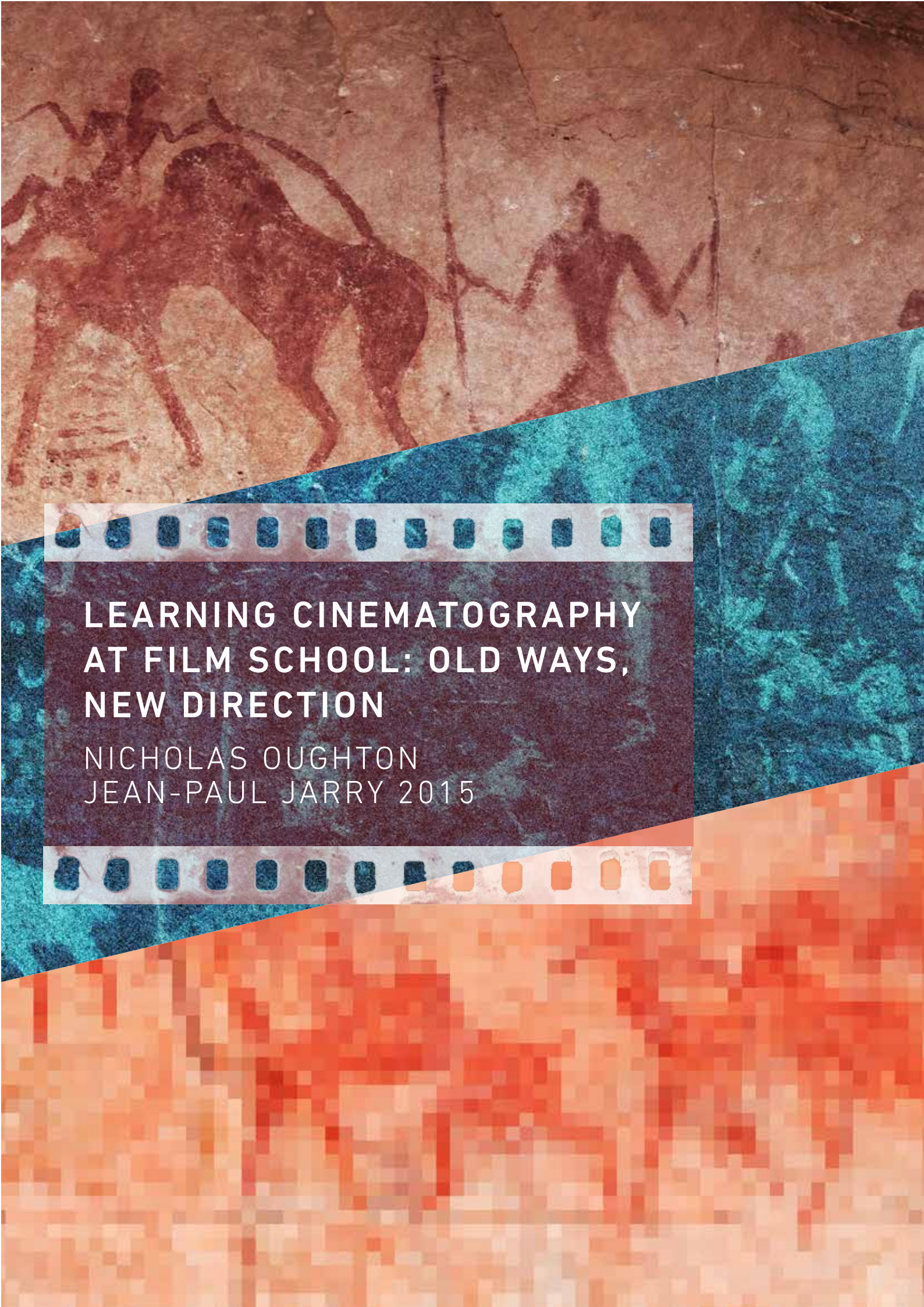

LEARNING CINEMATOGRAPHY AT FILM SCHOOL: OLD WAYS, NEW DIRECTION

NICHOLAS OUGHTON
JEAN-PAUL JARRY 2015

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– Allen Ginsberg

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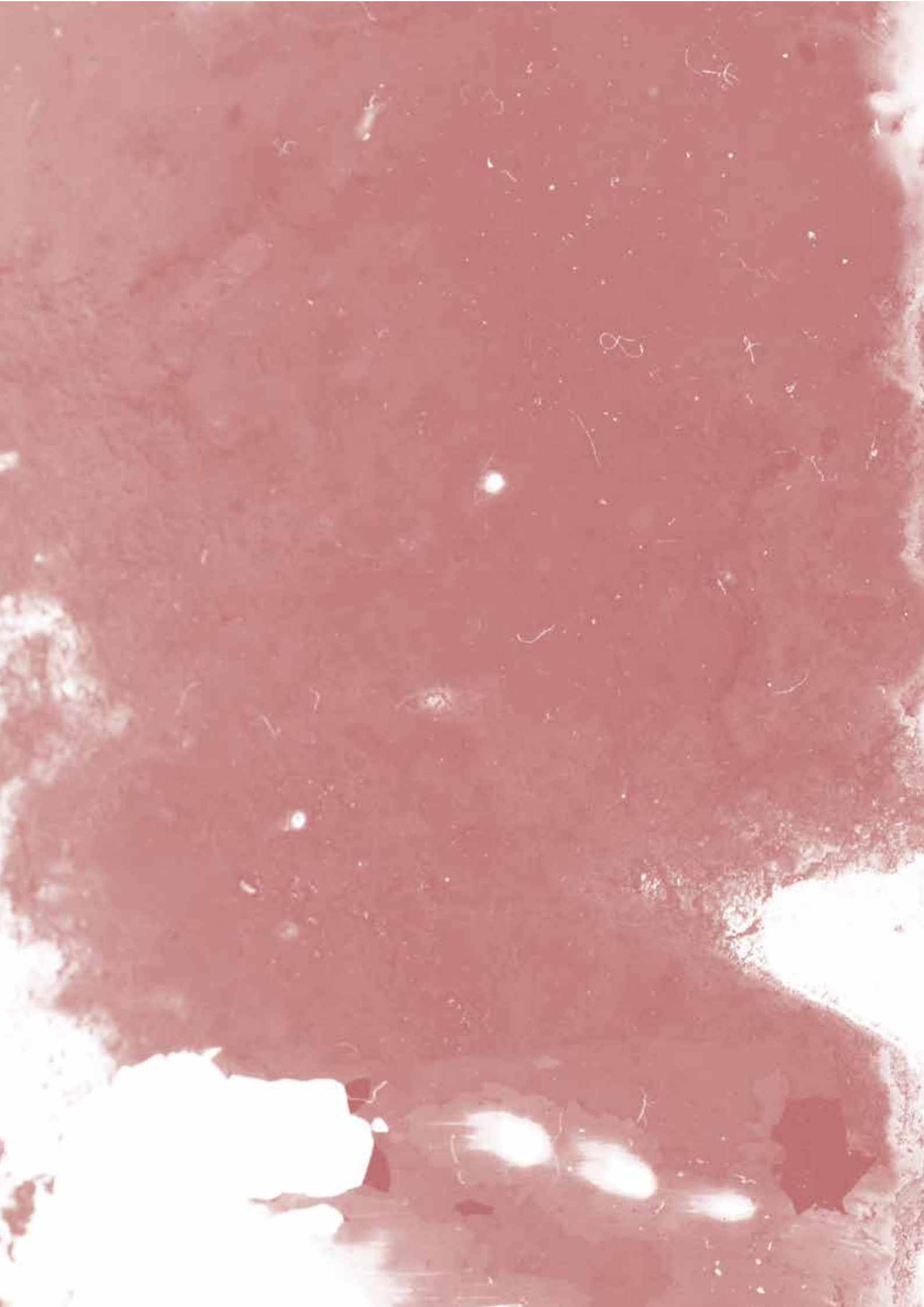

ABSTRACT

As a vehicle for story telling, Cinema offers the most convincing replication of reality of all the narrative mediums. The offspring of photography, Cinema is the heir to that medium's verisimilitude, and with the addition of movement, provides a persuasive restoration of reality that has provoked universal appeal for audiences around the world. Cinema continues a desire to represent the natural, spiritual and metaphysical world through illustration, that began some 40,000 years ago.

As with literature, music and theatre, Cinema has developed its own language, a didactic and animated procession of single frames that carries the viewer on a narrative journey. Rules and techniques have been developed that govern this language and its ability to communicate with an audience. Cinematography, the tool that creates this procession of single frames is the central discipline that brings cinema to life.

A principle act of creation occurs at the time of image capture (shooting), and is most apparent in the space between 'Roll Camera' and 'Cut' – the magic place where key creatives, technicians and actors combine to forge a cinematic narrative – one that relates to its audience with almost perfect meaning. The language and magic of this interaction has been shaped by the nature of celluloid capture and projection – it is intrinsic to the celluloid medium itself and an essential part of cinematic language.

As cinema developed both technically and aesthetically, its ability to mimic reality increased, and its language became increasingly diverse and subtle. But in the first years of the 21st Century, a new medium – Digital capture (for many reasons) – rapidly replace celluloid as the chosen means of acquisition. Along with this occurrence, and the development of computer-generated imaging, the authorship of the 'narrative image' has shifted from the cinematographer to the post-production team.

Further, at the other end of the production chain, cinematic coverage is becoming so predetermined by techniques used in 'previsualization' that little scope remains for cinematic 'creation' during image capture. The cinematographer's authorship and imagination is being circumscribed on both sides of the production chain.

The tipping point in this transition occurred in approximately 2011-12 and it is now perhaps time to ask a number of important questions. First, "is celluloid a unique and irreplaceable means of capturing the essence of a cinematic story"? Hinging on this question we can also ask: "Does film remain an important medium for teaching and learning the subtle arts of cinematography"? A third slate of question concerns the authorship of the image, the changing role of the cinematographer and most importantly: "Will cinematographers maintain their artistic role in producing images for the screen.

In the light of the foregoing, and context of a Post-digital environment, this paper will investigate the role and future of teaching cinematography through celluloid acquisition in the contemporary Film School.

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Nicholas Oughton has extensive experience in cinematography having produced a wide range of television commercials and documentaries for a variety of national clients in Australia. He has produced and directed a number of prize winning educational films and videos and worked as a production manager on theatrical films such as 'Stations'. Nicholas has been involved in Film and television education since 1978, developing a range of degree and higher degree programs. His main teaching focus is Cinematography and Television Production. He has been a member of several industry and academic bodies including the *Film and Television Sector Training Standing Committee, Arts Training Queensland*, *The Australian Screen Production Education and Research Association* (President 2007–08), and the *CILECT Asia Pacific Association* (Secretary).

Nicholas also has extensive experience in Risk Management for the Creative and Film Industries. He has published a book, a number of reports and many articles on this subject. His most recent publication is: *Slow Fade To Black: 'The Future of Celluloid Acquisition In Film Schools,* (2013). This report was based on a survey of 148 international film schools.

Nicholas is currently Program Director for the *Bachelor of Film and Screen Media Production* at Griffith Film School, Griffith University.

JEAN-PAUL JARRY

Jean-Paul Jarry is a cinematographer and cinematography teacher. After graduating from *Ecole Nationale Supérieure Louis Lumière, Paris*, Jean-Paul worked as camera assistant, cameraman and Director of photography in many facets of the Film and television industry. These include short fiction films, feature films, commercial and corporate films, entertainment and live TV shows, news and live reportage for television.

In parallel, Jean-Paul broadened his experience by writing short television screenplays, directing short television narrative projects, educational and documentary films. From the nineties he became involved with film education specifically, designing curricula for cinematography courses and mentoring students film productions in a number of film schools including *Institut International de l'Image et du Son (3iS).*

Jean-Paul has collaborated with colleagues from many European film schools. He has written for a variety of professional websites and published articles including: "Teaching cinematography in film and audio-visual schools" (Jarry, 2011), and "Cinematography in productions of the curriculum of cinema and audio-visual schools and the global duration of studies" (Jarry, 2012).

In addition, Jean-Paul has convened and participated in a number of international conferences and symposia concerning the development of curriculum, content and teaching method for cinematography. These include, "How to teach cinematography nowadays?", HFF, Munich, 2012; "Cinematography in progress", Poitiers film Festival (France), 2013, and; "Cinematography in progress", with the Belgian Cinematographers Association (SBC), Institut des Arts de Diffusion (IAD) and IMAGO, Louvain la Neuve, Brussels, 2014.

INTRODUCTION

In film schools around the world where celluloid acquisition is taught, a time-honoured ritual occurs in the first workshop of the course. Handing each student a short strip of motion picture film, the teacher asks the students to feel, smell and generally examine the piece of celluloid. As the examination proceeds, the teacher draws attention to various elements and features of the sample.

The students are then asked to place the film, emulsion side up, between their lips. As the tacky emulsion sticks to their top lip, laughter ripples through the class as the students encounter the substance and materiality of the medium.

This initiation into the world of celluloid – its tangibility, tactility and texture – introduces one of the medium's most intrinsic qualities: its physicality. Paradoxically, if the teacher conjures the appropriate setting, the ritual also draws attention to the metaphysical, illusory, and paranormal nature of the cinematic experience. It can recall film's first audiences who ran from the cinema when confronted by big close-ups of a character's head, or looked behind the screen for the actor – the seductive illusion of reality.

Cinematic illusion is generally interpreted as a 'version' of 'reality', one facilitated by a consonant relationship between human and mechanical vision:

> Technological and physiological mechanisms suggest that the magic of film comes from its power to re-create how we see the world through imagistic compositions that direct, expand, and even transform out natural vision.[1]

Some observers argue that the analogous relationship between perception of the 'real' world and the world that is created and perceived cinematically is evoked as effectively in the digital medium as with celluloid. Both systems similarly rely on the rapid projection of a sequence of still images for their effect. Others, however, claim that the two systems are subtly different in representation, and that the viewer subliminally ingests this difference. Some even argue that the difference is clearly visible to the naked eye.

Despite the fact that only a small portion of screen product is originally captured on celluloid today, some producers of work for the large and small screen consistently argue that celluloid contributes a visual aesthetic that adds distinctive value to their product. These views are held despite a digitally driven industrial revolution that has contributed much to the viewer's experience of cinema and small screen, and to the economics and flexibility of production, distribution and exhibition.

Further, some of those who teach cinematography in Film Schools believe that students acquire important skills, practices and intuitions when learning their craft within the celluloid realm. Perhaps the physical experience of film opens up a part of the brain – thinking and creative processes not so readily stimulated by the less palpable digital experience?

This article investigates the notion that digital and celluloid capture are different species, but of the same genus – there is much in common, yet there are also differences. The article aims to clarify these differences and examine their pedagogical implications with particular reference to teaching and learning the discipline of cinematography. In addition, it will propose a teaching model that supports and capitalizes on these contemplations.

THE FRAMEWORK

This task will be approached through an examination of previous considerations of the advantages of teaching cinematography within a celluloid context; the historical background to the development of the cinematic frame; the nature and structure of motion picture film; the functions of the motion picture camera; lighting; exposure and the role of the light meter; and colour grading. The article argues that celluloid training should continue in film schools while film stocks are available, and proposes an e*xperiential learning model* to help achieve this purpose. It should be noted that this does not rule out the application of the proposed experiential learning model in a digital capture environment; rather, the model is particularly suited to a celluloid context.

Conceiving a cinematic image should begin with *thinking* – with observations, considerations, judgements and plans. We propose that Film is the ideal medium for inculcating this *thinking* process in a film school environment. Further, although a student may never employ celluloid in an industrial setting, their ability to construct eloquent visual narratives in their 'mind', will enhance their creativity in the digital capture environment. This way of going about things also acknowledges the antecedents and heritage of digital cinematography and the cinematic medium more generally.

Allen Ginsburg wrote that, 'Ideas are like photographs, they take time to develop.'[2] Just as a picture emerges in the photographic dark room, so cinematic constructs develop in the mind's eye of the student – a skill acquired during a specific and organized learning experience in a celluloid environment.

PREVIOUS CONSIDERATION OF THE ADVANTAGES OF TEACHING CINEMATOGRAPHY IN A CELLULOID CONTEXT

In an article entitled 'Teaching Cinematography', teacher and cinematographer Jean-Paul Jarry reviews the undergraduate programs of thirteen European Film Schools. The objective of this mission was to learn how cinematography was taught in these schools and the pedagogical foundations that informed their courses. Jarry observes that:

> Many students show a very different attitude towards shooting a movie in film after already having shot in video. Video is fully integrated into their daily lives and belongs to their familiar surroundings: Television, Computers, Mobile Phones etc. Paradoxically, while film is and older medium, it is a whole new world for them. For example, having to interpret how the picture [will] turn out on the screen, (without video monitoring) creates a strong awareness [of their craft].[3]

He adds that after using digital cameras with zoom lenses prior to entering a film school, students are often introduced to the use of prime lenses for the first time. This prompts them to ask questions about lens selection, the creative implications of this selection and how their choices are rendered on the screen.

Interestingly, Serge Hannecart (INSAS, Brussels), noting a propensity to use monitors during digital acquisition and a reliance on 'what you see is what you get', note

> Indeed, the attraction of beginners to see their live images is very strong, but I notice that even in their first attempts … they easily get used to working without [the monitor] and are much more receptive to the questions they should be asking themselves about focus, exposure and colour balance.[4]

Harriet Cox (LFS) says, 'About a quarter of our students come [to the School] wanting to become cinematographers [and] … they want to learn it within the discipline of film.' Cox adds that a monitor was given to the students with the new Arri Alexia camera the school had purchased. However, 'They gave it [the monitor] back to me. They said they didn't want it because they don't want film making by committee.'[5]

At an international colloquium entitled 'How to Teach Cinematography, Nowadays', held in Munich in 2012,[6] participants – all teachers and practitioners of cinematography – advanced three central propositions:

- Cinematography students must learn each and every step of the post-production process, not just camera work.
- Many aspects of cinematography – for example, frame composition and camera movement rules – translate from their analogue predecessors to the digital domain. However, teaching will still have to be strengthened on lens choice, focus work and depth of field.
- Film acquisition remains an important option and must be kept for specific workshops.

In support of the third proposition, the Munich group asserted that 'film training must be carried on as long as possible', but added that 'different situations have to be considered according to region'. Uppermost in the group's mind was the future of motion picture film manufacture and processing. Some regions may lose laboratory services; however, unexposed film could be transported to countries where laboratory services still exist. The notion that, at some point in the future, both film manufacture and negative processing may cease altogether should also be considered.

Distant processing of film negatives rules out the idea of viewing 'dailies' while – ironically for this argument – digital capture provides opportunities to view the previous day's capture with relative ease. Some cinematography teachers consider that the environment created by viewing daily rushes provides opportunities for reflective thinking about the visual aspects of cinema and the story being told.

The Munich group further commented that:

> For most students today ... film is a 'new world'. It gives a conceptual obligation and constitutes a great discipline for their reflections about the frame's creation [before it is recorded]. They learn how to shoot an image correctly in manual mode without any monitoring support and most of all, the specifications of working in a unit from director of photography to assistant camera. It is a process that demands discipline in handling and using.

A fourth proposal suggested that, in order to preserve the essential knowledge of cinematography – whatever important consequences new digital technology introduces – a closer connection should be established in the curriculum between cinematography, direction, editing and production teaching.

A SURVEY OF WORLD FILM SCHOOLS

Oughton's 2013 study, 'The Future of Celluloid Acquisition in Film Schools', surveyed members of the Centre International de Liaison des Ecoles de Cinema et de Television (CILECT), the peak body representing the world's film schools. During this study, a self-completing questionnaire was sent to 146 full members of CILECT. Sixty-one members (42 per cent), replied to the survey.[7]

The study set out to find answers to the following questions:

- How many schools around the world currently teach celluloid acquisition?
- Why do these schools continue to teach celluloid acquisition?
- How long into the future do these schools anticipate teaching celluloid acquisition?
- What future occurrences may prevent schools from teaching celluloid acquisition?
- What explanations are given for no longer teaching celluloid acquisition?

The survey requested 'tick the box' and one-word responses to a number of demographic and historical questions, followed by consideration of two central questions for brief, 'short-answer' responses. The replies to these short-answer questions were subjected to content analysis that revealed common themes and classification, with weighting according to popularity and importance.

The survey revealed that 80 per cent of respondents currently taught celluloid acquisition, and a large majority planed to continue teaching celluloid beyond 2016. The reasons cited for pursuing this goal were as follows:

- It encourages discipline – thinking before shooting, planning, organization and precision.
- It teaches craft together with important technical processes such as exposure, latitude,

lenses, lighting, etc., and these skills are transferable.

- It encourages pre-visualization, imagination and creativity.
- It stimulates an understanding of 'the look' and visual palette of cinematography.
- Many students want to learn film acquisition.
- It encourages industry standards and professionalism.
- It builds an understanding of the 'chain of history', visual narratives and film language.
- It enhances communication skills between key members of the unit.

These precepts echo the principles enunciated at the Munich Colloquium

Nevertheless, according to Oughton's survey, many schools view the future of celluloid acquisition with some apprehension. The availability of motion picture cameras and their maintenance, film stock, negative processing, telecine and related services was concerning. Schools that no longer, or had never, employed celluloid acquisition in their programs (20 per cent) provided the following justifications:

- There is a lack of laboratory and telecine services. Regarding this topic, a school revealingly commented, 'While we may wish to continue to shoot on film, for whatever pedagogic reasons, the reality may be that we do not have a practical choice in the matter.'
- There are problems with acquiring film and the cost of film stock.
- There are problems with acquiring and maintaining cine cameras.
- The quality of digital images is now equal to that of film images.
- There is industry pressure to focus on digital acquisition exclusively.

Some schools believed that digital acquisition was a cheaper option than film; however, others thought the post-production costs associated with digital acquisition might, in some cases, outweigh the initial cost of shooting film.

When Deluxe, the last Australian negative film-processing laboratory, closed for business in June 2013, it caused heated debate among the Australian film community. The national president of the Australian Cinematographers Society (ACS), Ron Johansson, commented, 'This is a disaster for the Film and Television industry here in Australia, jeopardizing future training and employment'.[8]

Contemplating the demise of film processing in Australia, cinematographer and teacher Erika Addis commented:

> The availability of high-end digital cameras has certainly unshackled directors and crews from the constraint of a low shooting ratio arising from the hard costs of shooting on film raw stock, processing and telecine … Shooting ratios have [as a consequence] expanded.

Addis continued:

> But the question is, has this 'liberation' brought about a corresponding increase in experimentation, better storytelling, depth of learning and more powerful works? My experience is a definite no. There is no discernable increase in experimentation or better-told stories arising [in projects] shot on digital systems.[9]

Interestingly, a new negative processing laboratory, NegLab, opened its doors in Sydney, Australia in October 2013, and continues to operate today.

A ROUND TABLE IN POITIERS, FRANCE

Further consideration of how to teach cinematography was engaged at a Round Table held during the Festival (now called Poitiers Film Festival)Poitiers, France.[10] Opening the proceedings, Luc Engelibert set the agenda for the meeting by posing a number of questions:

- How much room is still dedicated to shooting [cinematography] in the making of a film when post-production has taken up so much space?
- Is there still such a thing as an 'original' of the frame as the negative used to be for film?
- Now that we have shifted to digital, who has control over the picture itself, does it still happen during the shooting or is [ownership] challenged by the new technologies?[11]

Following Engelibert's introduction, Moderator Jean-Paul Jarry suggested that delegates also consider the following:

- Has shooting the film – creating the original image – become simply 'a formality'?
- Has the intimate relationship historically forged between the director and the DOP been superseded by new relationships between the director and the post-production team? If so, how do these changes impact on the other departments and the actors?
- Most importantly, has discussion regarding the aesthetics of the image been replaced by a concentration on technical matters such as workflow?

Taking up the discussion, Timo Heinänen expressed the concern that students should be taught the whole process from capture (the camera original) to post-producing (virtual cinematography); otherwise the profession [and craft] of cinematography would be diminished. Heinänen was also concerned about 'losing the meaning of lighting'.[12] He commented that many contemporary films 'are the same, without any impact of lighting at all – without any emotion coming from the lighting'. Robert Buchar added that failing to teach the narrative power of lighting would encourage students to believe that light was simply for exposure purposes, with the 'creativity' added in post-production: 'Cinematography [would] thus becomes nothing more than a mechanical acquisition of images.'[13]

Meanwhile, Stuart Harris suggests that cinematography was 'always going to be a technical exercise … and we shouldn't be worrying about that because it is really not a problem'. He added, 'I still go to the grader and look at the images and grade with somebody … we [cinematographers] are not going anywhere, we should not be frightened.' However, he pointed out that things could be lost, and that 'if we're not careful, the engineers will take over the asylum … if you let the engineers do too much, creativity will go out the window'.[14]

Harris's comments resonated with Christopher Doyle who, in response to Claudio Miranda winning an Academy Award for his cinematography on *Life of Pi*, fumed, 'If it were me, I would've said fuck off … If somebody manipulated my image that much, I wouldn't even turn up.' He continued, 'Of course, they [the Academy] have no fucking idea what cinematography is. The lunatics have taken over the asylum.'[15]

Changing tack, Tony Costa affirmed the importance of teaching students the elements of post-production, but added that encouraging a 'disciplined' approach to image capture was of great importance. Further, he pointed out that his students were well aware of this need and believed that shooting with super 16 mm film had assisted them develop the discipline required to become competent cinematographers. Philip Cowan agreed, saying, 'The danger with the emphasize on post-production is that we lose the discipline … in preproduction.'[16]

Pierre Mennel and Marc De Backer suggested that teaching students to 'use their eyes', in addition to employing a waveform monitor or other devices as image proxies, was important. Robert Buchar mused, 'I don't worry about technology, technology is just a tool … [but] how do we teach our cinematography students to learn … conceptual thinking?'[17] Stuart Harris suggested that, 'If you go back and teach [cinematic] history, people would become aware of images and framing.'[18]

Summing up the Round Table discussion, Jean-Paul Jarry suggested that, over time, two aspects of cinema have remained constant. First, the way a lens forms an image has changed little, and the rectangle of the screen or 'frame' remains very much the same (apart from some change in dimension and scale). Second, the two ends of the process – image capture and its final representation on screen – persist: 'All that has changed happens in between.'

A further point – one emphasized by a number of speakers – was that, in these 'fast and furious times' with a need for instant gratification and immediate feedback, and as a counterpoint, cinematography students should be encouraged to take the time to reflect and mentally pre-visualize the images they are planning to create. They should pause to consider the frame and its meaning.

THE CHAIN OF HISTORY AND DEVELOPMENT OF THE CINEMATIC FRAME

Well before the development of writing and alongside the growth of speech and language, human beings created pictures. Their images most often portrayed the world around them – its animals, flora and the domestic context of their communities. In many cases, these pictures were 'framed' by an idea, one made tangible by the surface available on which to render their inscriptions.

By enclosing an idea and its likeness within a 'literal' frame – a rectangle, square or occasionally a circle – image-makers have formalized ways of providing borders to contain and focus their visual narratives. The frame also provides a device (or vessel) for preserving and reproducing an image – for conveying a message or a story in an explicit, comprehensible and sometimes oblique way as circumstances demand.

As human beings, we do not view the world in a single frame. We generally accumulate many images through our eyes – moving our head from side to side as if we were shooting from several points of view with a moving camera; or we concentrate on a specific subject, as with a locked-off camera. Our brain interlaces this accumulation of moving and still images into a frameless, personal and unique impression of the world and its things. A framed view, on the other hand, is an abstraction of the world and its contents – as in a still photograph. It provides a space where lines, tones and textures can be made that offer 'public' rather than personal visions – shared understandings and common views that capture and preserve ideas, a moment in time and space.

The first frames were made some 35,000 years ago on the walls of Paleolithic caves. Today, even after many thousands of years, modern human beings can understand much of what the prehistoric artists wanted to say. For example, the animals they painted are perfectly recognizable, and we understand when they are running or still, fighting or peacefully grazing. If they are frightened, we can see the fear rendered in their eyes.

Through these frames and their content, modern humans can understand something of the Paleolithic fauna, and in some respects deduce the concerns and feelings of the artists who made them. This eloquence of communication was clearly informed by a thinking process that preceded the activity of mark-making – much as a cinematographer should, as a general rule, make deliberations before shooting.

Speaking of such Paleolithic images during a cinematic exploration of the Chauvet Cave, discovered in 1994, filmmaker Werner Herzog commented, 'The artist painted the bison with eight legs – suggesting movement; almost a form of Proto-cinema … like frames in an animated film.'[19] Here Hertzog alludes to a desire to represent movement through graphic representation – an attempt to restore reality; this is a craving that remained relatively unsatisfied for approximately 35,000 years until the birth of cinema.

In many ways, the rigorous aesthetic and technical rubrics employed in Paleolithic images – of shape, colour, proportion and nuance – allow us to understand what they represented and perhaps, their meaning. These aesthetics, technical rules and ideas are worthy of conservation, and can inform our consideration of the cinematic frame, and how it is fashioned.

THE EVOLUTION OF THE FRAME (PERSPECTIVE)

The cave walls of prehistoric humans provided the perfect ground on which to create images of their world with the added advantage that the whole community – a ready-made audience – could see these images. Over time, these representations moved from the walls themselves onto frames of timber canvas and paper – artefacts that were transportable and could be mounted as desired in dwellings and public buildings. But, all were rendered in two dimensions, whereas humans, aided by binocular vision, see the world in three dimensions.

Devised during the Renaissance, linear perspective – a geometric way of creating three-dimensional images on a two-dimensional surface – provided techniques for rendering the third dimension. In addition, Renaissance artists began to understand how an object's size and its position within a painting could be manipulated to define depth. They also understood how shading (Chiaroscuro) adds depth and shape to a two-dimensional picture. These visual techniques of composition and lighting are still employed by cinematographers today when composing and framing an image.

THE INVENTION OF OPTICS: THE LENSES

Early references to the pinhole camera date back to the fourth century BCE. This enclosed lightproof box, with a small hole in one side through which light passes to form an image on the opposite wall, is the antecedent of the modern camera. Working inside the box, an artist could trace the image formed on the wall, thus creating a heightened level of reality in their reproduction of the world.

The addition of a lens in place of the hole made the image brighter and sharper, and introduced magnification. Thus the pinhole camera became the Camera Obscura – an image-making system similar to that of the human eye. Lens-making technology has advanced considerably since the Renaissance, but the principles used in Galileo's telescope are still employed in the manufacture of cinematic lenses today.

RESTORING REALITY, FRAME-BY-FRAME

The Camera Obscura became the photographic camera. It kept the lens, but instead of the artist drawing a version of the world on opaque materials, a sensitized emulsion recorded a translucent image thrown by the lens. The image was 'drawn' by light rather than by the artist's hand. This direct 'drawing with light' onto a frame improved the sense of realism and verisimilitude to such an extent that early cinema, audiences believed they were witnessing 'actuality' rather than its reproduction.

Historians generally believe that Louis Lumière, capitalizing on the work of Fox Talbot, Daguerre, Muybridge and Marey, created the 'chemically' based moving picture experience known as cinema. These pioneers gave movement to still photographs, thus establishing the means of reconstructing reality and providing the foundation for cinematic language.

At about the same time, a pioneer of television, Paul Nipkow, experimented with a rival, 'electronic' system for restoring movement. In the Nipkow system, a lens projects an image of a scene directly onto a disc consisting of a spiral of holes or pixels. Each hole in the spiral takes a 'slice' through the image, which is picked up as a pattern of light and dark by a sensor.

In television, as in cinema, the frame is formed directly by light, thrown by a lens onto a sensitized surface. In the case of television, however, the sensitized surface or sensor, consisting of many small photosites (light-sensitive cells) generates an array of electrical micro-currents that can be played back immediately by reversing the process. Unlike film, with its requirement for chemical processing, television can reveal a scene to an audience as it is being recorded – in real time. The signal can also be stored on videotape, a hard drive or a capture card.

Television and cinema have a similar photographic heritage. In both cases, the image is contained within a rectangular frame – one that is essentially governed by the same rules of perspective, two-dimensional composition, colour balance and meaning. Both systems also employ a similar flow of still frames, captured and reproduced at a rate of 24 frames per second for cinema and 25 or 30 frames per second for television, in order to 'reconstruct' movement and recreate reality.

However, the ability of television to broadcast 'live' images of events sets the two systems apart. An additional advantage for television and video was gained when the analogue video output of the image sensor was digitized. When employing digital acquisition, filmmakers generally utilize the immediacy of video to provide real-time feedback of their work, avoiding delays generated by chemical processing. Some argue that there are advantages to this process, while other see only drawbacks.

In contemporary cinematography – whether film based or digital – we propose that the visual legacy and 'hand of the artist' must remain active and learned through the rules of two-dimensional perspective, composition, light and shade, and all other devices that assist a framed picture to convey meaning, excite emotion and tell a story.

THE CINEMATOGRAPHER AS ARTIST

Similar to the traditional artist or still photographer, a cinematographer composes a cinematic frame by choosing a place to set up the camera, with consideration for its height, distance, axis, point of view, field of view, perspective, depth of field and a raft of other compositional factors. If the camera moves, these 'spatial' aspects are modified through reframing the scene. Fashioned by the boundaries of the frame, these 'points of view' determine the viewer's physical, emotional and psychological perceptions of the 'restored' world. In some respects, this 'cinematic' view accords with human vision, where we scan a scene in general, or mentally zoom in, or limit our depth of field to a particular feature that demands our attention.

A second aspect of motion pictures relates to 'time'. With a still image, the viewer determines the time spent engage with an image. In moving pictures, the cinematographer, the director and editor manipulate the timing of the viewer's attention.

Controlling the impact of lighting is a third creative mechanism for the cinematographer. Lighting can cause or eliminate shadows, brightly illuminate a scene or shroud it in eerie darkness; it can indicate time of day, a point in history and the state of the weather. Lighting can provide an insight into the emotional and physiological condition of a character, a community or a nation. Lighting establishes the 'mood', and in many ways determines how an audience responds to a scene, its characters, their circumstances and surroundings. These elements are manipulated by the use of contrast, light and shade (chiaroscuro), direction, quality, colour balance and exposure.

When employing film, there is a sense that, at the point of exposure, the cinematographer authors the image. This may also be true in digital acquisition; however, in many cases it is the data manager, colour grader and visual effects technician who also author the digital image. With digital technology, the original frame is no longer mainly fashioned at capture; rather, the image is re-authored on a continuing basis as it moves through the post-production workflow. Cinematographer and teacher Philip Cowan suggests that:

> The danger with the emphasis on post-production is that we lose all the discipline. The cinematographer needs to be involved at an early stage [in pre-production] with discussions about … creating the image.[20]

With much at stake – both technically and creatively – at the point of capture (whether shooting celluloid or digital), a thinking cinematographer who considers the aesthetic and technical aspects of their craft prior to pressing the run-button will, in most cases, provide effective and eloquent images. As this article will demonstrate, celluloid acquisition encourages a student to reflect on the technical and aesthetic needs of a story, to develop a subtle understanding of visual language and to consider the implications and responsibilities of becoming the author of images.

THE NATURE AND STRUCTURE OF MOTION PICTURE FILM

A strip of exposed film consists of two elements: first, the sensitive material – a strip of flexible plastic – cut to a specific size and coated with an emulsion containing light-sensitive silver halide crystals; and second, the image – a message recorded in the emulsion caused by the effect of light on the silver halide crystals. A third dimension – a window into the world – formed directly by the camera can also be identified. This is the frame, which becomes apparent when the film is developed. There are, of course, many frames in a strip of celluloid, each one following the previous one in a sequence of pictures, each capturing a visual moment in time.

Motion picture celluloid or film is unique in a number of ways. Unlike traditional mediums (for instance, a painting, drawing or printing), where the image is layered onto a surface at the time of its creation, the film image is rendered within the material itself – the emulsion. In addition, film is transparent and viewed via transmitted light, while the other mediums are viewed by reflected light – much in the way we normally see the world.

Most essentially, film is a time-based medium that depicts a time and space continuum. The 'time-frozen' mediums can create the illusion of motion via technique and suggestion (like the eight-legged bison in the cave painting). However, projected film conveys a convincing and lifelike illusion of movement. Some would argue that cinema is not an illusion, but rather a facsimile of reality.

It was originally believed that this 'apparent' deception was assisted by the 'phi phenomenon', an optical illusion sometimes confused with 'persistence of vision', whereby a sequence of images played in rapid succession causes the viewer to perceive a sensation of movement. In many respects, the phi phenomenon is better understood as related to light flicker rather than a simulation of movement. For example, when we observe a fluorescent light tube employed in an industrial or domestic setting, it is flickering at a rate of 50 times per second (50 Hz), but gives an impression of continuous transmission to the viewer.

A later theory, seeking to explain why humans perceive cinema as motion, employs the term 'apparent motion'. Mathew Ruckwood explains:

> In their research, Biederman-Thorson, Thorson and Lange found that there were two types of apparent motion: short-range and long-range. Short-range apparent motion involves closely separated visual stimuli i.e. objects that alter form very little as successive images are presented (like cinema), and long-range, which involves the opposite. It was only at short-ranges that apparent motion was perceived, therefore it was concluded that short-range apparent motion must share certain characteristics with real motion.[21]

Short and long-range apparent motion are theories of visual perception based on how humans perceive movement in real life. The motion picture phenomenon – a sequence of closely spaced moments of time and action – is a mechanical device that mimics short-range apparent motion. Ruckwood suggests that perhaps humans cannot distinguish between the real and the cinematic. Thus the experience of viewing motion pictures, to our minds, 'Is an actual experience, an authentic presentation of reality – it is not a "rehashing", a form of pseudo-movement, but actual movement'.[22]

In other respects, film is similar to the traditional mediums – for instance, in its materiality. As with a painting, or an illustration in a picture book, you can see it, touch it and smell it – you can even taste it if you wish. Steven Spielberg emphasised this point and its appeal to him when he commented:

My favorite and preferred step between imagination and image is a strip of photochemistry that can be held, twisted, folded, looked at with the naked eye,

> or projected on to a surface for others to see. It has a scent and it is imperfect.

If you get too close to the moving image, it's like impressionist art.[23]

The most fundamental layer in a film is the emulsion, a light sensitive material (silver halide) evenly dispersed in a colloidal medium. The emulsion is attached to a flexible transparent base by means of a binder. In colour film, three emulsions – each one sensitive to a primary colour (blue, green and red) – are linked to colour couplers, which form coloured dyes in order to record a coloured impression of a scene. Interestingly, some manufacturers of image sensors are endeavouring to emulate this layering of colour-sensitive strata by employing the Foveon scheme, which uses vertical filtering rather than a fixed mosaic for colour sensing.

Although evenly distributed throughout the emulsion, the silver grains have a random dispersion, whereby no one section of emulsion or film is exactly like another – no doubt this contributes to the unique quality commonly dubbed the 'look' of film, a term coined since the arrival of digital technology. Eminent cinematographer John Bailey claims that this randomness makes film in particularly 'organic, alive, and vibrant'.[24] In contrast, the pixel array used in digital cameras (most often a Bayer pattern) consists of a fixed grid, or a mosaic of pixels. Each frame of digital video is recorded on the same matrix as the preceding one imparting a 'digital look'.

One problem with the Bayer array is its susceptibility to false colour artefacts when recording an image that contains finely repeating patterns (for example, a striped shirt). This is caused by interference between these patterns and the regular grid of photosites, and results in unsightly bands of colour. In most digital cameras, this shortcoming is suppressed by the addition of an optical low-pass (or 'anti-aliasing') filter placed in front of the sensor, which blurs away the finest image detail. This reduces any moiré patterns, but causes a loss of resolution. Due to its random grain structure, film avoids this hazard.

In an effort to correct this situation, Fujifilm, a leader in image sensor design and inspired by the natural random arrangement of the fine grains of silver halide in film, has created a less systematic mosaic, or pattern of photosites in a new image sensor. The result, Fujifilm claims, is an increased filmic look and improved sharpness of image caused by removing the optical low-pass filter.

It should be noted, however, that the Foveon principle and Fujifilm system work only for 'still' photography, and the ability to conceive multi-layered sensors and 'random' pixels is perhaps some years away for moving images.

Another characteristic of film inspiring the designers of digital image systems is that it does not respond to exposure by extremely dark or light areas of a scene in the same way that it responds to the middle tones. Film does not react in a linear fashion to even or equal increments of light; rather, it exhibits an 'S'-shaped response with a flattened 'toe' and 'shoulder'. As a consequence, film has an inherent ability to record detail in shadows and highlights that could not be achieved by early digital systems. Once again, image sensor and software designers have emulated the manner in which film records light by remapping the pixels of a digital record (image) to replicate a curved rather than linear response to light – an example is Sony's S-Log algorithm.

CULTURAL OBSOLESCENCE

Lev Manovich, a highly respected new media theorist, suggests that:

> A hundred years after cinema's birth, cinematic ways of seeing the world, of structuring time, of narrating a story, of linking one experience to the next, have become the basic means by which a computer fulfils the promise of cinema as a visual Esperanto – a goal that preoccupied many film artists and critics in the 1920s.[25]

While emulating film in a technical sense, and adopting its role of providing a 'universal' language, the shift from analogue to digital media is often viewed as a natural progression – a new technology building on and improving an older one.

Annexed to this view is the notion of 'cultural obsolescence', described by Kim Knowles as, 'A complex web of technological consumption and consumer commodity economics … often disguised as utopian, liberating and democratising'.[26] This notion encourages the understanding that digital is a replacement for celluloid technology – rather as the e-book has replaced the tree-book. Rodowick points out, however, that, 'This approach has actually prevented the digital from finding its own autonomous, creative voice as a medium with distinct properties and possibilities.'[27]

It is also arguable that digital rendering in its current iteration is merely another form of representation – a parallel mode rather than a technological advance. Analogous is the internal combustion engine, which we perceive as an advance on the steam engine. In reality, both systems depend on a common devise, in this case pressure generated in a cylinder to push a piston, that drives a crank shaft and turns a wheel. This is not to say, however, that the digital medium will no evolve in unimaginable and exciting ways.

In many respects, the forebears of film and cinema – the animated toys and devices first used to create 'moving pictures' – were exhibitions of the wonders of technology: 'the audience was asked merely to bare witness to the phenomenon of seeing pictures move'.[28] Perhaps those times have returned, and as some present-day cinematographers have claimed, technological tricks have become the stars of contemporary cinema.

Certainly, digital cinema and digital acquisition is far more that just a technological trick. It stands as a powerful and creative medium in its own right. In addition, digital acquisition is the chosen way to capture images in the vast majority of productions. However, the evolution of the digital from the celluloid medium, and its consistent desire to create a 'film look', suggest that screen educators should continue to employ celluloid in some capacity – if only as a background to practice and foundation for 'craft'.

THE FUNCTIONS OF A MOTION PICTURE CAMERA

THE CAMERA MOVEMENT

When in operation, a motion picture camera creates cinematic frames by decomposing movement into a series of still photos or frames. One frame follows another, rhythmically recording a moment of time and space – captured and exposed by means of a shutter. The shutter allows reflected or transmitted light from objects to pass through the lens intermittently, and to be recorded onto sensitized film. A constant and systematic frame-rate (the number of frames shot in one second) together with a stable shutter speed (the exposure time) is essential for the illusion of movement and restoration of the scene. A variant of this process is employed in analogue and digital video systems.

Louis Lumière chose 16 frames per second (fps) as the frame rate for his cinematograph system, and this was adopted as the international silent movie standard. With the development of sound film, this standard became – and still is – 24 fps. For television, 25 or 30 fps was chosen according to the technical standards adopted in different countries.

Shutter speed is important: it determines the exposure time of each frame, which in turn depends on the frame rate. For a rate of 25 fps, with an 180-degree shutter, the exposure time is 1/50th of a second. For a fast or slow motion (over- or under-cracking the camera), the exposure time will be determined by the chosen frame-rate. Interestingly, the electronic shutter system employed in digital cameras (SD and HD) mimics this process, with a '180-degree' employed as the standard reference for shutter speed.

On film, individual frames are visible and tangible, while in traditional video, the frames do not exist in a visible sense on the recording support. In analogue video, data corresponding to each frame captured by a cathode ray tube or a CCD are delivered to, and recorded as, a magnetic field on magnetic tape. For SD/HD digital video and digital cinema, the analogue data (generated by an image sensor) are first digitized, and then recorded as binary data on to a hard disk or capture card.

With film, each frame is maintained throughout the workflow. With SD/HD digital video, after the image has passed through the lens and accumulated by means of an image sensor, it becomes a stream of data, which travels throughout the workflow only to be re-created as a 'real' frame at the point of play-back on a screen.

When students only learn cinematography via digital acquisition, the subliminal nature of the frame and an emphasis on post-production obscures some important and founding principles of cinematography. On the other hand, celluloid directly reveals the palpable configuration of the system.

When loading a film camera, students see how light passes through the lens and the camera body – they note how the shutter functions, how the frame is intermittently formed behind the aperture plate: a frozen moment of time and space. They comprehend in a concrete way the principles of decomposing and recomposing a world of movement, the relationship between frame-rate, exposure, fast and slow motion and their influence on digital technology.

THE OPTICAL VIEWFINDER AND THE GROUND-GLASS SCREEN

In film, the cinematographer composes the cinematic frame on a ground-glass screen. The director of photography (DOP), camera operator, focus-puller and director can all view this screen.

Viewing a scene via a single eyepiece creates an intimacy for the viewer, providing the perfect conditions by which to analyse a frame. The viewer is placed in a similar environment to that of an audience – watching a screen in a darkened space. The camera operator, aided by a precise delineation of the frame (with no outside distractions), can concentrate on the action, composing the frame and managing camera movements while considering the graphic and rhythmic relationships of the *mise en scene* and performance.

Also working in this way, the student will learn to think through the possibilities and choices available to them, plan thoughtfully how a scene can be covered and advise the director of their options. Most importantly, a 'thinking' approach to shooting will reduce time spent in post-production and provide more eloquent visual sequences.

For the director, too, the viewfinder provides a likeness of the scene as if they were viewing it in a darkened theatre. This intimacy also provides a notion of how the frame will ultimately be rendered and perceived by an audience. The focus-puller can see perfectly the relationship between point of focus and the different focal lengths of prime lenses. They can verify depth of field by employing depth-of-field tables, as well as visually through the viewfinder.

A video camera can have a similar viewfinder, but control monitors generally are employed that are visible to all present on the set. This creates an opportunity to confuse the monitor's image with the final broadcast frame or an occasion for 'image control' by council, as various crew members comment on how a scene should look or be shot.

In addition, when employing a film camera without a representation of the supposedly 'real' image on the monitor, a student can take advantage of 'not seeing' this proxy frame, to refine their ability to pre-visualize the outcomes of their work. Through repetition and leaning, the student acquires the knowledge, intuitive sensibilities and skills to accurately determine the visual outcomes of capture in both the creative and technical domains.

In the early stages of learning the craft of cinematography, students generally use a digital camera with a flip-out or rear-mounted LCD screen. These cameras are mostly hand held or mounted in such a way that the operator views the screen at arm's length with 'both' eyes – also taking in the world external to the frame. In contrast, an optical viewfinder and ground-glass screen provide a more delineated view of the world, revealing only the frame and its contents. Monitors may also be used on the stage or on location; however, the ground-glass screen provides the final arbiter of the frame.

There is a psychological and hypothetical distance between the viewfinder frame and the one eventually seen by an audience. Understanding this metaphysical space is an important pedagogical point in this discussion. A subtle understanding of frame-by-frame deconstruction of the real world, and its re-construction through cinematic representation, is an essential element of the cinematographer's craft. An exposure to celluloid enhances this understanding.

LIGHTING, EXPOSURE AND THE ROLE OF THE LIGHT METER

A cinematic frame has little illustrative value or purpose until its contents are modulated by tonality. Light and shade define objects, making them alive with meaning and significance. A succession of such frames becomes a narrative, and even without colour the pictures convey most of the story. In addition to revealing graphic elements such as shape, form and texture, shading and contrast can create atmosphere and mood – nuances that suggest the season; the weather and time of day; the period or point in history when an event takes place; the disposition of a protagonist – their innermost thoughts, desires and fears.

While employing tone and contrast an artist works directly on an 'unbiased' medium for example canvas or paper. In cinematic recreation, the circumstances are quite different. In photography, light reflected from objects in front of the camera imposes tonality and contrast on to a 'biased' medium – one that possesses specific 'characteristics' of its own. This poses an important question for the cinematographer: how to match the tonality and contrast of the scene to the characteristics and latitude of film. This question arises in both film and digital acquisition.

A film emulsion responds to light in an eccentric manner, best illustrated by a sensitometric, or characteristic curve or graph – a curve shaped like an 'S'. As discussed above, digital systems have been created that emulate this 'characteristic' of film, and the manner in which it records tonal values and renders contrast. The aim of this digital manipulation is to mimic the 'look' of film, and its ability to capture relatively contrasty scenes, while holding detail (variations in density) in both highlights and shadows.

This is generally achieved by capturing a low-contrast, uncompressed, 'raw' image, and manipulating the data files post-capture. Although raw digital capture adapts well to recording relatively contrasting scenes, there are many creative and technical reasons why the student cinematographer should learn the subtle art of manipulating light and exposure, and understand their relationship to recording mediums through the agency of film capture.

Learning the artistic and technical elements of lighting requires deliberation, practice and, in particular, the use of a light meter. The discipline of celluloid capture, together with a philosophy of 'getting it right' while shooting, rather than relying on image manipulation at a later stage to correct mistakes can save time and money down the track. Learning only through digital capture in foundation courses can foster a lazy, ill-disciplined approach to cinematography.

While employing a light meter, a student can also use the ground-glass screen to check contrast rendering, while taking account of the characteristic curve of the emulsion. In addition, the viewfinder preserves the intimacy of the frame, giving the best conditions for thinking on a busy stage. The students can also use a third device, the grey contrast glass. This tool does not show exactly how the film emulsion will respond to exposure, but provides a useful approximation of how the scene will be rendered.

A further advantage of learning via celluloid relates to the sensitivity or ISO of film stocks. An intimate awareness of this important element of exposure control helps students understand the precise value of the ISO scale, its relevance to exposure, video gain (the equivalent to pushing a film) and its consequence for image quality.

COLOUR TEMPERATURE

In the real world, our brains adjust automatically to variation in colour caused by different light sources – for instance, the warm hue of tungsten illumination or the cooler light found in an exterior shadow. In film and digital cameras, the cinematographer must make this adjustment by using appropriate filters to modify the hue (colour balance) of the light passing from the lens to the celluloid or digital sensor.

In general, judgements made about colour balance using a standard monitor or LCD screen are misinformed, while a white balance made by using a white card can be equally deceptive. Pushing a button does not create the desired or technically correct colour balance. It can be argued that shooting raw images allows opportunities for later correction; however, it disengages the student from mastering contrast management and colour temperature control at the point of capture.

it is essential for students to understand that colour temperature refers to the light transmitted from a light source, and that every source has a specific colour temperature. When using colour film – either daylight balanced (5600 K) or tungsten balanced (3200 K) – a student becomes aware of the gels and filters required to maintain colour balance. This simple lesson can be developed into more sophisticated understandings of lighting and colour balance later. Working with film encourages students to master the control of contrast, exposure and colour balance. They learn how to create the 'original' frame during shooting, in order to provide a precise resolution of the 'original scene' in the cinema, on a television screen or other device.

COLOUR GRADING

Post-capture, the DP, the director and the colour grader work to adjust printing lights and colour cast to match the desired technical standards, and render the mood and atmosphere of a scene. In many respects, colour grading actually begins at the capture stage, when the DOP lights the scene, shapes the image contrast, selects filters and chooses an exposure. For creative and technical reasons, and as a general rule, the DOP works within the latitude of the shooting stock in order to maintaining options for adjustment at the grading level. Matching 'latitude' to 'subject brightness range' is a principal consideration for the DOP and cinematographer.

At the point of exposure, decisions are made that often cannot be corrected effectively at a later stage, For instance, when shooting a night shot with film, the lighting and aperture will be set to take into account the appropriate contrast and under-exposures of the frame, in order to capture a convincing night-time environment. In this case, the bottom of the straight-line portion (SLP) and the 'toe' of the stock's characteristic curve are employed. Having established these lighting, exposure and colour-balance parameters at capture, there is little scope to render a convincing 'daytime' look from this original frame. With the electronic image, under-exposed and over-exposed parts of the frame generate the same loss of information and details that occurs in celluloid acquisition. Again, this information can never be restored. However, in many respects digital technology is quite different from celluloid technology. Post-capture, the characteristic S curve of the digital image can be manipulated by changing the contrast of the whole frame or even some sections of the frame. This facility will, however, not restore detail or data lost at the capture stage. In addition, subtle nuances and notes in the image, its tonal renderings and colour may be lost through digital manipulation.

EXPERIENTIAL LEARNING: FROM CONCRETE TO ABSTRACT, FROM FRAME TO AUDIENCE

Cooperation and exchange of information between the DOP and colour grader are important aspects of image creation from pre-shooting to post-production. When students experience this relationship in a celluloid context, they become attuned to the subtle aspects of image control that may well otherwise be missed. In particular, the DOP or cinematographer gains an understanding of the responsibilities, scope and creative options for image creation, the importance of the 'original' frame and a deeper understanding of digital workflow and post-production procedures. Most importantly, the aspiring DOP or cinematographer becomes familiar with a team approach to image capture and post-production.

It is now time to discuss an educational model that provides a learning framework for the ideas expressed in this article.

Experiential learning theory (ELT) provides a holistic learning paradigm for young adults that is consistent with the ways in which they learn, grow and develop. The process is called experiential learning to emphasize the role that 'experience' plays in the learning process. This theory has evolved from the work of Dewy, Lewin and Piaget – in particular, Dewey's philosophical pragmatism, Lewin's social psychology and Piaget's cognitive-developmental genetic epistemology.29 Experiential learning theory is founded on the work of educational theorist David A. Kolb.

ELT defines learning as the process whereby knowledge is created through transformative experiences. According to Kolb, 'Knowledge results from the combination of grasping and transforming experience.'[30]

Responding to Kolb's model, psychologist Saul McLeod explains that, 'Learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations.'[31] Putting Kolb and McLeod's ideas together, we can employ a fundamental educational principle, which postulates that learning occurs when 'concrete' experiences are transformed into 'abstract' concepts – or, put another way, learning is created through reflection on (thinking about) experiences.

Kolb has illustrated the notion of experiential leaning theory by designing the model shown in Figure 1.

Kolb's model demonstrates that knowledge is the outcome of a cycle of interrelated events that includes concrete experience leading to reflective observation, which in turn stimulates abstract conceptualization. Further action, or active experimentation, may then lead to new concrete experiences, thus closing the loop and beginning the cycle once more.

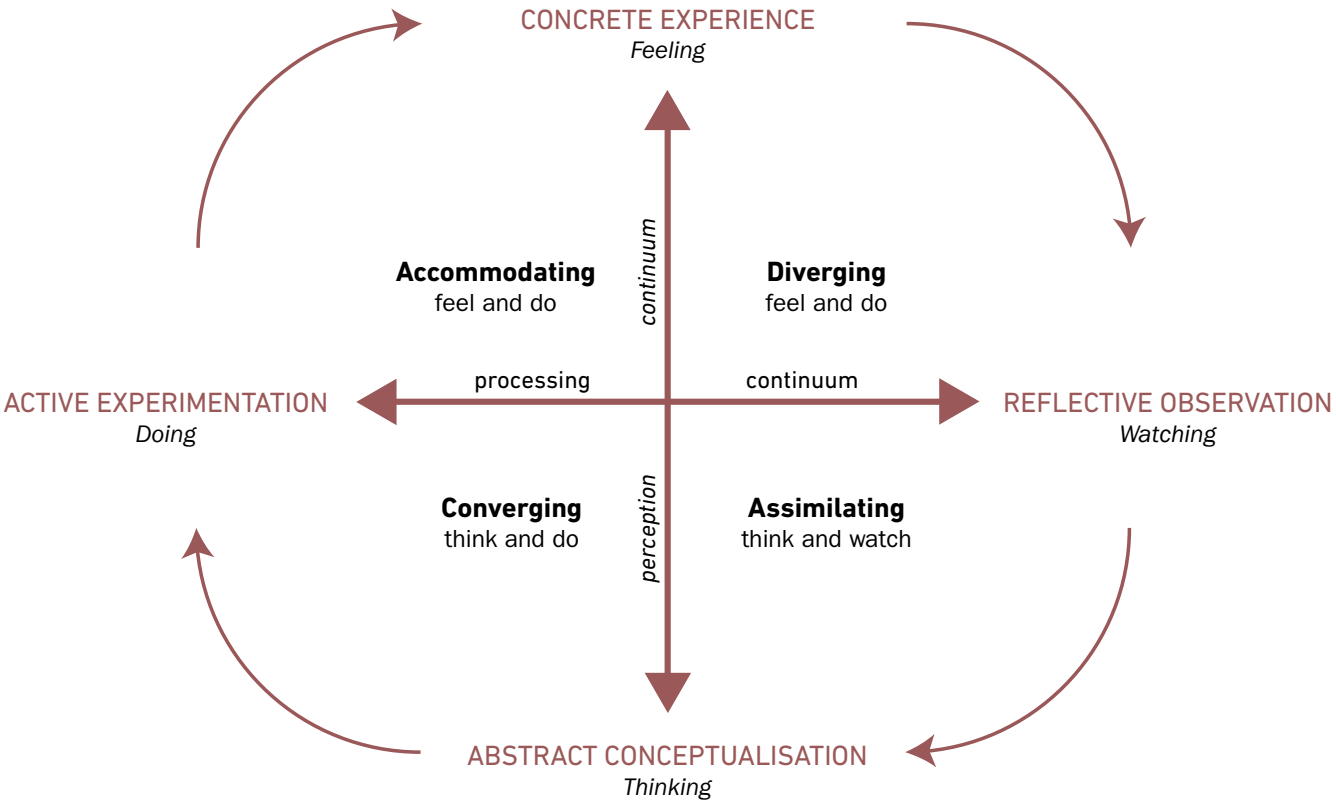

Figure 1. The Kolb model of experiential learning theory

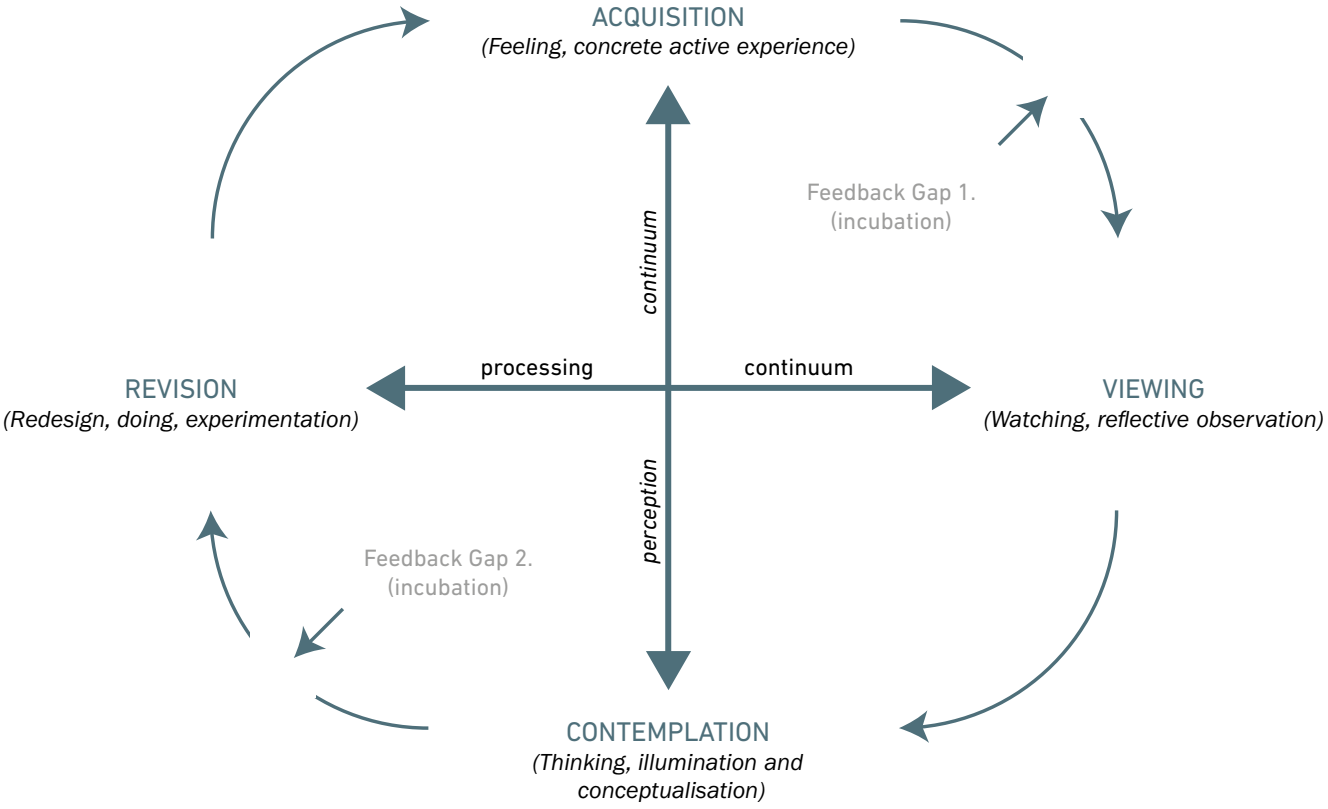

Figure 2. The celluloid model of experiential learning

Kolb's model includes two axes that link concrete experience (feeling) to abstract conceptualization (thinking) on Axis 1, and reflective observation (watching) to active experimentation (doing) on Axis 2. Axis 2 reflects a 'Monkey see, Monkey do' progression, for instance, as when a student learns skills and creative technique from a mentor. Kolb suggests that we cannot perform both variables on a single axis simultaneously – for example, think and feel or watch and do at the same time.

We believe that the process of celluloid acquisition involves a cycle of events that in some ways reflects the Kolb learning model, and that the celluloid model (or learning loop) provides a valuable induction into the practice of cinematography.

The celluloid model of experiential learning (Figure 2) demonstrates a cycle of learning experiences that occurs when students engages with film-based exercises. The model demonstrates the progress from image acquisition (shooting) to viewing rushes, through to 'contemplation' and analysis of the rushes, to revision and, finally, to testing through further acquisition. A key feature of this model is the feedback gaps (interludes) that exist between acquisition and viewing, contemplation and revision.

THE INTERLUDE BETWEEN ACQUISITION AND VIEWING

The interlude between image acquisition and viewing rushes is an essential part of this learning model. Lacking an immediate rendition of the created image (by means of a monitor), the student cinematographer is forced to employ pre-visualization and imagination in an attempt to envisage, and then execute their creation. Initially, the disparity between what is intended by the student (imagining and planning the shot), and what is actually achieved (the negative) is great. But, as each learning cycle is completed, and the student compares their intentions with the consequential image, they become more adept at managing the functions and characteristics of their medium. They begin to understand its strengths and weaknesses, and how it responds under certain conditions and environments. This process is concrete, evidence based, accumulative, reflective, mindful and conceptual.

In this learning cycle, the student will develop the ability to control their medium – to think before seeing rather than seeing before thinking. More importantly, they develop informed intuition and the imaginative muscle that allows them to problem-solve and accurately pre-determine the visual outcomes of their work. They will think about their intentions and plan their approach before pressing the 'run' button.

THE INTERLUDE BETWEEN CONTEMPLATION AND REDESIGN: CREATIVE COGNITION

The interlude or gap between contemplation and redesign (see Figure 2) provides further space for thought and reflection. At this point, the student evaluates all the information that has previously been gathered – they redesign their approach to cinematic capture in general, or executing a certain shot in particular. Where intentions (at the capture stage) have been achieved, prior learning is reinforced; where intentions have not been fulfilled or mistakes have been made, procedures are reviewed and new learning takes place.
In summary, the two interludes in the celluloid model encourage a 'thinking' approach to creating cinematic images, the generation of important craft skills and 'creative cognition'. In these interludes, aided by peers, teachers and mentors, the student cinematographer not only evaluates their own personal response to the images they

have created, but also assesses these images from an 'audience' perspective. Crucial assumptions in the 'creative cognition' approach are that the process and properties of conceptual structures are causally related to outcomes (the cause and effect relationship) and that 'Creative activities can be described in terms of an initial generation of … ideas, followed by the extensive exploration of those ideas'.[32]

FURTHER LINKS TO KOLB'S MODEL

As stated above, Kolb believes that we cannot effectively perform both variables on a single axis – that is, think and feel, watch and do at the same time. The celluloid model for experiential learning respects this notion by separating 'acquisition' or filming (feeling and concrete action) from 'contemplation' (thinking and conceptualization). It creates a second space between 'viewing' (watching and reflection) and 'revision' (redesigning and further action). It is at these points of separation that learning is maximized, as the student knits sensory experiences with cognitive reflection for the purpose of improving their creative, technical and 'intuitive' skills.

VISUAL THINKING, INTUITION AND PRE-VISUALIZATION

Associate Professor of Cognitive Psychology Ben Newell suggests that intuition is 'often invoked to explain how the mind can "see" answers to problems or decisions made in the absence of explicit reasoning – a "gut reaction"'. Newell explains that this process is not 'some magical method by which answers pop into our minds from thin air or from deep within the unconscious'; rather, 'intuitive decisions are often a product of previous intense and/or extensive explicit thinking'.[33]

Celluloid acquisition involves a similar process. When a practiced cinematographer exposes celluloid, they employ intuition – building on past experience, to inform their work and capture the desired image.

In digital capture, a representation of the image is generated via a preview monitor, and there is less requirement for pre-visualization, intuition and anticipation. In some respects, this 'risk-management' process may be viewed as useful insurance for a producer; however, reliance on immediate feedback may stunt the growth of important conceptual and creative skills for the cinematographer.

In Oughton's survey of film schools conducted in 2012–13, teacher/practitioners of cinematography provided the following relevant comments:[34]

> We think that the use of celluloid film asks for a level of abstraction more than the digital camera. The students have to make a reflection before and during the shooting.
>
> Learning to work with hidden images teaches students how to use their imagination.
>
> The effect of surprise after developing [film] is much more powerful in psychological terms than looking at life on a monitor.
>
> Celluloid acquisition teaches a student to use their imagination; it teaches concentration and planning, thinking things and ideas through, not just pressing the button.

THE INCUBATION EFFECT

Further ideas that throw light on the productive interlude between image acquisition and viewing rushes, and between contemplation and revision, reside in studies of creativity and problem-solving. Wallas postulates that problem-solving is comprised of four stages:[35]

- *preparation* – defining a problem and consciously attempting to solve it
- *incubation* – when a solution has not been forthcoming, conscious work ceases, but it continues subconsciously
- *illumination* – which encompasses the moment of insight
- *verification* – whereby the solution is refined and confirmed.

The second stage of Wallace's model, incubation, has been investigated by researchers employing non-empirical (qualitative) strategies, and their evidence clearly shows that a period detached from a task leads to the generation of valuable solutions and creative ideas. Other researchers have conducted empirical (quantitative) investigations into this phenomenon, which measurably demonstrate that 'after a break [from a task], people generate a greater number of ideas than those who work continuously' on a problem or creative task.[36]

There are two basic viewpoints that underpin quantitative investigations. The first asserts that task-specific fatigue is alleviated by a break in concentration, leading to further enlightenment and 'illumination'. The second suggests that 'switching to an unrelated task … involving similar cognitive demands', leads to 'non-conscious idea generation',[37] or 'incubation'.

Thus the two interludes included in the celluloid learning model could be considered to be periods of incubation, in which the learner both consciously and subconsciously digests information that informs future actions through building 'new' skilled and intuitive responses to the challenge of image acquisition.

CONCLUSIONS: WHY CONTINUE TO TEACH FILM?

This article briefly traced the history of the 'framed' image from the Paleolithic era through the Renaissance revolution to the cinematic toys of the nineteenth and early twentieth centuries. We also considered the arrival of cinema and television, concluding with the digital revolution and the spawning of new screen media. Over the centuries, a major objective of image-makers, whatever their purpose, has been the graphic restoration of reality – in most cases, rendered in two dimensions within a rectangular frame and soon, perhaps, as holographic cinema.

The artists and technicians responsible for these creations developed the aesthetics, principles, techniques, methodologies and mechanics that would efficiently and convincingly delivers stories, message and information to an audience. Today, we still use many of the rules and methodologies these artists created along the way.

In many respects, the great leap forward in 'signifying' actuality arrived with the development of animated photography – reality 'came alive' and became 'cinema' through decomposing and recomposing movement anchored by a regular frame rate. In addition, elements of time and space were cut out so as to to compress events, concentrate ingredients, lift tension and heighten engagement.

As technology developed and visual language became more subtle and expressive, cinema improved its ability to more convincingly render reality. Iconic films such as *Citizen Kane* (1941), with its consideration and exploitation of the rectangular two-dimensional frame, composition within that frame and the use of depth of field, became a reference for technique. Meanwhile, *Barry Lyndon* (1975) was recognized for its novel approach to lighting and establishing the verisimilitude of an eighteenth-century aristocratic interior.

As chemical-based modes shifted to electronic media, the emphasis on creating the framed image shifted from the authorship of the cinematographer to the post-production team and the work of the digital artist. The original 'camera' frames were often transformed at each step of the workflow, from shooting to exhibition. Further, with the development of pre-visualisation software, in some cases shooting has become like 'painting by numbers'.

With the development of television, image capture and its representation became synchronous. Any camera operator, director or producer could now see the results of their work instantaneously. In addition, the advent of videotape, hard drives and capture cards introduced the idea that 'excessive' shooting, (which can be done relatively cheaply) yields equal or better results than planned and thoughtful shooting. Shooting in a 'scatter gun' fashion may yield results, but at the expense of de-skilling students in terms of their ability to imagine, conceive, plan and control the cinematic image. There are also negative outcomes downstream in post-production.

A central argument of this article is that the immediacy of feedback provided by digital technology may be detrimental to the development of the neophyte cinematographer, but this outcome may be ameliorated through an immersion in film capture. We believe that students who experience film alongside digital capture learn: discipline and economy while shooting; specific and transferable skills; visual perception and insight; a considered understanding of continuity; communication and authorial responsibility; and an aptitude for visual narration. Most importantly, the student cinematographer acquires the ability to see a shot or scene in their own mind before it is created and recorded.

Teaching with celluloid in conjunction with digital capture is not a step back in time; rather, it represents an efficient method of learning the skills, techniques and creative strategies of cinematography. Furthermore, the majority of students entering film schools today have no acquaintance with film. Celluloid capture introduces them to a new, fresh and unique approach to shooting images – one that challenges them to reflect thoughtfully on contemporary notions of visual storytelling.

When employing film capture, students become acquainted with different rhythms and approaches while setting up and executing a shot. They learn about the subtle interplay between the demands of capture on the one hand, and intentions for image manipulation in post-production. Most importantly, the celluloid medium encourages the neophyte cinematographer to assume (where appropriate) authorship of, and responsibility for, the 'original' cinematic image, as well as understanding the multiple authorships that may occur in certain circumstances downstream.

In Steven Covey's book, *The Seven Habits of Highly Effective People*, Habit 2 suggests that, in our projects, we 'begin with the end in mind'. Covey explains:

> the ability to envision in your mind what you cannot at present see with your eyes … is based on the principle that all things are created twice. There is a mental (first) creation, and a physical (second) creation. The physical creation follows the mental, just as a building follows a blueprint.[38]

Beginning with the end in mind is a most useful foundation for creating effective cinematography.

Covey also argues that this concept is important in terms of personal growth. He suggests that, 'If you *don't* make a conscious effort to visualize who you are and what you want in life, then you empower other people and circumstances to shape you and your life by default.'[39] As educators, we have a responsibility to nurture our students in many aspects of life – perhaps learning in a celluloid environment cultivates more that just trade skills and professional attributes.

THE FUTURE OF CELLULOID ACQUISITION

The ability to maintain the pedagogical option of celluloid acquisition in film schools hinges on the continuing availability of film stock, film processing laboratories and a collective will to support the celluloid industry.

Some critical issues regarding the future of celluloid acquisition reside in the following four questions:

- Will the world's film industries continue to employ celluloid capture at sustainable levels? If so, for how long and what qualifies sustainability in current economic realities?
- Will film manufacture, film processing and downstream services remain economically viable at sufficient locations around the world, and where would these services be located?
- How long will the accumulated bank of film cameras remain in commission?
- Will film schools continue to see compelling reasons for teaching celluloid acquisition?

The first two questions are key. With economies, markets, industrial and technological environments changing rapidly, there is no assurance that film manufacture will continue. Celluloid capture may continue into the foreseeable future, in a 'boutique' sense, but will demand for stock and services provide appropriate economies of scale and incentives for film manufacturers and film laboratories to continue operating?

In many respects, the 'experiential learning model' described above provides a scheme that can be transferred to a digital acquisition environment. Although a number of important elements would be lost (if celluloid was no longer available), the overall value of the model would remain, providing an effective learning and teaching approach to training cinematographers for the twenty-first century – old ways transformed into new directions for a Post-digital age.

NOTES

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