PCM |
| **Control** | Independent limiters and auto/manual settings |
| **Microphone attenuation** | YES |
| **Microphone level meter** | YES |

**Accessories**

| | |
|---|---|
| **Supplied** | XF Utility and NLE Plug-ins, Monitor Unit (LCD and XLR), Handle Unit, Thumbrest, Tripod base adaptor plate, Shoulder strap, Eyecup, EVF cap, Battery Charger CG-940, Compact power adapter CA-941, Battery pack BP-955. |
| **Optional*** | Batteries BP-955, BP-975, Compact Power Adaptor CA-930 (battery charger only), / CA945 / CA946, Tripod Adapter TA-100, Wireless Controller WFT-E6. GPS Receiver GP-E1 |
| **Power Consumption** | 10.3W[1] (NTSC mode) |
| | 10.0W[1] (PAL mode) |
| **Continuous Recording Time** | Supplied BP-955: Approx. 205 minutes[1] |
| | Optional BP-975: Approx. 310 minutes[1] |

**Miscellaneous**

| | |
|---|---|
| **Dimensions** | Approx 133 x 179 x 171mm (thumbrest attached); Approx 174 x 179 x 171mm (grip attached); Approx 185 x 284 x 301mm (grip, monitor unit and handle attached) |
| **Detachable handle** | YES |
| **Weight (camera only)** | 1430g |
| **Weight (fully equipped)** | Approx 2700g (grip, monitor unit, handle, BP-955, 2x CF card) |
| **Operating Temperature Range** | -5ºC to +45ºC, 60% relative humidity |

**All specifications are subject to change without notice.**

* Firmware upgrades may be required to enable all camera features. Visit the Canon Support website for more information, or contact your local Canon representative.

1.  [1] 320, 20000, and values above 20,000 are not 1-stop increments

² [850] = Base ISO sensitivity for Canon Log Gamma (800% dynamic range), above which highlight and shadow latitude remains consistent.

2. ¹ 50Mbps CBR mode, HD-SDI off, using EVF.

3. ¹ 50Mbps CBR mode, HD-SDI off, using EVF.

4. ¹ Some STM lenses may not support Continuous AF for video shooting. Contact your local Canon representative for more information.

5. ¹ Some STM lenses may not support Continuous AF for video shooting. Contact your local Canon representative for more information.

6. ¹ One Shot AF/Push AI and continuous options available after firmware upgrade.

7. ¹ One Shot AF/Push AI and continuous options available after firmware upgrade.

Canon UK:

https://www.canon.co.uk/for_home/product_finder/digital_cinema/cinema_eos_cameras/eos_c300/specifications/

**ARRI ALEXA Classic**

**Introduction to ALEXA**

ALEXA is a 35-format film-style digital camera made by ARRI, the world leader in professional cinematographic imaging. It combines leading edge digital technology with film camera features that have been refined over the more than 90 years of ARRIs history. The result is a

camera that allows classic cinematographers to shoot digitally without the need for a excessive training when transforming from film. People who are used to shoot digitally will experience a camera like they never did before, providing more powerful features than any other camera available today.

**Handling**

The camera is a true ARRI. It has a high-precision integrated camera housing with an ergonomic design. It is rugged, reliable and flexible. Sealed to make it splash-proof. It also has countless mounting points for accessories, as ALEXA integrates well with existing ARRI accessories. In addition, a new range of accessories specifically designed for ALEXA is available.

**Operation**

ALEXA features a unique user interface, designed to make camera operation easier than ever, while giving access to more controls than any camera before. There are three different control interfaces:

· The Main user interface on the right side gives access to every camera parameter through a graphical display and a button panel.

· The Operator user interface on the left side for basic control, adjustable to the operator's individual needs by supplying assignable buttons in addition to function buttons.

· The viewfinder user interface for adjusting the most important image parameters with buttons on the viewfinder and the interface graphics overlayed to the viewfinder image.

**Power management**

The camera accepts any input voltage from 11-34 V DC. Different power sources can be connected to the camera simultaneously. The camera's power management ensures that the power source with the highest voltage level is used. Power sources are hot-swappable to minimize the risk of sudden power loss. Switching power sources without the need to reboot saves valuable time during a shoot.

**ALEV III sensor**

The ALEV III sensor has a horizontal pixel count of 3.5K resulting in true 2K resolution. It covers the full Super-35 format and it provides a latitude of 14 stops at a base sensitivity of 800 ASA. The result is a superior image quality. The sensor temperature is kept stable by a Peltier element to ensure optimum image quality under all operating conditions.

**AIT - ARRI Imaging Technology**

ARRI imaging technology ensures the most organic, film-like image quality of any digital camera with natural color rendition and pleasing skin tones.

**Thermal concept**

The camera electronics are fully sealed to protect them from dirt and moisture. Camera heat is transported via heat pipes to a radiator which is cooled by a fan. The fan itself is very silent, so the camera noise level is below 20 dB (A)* - this is the same as with ARRI sync-sound film cameras. If the fan noise level starts to increase due to fan aging, the fan can be swapped in a matter of minutes by a trained technician. *at 24 fps and ambient temperature < 25°C

**EVF-1 electronic viewfinder**

ARRI is redefining electronic viewfinders with LED lighting, high resolution and a viewing experience that comes as close to an optical viewfinder as possible.

**Internal recording**

ALEXA can internally record Quicktime movies with Apple ProRes codecs to Sony SxS cards. The cards deliver high data rates and are very robust.

ProRes can be natively edited in FinalCutPro, eliminating the need to transcode. ProRes 422 (HQ) and ProRes 4444 deliver visually lossless compressed images with a color depth of 10 bit for ProRes 422 and 12 bit for ProRes 4444.

**Technical specifications**

**Image Sensor**

- Type ALEV III CMOS sensor
- Sensor frame rates 0.750 - 60.000 fps
- Shutter angle 5.0° - 358.0°
- Total active pixels (incl. surround
- view)
- 3112 x 1782
- Pixels of recorded image 2880 x 1620
- Aperture of recorded image 23.76 x 13.365 mm
- Image aperture (incl. surround
- view)
- 25.674 x 14.701 mm
- Pixel pitch 8.25 mm
- Aspect ratio 1.78:1 (16:9)
- Filters optical low pass, UV, IR
- Color filters RGB primary colors

**Lens**

- Lens mount Exchangeable lens mount, with PL mount
- LA-PL-1 installed

**Image processing**

- White balance 2000 - 11000 Kelvin
- CC Shift -8 to +8 (translates to full magenta/ full

- green gel correction)

- EI rating 160-1600 ASA

- Recorded image resolution 1920 x 1080 pixels (downscaled from 2880

- x 1620)

**Viewfinder**

- Type ARRI EVF-1

- Technology LCOS imaging device

- Resolution 1280 x 784 pixels

**Power**

- Power supply DC 11-34V

- Power management Active ORing between BAT connector and

- onboard battery adapters

- Power consumption ca. 85W w/o accessories

- Power outputs 2 x RS (24V), 1x 12V

**Recording**

- Recording media Sony SxS-Pro cards

- Recording compression codec Apple ProRes 422/4444 codec family

- Frame rates 0.75-30 fps

**Image Outputs**

- **Recording output**
  - 2x REC OUT configurable as:
  - 2x 422 1.5G YCbCr @
  - frame rates: 23.976, 24, 25, 29.97 and 30
  - fps
  - or 1x 444 1.5G RGB @
  - frame rates: 23.976, 24, 25, 29.97 and 30
  - fps
  - or 1x 422 1.5G DL YCbCr @

- frame rates: 48, 50, 59.94 and 60 fps
- or 1x ARRIRAW T-Link @
- frame rates: 23.976, 24, 25, 29.97 and 30
- fps

- **Monitoring outputs**
    - EVF out: proprietary signal for EVF-
    - 1 with delay<1 frame
    - 1x MON OUT: 1x 422 1.5G @
    - frame rates: 23.976, 24, 25, 29.97 and 30
    - fps

**Timecode**

- Type TC clock generator with crystal oscillator
- TC input LTC in
- TC outputs LTC out
- HD-SDI LTC/VITC out

**Dimensions and weight**

- Length x Width x Height (body) 329 x 158 x 153 mm
- Camera body weight 6.26 kg / 13.79 lb
- Camera setup weight 8.0 kg / 17.62 lb
- (incl. EVF-1, VMB-1, CCH-1)

**Others**

- SD card slot for FAT/FAT32 SD cards
- Fan module with noise level <20 dB(A) @
- 24 fps and ambient temperature < 25° C
- Lemo Ethernet port for remote control and firmware update

    Source: Alexa Classic User Manual. 9 September 2010.

**Exhibition Poster**
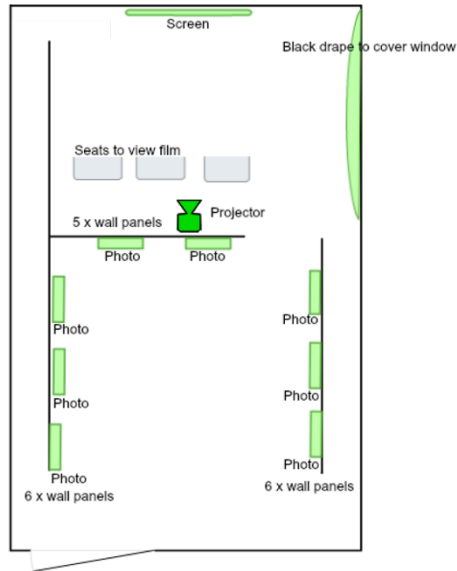
**Exhibition Floor Plan**
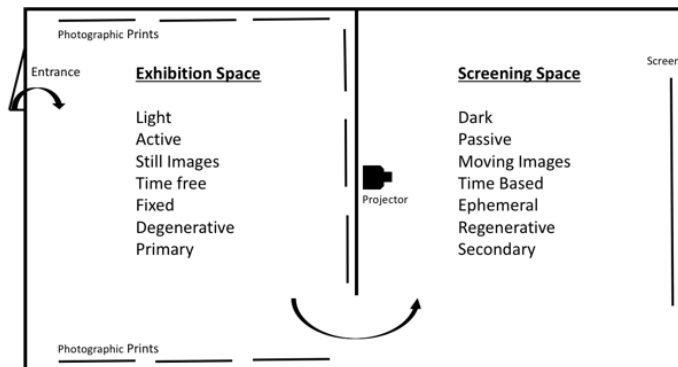


**Attributes of Exhibition Spaces**

**1. Woodworm**

**2. Splinter**

**3. Split Skin**

**4. Within**

**5. Branches**

**6. Above Still Water**

**7. Remembered**

**8. Holes**

**Images and Notes.** *Outside In* **Recce**



Testing long lens shots and depth of field in low light under the dense canopy of trees.



Testing lens bokeh, contrast and highlight information detail retention.



Examining colour, texture and form of tree bark.
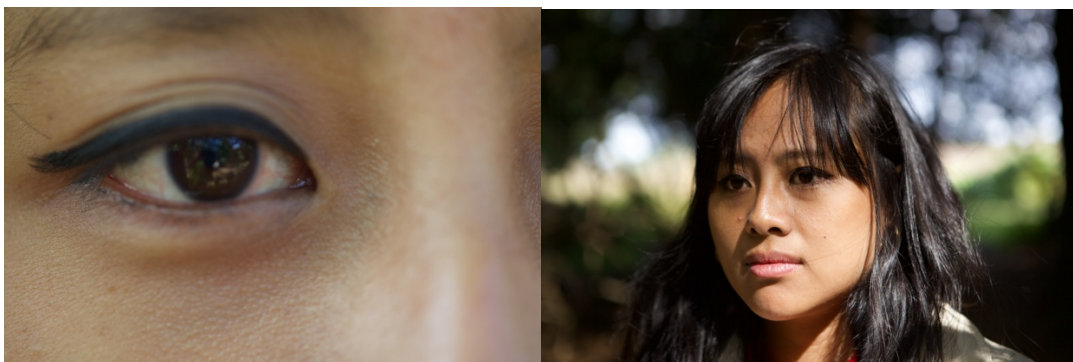
Examining colour texture and form of fungal growth, moss and lichen.
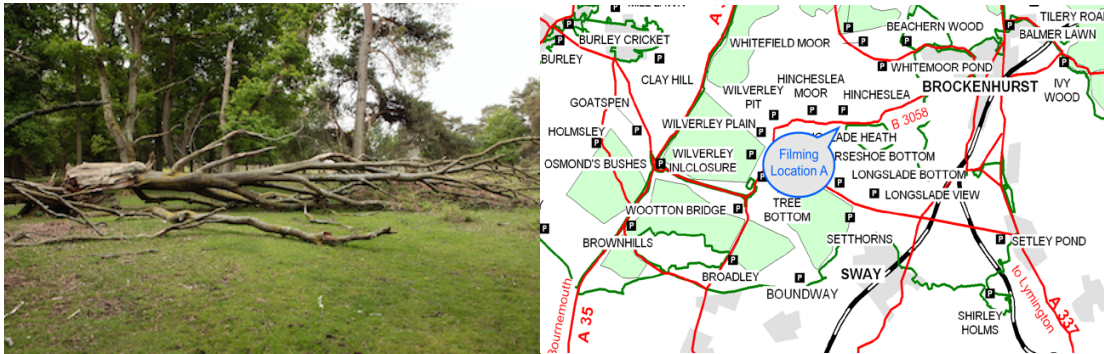


Listya Widyasa, Actor                    Ian Hunt, Camera

Testing visibility of main character and car at a range of distances.



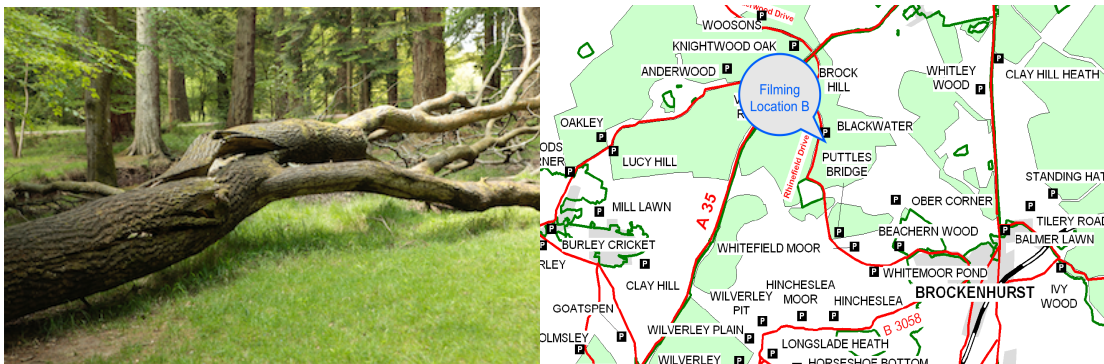Examples of extreme close-up detail of eye and shallow focus, close up, head shot.

**Images and Notes.** *The Garden* **Recce and Production Stills**



Subject Tree A. Exact filming locations, access and parking agreed with Forestry Commission England.



Subject Tree B. Exact filming locations, access and parking agreed with Forestry Commission England.



Signs of physical trauma evident on subject trees A and B.

The search for interesting images that evidence insect invasion, decay and fungal growth.



The recce selection presents a variety of image options highlighting materials in transition.



The dynamic visual aesthetic illustrates the elemental impact of entropy in the forest environment.

Wide shots contextualise the elemental forces at play in the forest ecosystem.



Mark Bond and Iakovos Panagopolous discuss and plan shots.



Alexandra Nawar cleans the lens

Brendan sets the jib



Charles Millen changes the lens



Iakovos Panagopolous, Brendan Sendan, Mark Bond and Steve Hubbard.

**Glossary**

| | |
|---|---|
| Actualisation | The process of realisation or making real. Cinematographic image realisation in a production environment. |
| Affordance | The properties or qualities that offer the opportunity to act in a particular way. |
| Agile Working | An approach to work that recognises the importance of versatility in adapting to challenging situations. This includes a flexibility of thinking and doing to enable creative solutions in cinematographic practice. |
| Aliasing | Visual artefacts most noticeable in repeating image patterns. Can be generated by the process of digital video sampling. |
| Algorithm | A sequence of instructions used to solve a problem, typically by a computer programme. |
| Artistic Research | A framework for research enquiry primarily concerned with critical artistic activities. |
| Authentic | Something that is true or genuine. |
| Backplate | A filmed background created for use in composite production environments. |
| Brain Bar | The specialist technical support teams employed on a virtual production set. Responsibilities include data management, image manipulation, camera tracking and creative visualisation. |
| Camera Tracking | A process that permits live action camera movements to seamlessly match virtual components. |
| Cathode Ray Tube (CRT) | A vacuum tube in which images are produced when electrons hit a prosenescent surface. Typical used in legacy television sets and monitors. |

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| Celluloid Film | A plastic film medium widely used to capture and project still and moving images. Generally referred to as film or film stock, available in a variety of gauges and light sensitivity. |
| Chroma Key | A process of image composition associated with visual effects and postproduction image manipulation techniques. The live production process typically employs a green screen or blue screen background replacement. |
| Cinematographic Immediacy | A self-awareness and understanding of the intuitive processes involved in creative cinematographic thinking in action. |
| Codec | A computer programme or device that encodes or decodes data or signal. A codec is employed to compress and decompress digital video. |
| Colour Science | The scientific study of colour. Colour science is a significant factor in effective digital cinematographic production workflow management. |
| Compositor | A person who creates composite images. |
| Computer Generated Image (CGI) | Images created or manipulated by computer. Typically associated with special effects and animation. |
| Constructivism | An educational theory that recognises the importance of experiential learning and reflexivity in the process of knowledge accusation. |
| Craft Knowledge | The accumulated wisdom of knowledge acquired through craft practice to a professional standard. |
| Creative Knowing | An awareness of option outcomes based on specialist knowledge and practice experience. |

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|---|---|
| Cyclorama | A large background curtain or wall used in a soundstage, studio or theatre. The Cyclorama may present a background image or background colour lit as required for production purposes. |
| Data | Common term for video content recording data in film production. |
| Deductive Reasoning | A top-down approach, moving from the general to the specific where logic dictates that if the premise is true the conclusion must be true. |
| Definition | A means of describing the degree of visible detail or image clarity. |
| Digital Cinematography | The process of image capture using digital sensors as opposed to celluloid film stock. |
| Digital Convergence | The integration of digital media devices and processes across related fields including entertainment and communications. |
| Digital Decay | A gradual corruption of digital data files through reproduction and other processes. |
| Digital Entropy | A gradual degradation in digital fidelity. |
| Digital Image Fidelity. | The degree to which the digital image is accurately reproduced. |
| Digital Imaging Technician | A specialist camera technician employed on set during production to manage complex digital workflow requirements. |
| Digital Technology | Equipment and systems used to manage, process and manipulate digital data. |
| Disruption | A disturbance or radical change to an existing state or event. |
| Digital Revolution | A term that denotes the shift from analogue electronic technologies to digital electronic technologies primarily associated with information, communication and entertainment. |

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| Embodied Knowledge | Knowledge and understanding based on sensory body experience. |
| Epistemology | The theory of knowledge. Concerned with what is knowable and the methods of enquiry. |
| Exegesis scripture. | Critical explanation or interpretation of a text, especially of |
| Expert | A person with specialist skills and knowledge in a specific area. |
| Explicit | Stated clearly and in detail, leaving no room doubt or ambiguity. |
| Film Format | A technical definition regarding the set of characteristics for still and moving image files. The principal feature of a film format is its size and shape. |
| Haptic | Based on the sense of touch. A physical engagement with tools and materials. |
| Hermeneutics | A method of research enquiry that permits a range of interpretations and meanings. Hermeneutics enables a problem to be viewed from different perspectives to advance understanding. |
| High Definition | A system of image capture and screening with high-quality detailed images. Typically, high-definition has a vertical display resolution of 1,080 or 720 lines. |
| High Dynamic Range (HDR) | Introduces an extended exposure range from dark shadow detail to bright highlight detail. |
| Image Capture | The process of image acquisition obtained by using a camera with a digital sensor, digital processing and storage. |
| Image Coherence | The degree to which visual elements correspond and interrelate throughout production to justify the cinematographic design. |

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|---|---|
| Image Knowing | Recognition that the cinematographer has a deep understanding of image cognition and image mediation, which are utilised to create meaning. |
| Information Technology (IT) | Specialist knowledge associated with computer and telecommunication systems. |
| Intuition | An immediate understanding without the need for conscious reasoning. |
| Latent Signature | A concealed set of distinctive identifiers. |
| Light Emitting Diode (LED) | A semiconductor that emits light when a voltage is applied. Commonly used in low voltage lighting for film production. |
| LED Volume | Refers to a soundstage incorporating an LED wall and the filming area. The LED wall emits a volume of light to enable mixed realities filming events within the scope of the LED volume. |
| Look Up Table (LUT) | Refers to a specific colour profile generated in camera which may be maintained through the workflow process to postproduction to ensure authentic colour rendering. |
| Loose Hierarchy | A communication hierarchy that allows for two-way communications, top-down and bottom-up. |
| Mapping Model | A diagram to show complex connections visually. |
| Mediated Image | The process considers the stages of image mediation, including pre-visualisation, image actualisation in a live production environment and postproduction manipulation techniques in a cyclical reflective process. |
| Methodology | The system of methods employed to conduct the research enquiry. |
| Method | A strategy used to peruse a research aim and collect appropriate evidence. |

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| Ontology | Relates to the nature of reality, the knowable and what one believes can be known. |
| Organic Light Emitting Diode (OLED) | A type of LED used in high quality screens design to enable rich blacks. |
| Positivist | A method of research enquiry biased towards scientistic quantifiable facts and statistical evidence. |
| Praxis | Practice-as-research emphasises the importance of theory imbricated within practice. |
| Previsualisation | The visualisation of a scene within a film prior to production. |
| Professional | A person who does a job of work that requires skills, education and special training. |
| Reflective | A cognitive research practice, a conscious self-awareness in thought and action. |
| Reflexive | A circular process of reflective analysis that enables adjustments in thoughts and action to provoke alternative outcomes. |
| Relativist | A philosophical approach that denies objectivity and considers valuation based on relative perspective. There are no absolute truths, rather truth is relative and contextual. |
| Research Paradigm | A framework or model for conducting research. |
| Resolution | Represents the degree to which one can identify and measure the smallest visible element on an image. |
| Rigorous | Adhering strictly to a system. |
| Rushes | The unedited content filmed during a production event. |

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|---|---|
| Subjectivism | The theory that all knowledge is subjective. Subjectivism does not acknowledge external truth or independent perception. |
| Tacit | Understood without being stated. |
| Technicolor | A colour motion picture process comprising three-strip celluloid film. |
| Triangulation | A qualitative research strategy employing multiple methods of enquiry to enable a comprehensive understanding. |
| Ultra High Definition (UHD) | A system of image capture and screening with ultra-high-quality detailed images including 4k, 6k, 8 k and above. UHD display resolution is 3,840 x 2,160, whereas 4k has a vertical display resolution of 4,096 x 2,160. |
| Video Noise | Undesired image aberrations associated with camera under exposure and high IOS settings. |
| Virtual Production | A production environment comprising mixed realities where live events are filmed and incorporated with virtual events to create a convincing three dimensional rendering. |
| Visual realisation | A creative cinematographic process that proceeds from a conceptual design through to the final realised image. |
| Visualisation | The internal imagining of the cinematographic image. |
| Unreal Engine | An open-source computer software tool to create real-time three-dimensional images for games and virtual production environments. |
| Video Glitch | A sudden visual disruption in the video image. |
| Virtual Art | |

Department (VAD)    The department responsible for creating real-time assets in a virtual production environment. Responsible for image capture of physical locations, virtual scouting and environment development for cinematographic lighting.