THE PRACTICE OF KNOWLEDGE EXCHANGE

ABSTRACT

Knowledge Exchange has been a buzz-phrase with the UK research councils for several years. Initially called Knowledge Transfer, it was realised that that description was one-way only and that academia might in fact learn something from industry. After 25 years as a professional cinematographer in 2007 Terry Flaxton won an AHRC Creative Research Fellowship that focused on how an increase in the resolution of the image might affect the production of art. Flaxton set about to investigate this by producing a set of 'research artefacts' (cinematic installations and artworks) and exhibiting them as a means of measuring increase or decrease of times of audience engagement when the resolution of the installations was increased. The works were shown both in academic forums and also to audiences around the world, as far afield as the USA, China, Norway, Italy, Sweden and Japan, to around 320,000 people. In 2010 Flaxton then won an AHRC Knowledge Transfer Fellowship, which required the dissemination of knowledge gained from that research within the Creative Industries of the UK (this completed at the end of November 2012). It became apparent that knowledge was wider than normal singular knowledge transfer subject areas because it was theoretical, technical, sociological and artistic at the same time, and that this composite would question the forms that the new medium was development into. This in turn affected the act of Knowledge Transfer and asked just how much of the research council's initiative could be accomplished, how much knowledge could be exchanged with communities that themselves were *not* research oriented, what was the quality of knowledge exchanged and was it indeed two-way in form? In this article Flaxton summarises his experience and the research area in general and whether the practice of Knowledge Exchange is itself an appropriate term for what happens between academia and the outside world?

KEYWORDS
Knowledge Exchange, Digital Cinematography, Practice

INTRODUCTION

One of the conundrums of Knowledge Exchange in relation to traditional academic behaviour is a dispassionate pedagogic stance that has to be assumed, that inevitably rests upon personal interactions. It is on this basis that 'I' am present within the article. For me, knowledge is not only empirical, it is also internal and so I had to take on that specific issue throughout what follows. Also I have always practiced art and tried to understand the technology with which I practice. In my case, academic and artistic concerns are always at play and it is through this combination and the understanding it generates that I seek to understand the world.

During the period September 2010 – November 2012, I was awarded an AHRC Knowledge Transfer Fellowship and successfully argued for the provision of a Red One Camera for the duration. This happened before the rise of Arriflex's Alexa and though certain Cinematographers have now championed its use (notably Roger Deakins with his

use of it on 'Skyfall' and also Ang Lee's 'Life of Pi'), there is a 50/50 split in the feature film sector between Alexa and the Epic (Ridley Scott's used the Epic on 'Prometheus', Peter Jackson on the 'Hobbit'). Regardless of brand loyalty, the point is that Digital Cinematography cameras (delivering data rather than images) have a set of parameters that distinguishes them from Digital Video Cameras, and as this article will argue, consequently they have more in common with 35mm film, than digital video.

PRACTICE AS A CINEMATOGRAPHER

On completion of my 1st Fellowship, with it's emphasis on research, in trying to formulate a schedule to deliver the knowledge gained that preceded the KT Fellowship I built upon my experience and 25 year grasp of Cinematography and its associated practices. I also had a long involvement in the production of video art, plus a 10 year period of producing programmes for UK television, from documentaries to dramas, from satellite events to live studio work. My Creative Research Fellowship then focused on a long-held interest in the development of electronic imaging up to the arrival of the Academy Colour Encoding System. [*1]

I decided the way to deliver the knowledge gained would best be set within a mixed practice of workshops, surgeries, the maintenance of online resources of interviews with people within the area of Digital Cinematography as well as gathering text based resources, the creation of a symposium on the subject area and a survey that would list access to Digital Cinematography equipment. In agreement with my two partners, the Watershed Media Center (Bristol) and Creative England I also prepared a document titled: 'Notes on Digital Workflows'[*2]. In this document I tried to dispel the disinformation I had encountered both in HEI's and in industry on the nature of Digital Cinematography and Digital Video.

RESEARCH ORIENTATION PRECEEDING THE KTF

Having been an artist and Cinematographer for 25 years, my aim in the creative research fellowship was to investigate through practice and critical reflection what is happening to the audience gaze as it shifts from the analogue to the digital and on to higher resolutions. In creating and staging the work I had investigated, reflected and written[*3] about a phenomenon that repeatedly occurs: as resolution increases so audience engagement deepens as the resolution of the work is increased – the measurement of this was the increased time people remain with the research artworks I had created to test the hypothesis. This process revealed to me that the velocitization of innovation is affecting everything we know, but which has previously been framed through 600 years of text based behaviour - and if David Hockney is correct - this was accompanied during the same period by a single lens viewpoint (through first the Camera Lucida, the telescope and finally photography, television and cinematography).

> "It is perfectly clear that some artists used optics directly and others did not, although after 1500 almost all seem to have been influenced by the tonalities, shading and colours found in the optical projection"[*4.]

Hockney's research has altered the history of the image so that many now accept that our received notions of 'perspective' and 'colour', amongst other elements of visual composition, are conditional on the use of a lens. Hockney argues that prior to this, artists depicted a world with parameters derived from societal and religious demands. With the invention of the lens and mirror a greater degree of verisimilitude of representing what lie before the artist became possible. The artists that had this advantage would win commissions from patrons whilst keeping their techniques secret. Hockney then argues, that with the invention of photography, artists were freed to pursue a development of a 'correct' reproduction of the world, that artists could then revert to the use of two eyes, rather than one. A movement like cubism could reflect the artists experience of the three dimensionality of the world – where 3Dimensions were also accompanied by a 4th, time, which enabled a multi-faceted rendition of the artists experience, followed by every kind of synesthetic metaphor and interpretation of colour, texture, etc. finally arriving at conceptual art as a means of creating an experiential visual metonym for our ontological state.

Simply put, the representation of the world that the artists *two* eyes revealed, was now liberated. Hockney hasn't updated his writing since, but neuroscience has added a further perspective: the eyes connect directly with the brain in a crossover manner: the right eye is connected with the left-brain and the left-eye is connected with the right-brain. With the advent of photography we no longer had to be dominated by a right eye, left brain *highly ratiocinatory* view of the world – which Professor Iain Gilchrist of All Souls Oxford argues is now the accepted dominant worldview of Western Civilisation[*5]. To echo Hockney's view, Gilchrist argues that this monocular period, with its right eye ratiocinatory focus, mapped the development of the ability to mechanically reproduce and disseminate printed text – and text became the dominant form not only for the church, but for scholastic or academic authentication and verification of 'fact' or 'truth'.

DEVELOPING THE MONOCULAR GAZE
Arguably, digital technologies are simply analogue technologies enhanced by vastly increased computational powers, which simply decrease the time a 'gesture of requirement' is made and its computational answer is received. This loose definition should also take on the changes in the qualitative nature of the 'answer' as exerted by velocitization. This may be a clue to the nature of Digitality. Viewed this way, quantum computational techniques will also further enhance digital computation – with all the drawbacks *and* benefits of increased velocitization, but the changes that the qualitative nature of the information generated will be similar to the relationship between the conceptualisation of the real world and the quantum world. Put another way, given that quantum computation requires not only 'yes' or 'no' gates, but also 'maybe' gates (and equally 'not' gates), computational answers will be conditional upon interpretation. So, in looking at what knowledge might have been gained in relating to the production of data one has to be mindful that data itself, in its mathematical formulation, is simply one, potentially of many, definitions of 'data'.

Nature itself has already revealed ways of encoding data biologically and digital storage is simply a first step towards our understanding of how to store information. This metaphor itself is a way of understanding how the world, its image and we ourselves are within a complex transformative relationship as opposed to a fixed system of understanding – so *we* may have a relationship to the storage of information that changes the nature of that information. This latter is a model where both empirical and cognizant sensoria, are bound together as one. So, though I'm interested in both the technology and aesthetics of developing digitality - I am also concerned with the situation we find ourselves within, and how technology and art can reveal something of that state. In terms of knowledge exchange: this would have to be the underlying meta-meaning of my fellowship and reveal itself specifically within a one-day practical workshop that delivered artistic, professional and engineering information. I decided that the teaching of the understanding of Digital Cinematography could be an intimation of the greater landscape that could be viewed when one realised there were an entire landscape to be seen. I then set about trying to create that realization.

CREATING KNOWLEDGE EXCHANGE APPRORIATE TO TASK
Within academia the belief that complex language can better reveal specific meaning because it is *efficient,* is broadly held. 'To be precise' is the intent and that precision reveals meaning by utilising short cuts through the employment of meta-language. But Knowledge Exchange requires a departure from this lingua franca and the landscape that one enters when heading out of a university has many features – one thinks one knows that landscape and it seems so familiar, but only when the journey begins do you realise that you need a Stalker to guide you, as everything is not as it seems. Academic language is shunned but the idea that the outside world is simpler, soon becomes disrupted, as people outside academia are just as complex as those inside, but there's a low tolerance for descriptions that do not 'cut to the chase' which fundamentally means: 'how does this profit me?' Outside, metaphor is embraced, complexity comes in expression, in gesture, in pauses, in languages other than word-based language.

But in my research I had embraced the articulation of *complex* ideas that had necessitated thinking through a conundrum: The idea of research suggests that there is an absence of knowledge that can be introduced if a dominant and recognised scientific methodology is utilized. This methodology posits an initial hypothesis that may be examined experimentally, then checked. Putting aside the immediate criticism, that creating a hypothesis immediately closes down other options, this proposition doesn't fit with the production of art, as the artist looks inwards to internally reveal their knowledge. Scientific methodology posits that knowledge comes empirically from without, artistic revelation posits that knowledge is revealed as a gnosis from within. This is the old conundrum of 'a priori' and 'a posteriori'. When the argument was first constructed it was a time that we had to have faith in some things we now 'know'. In the age of reason we rightfully rejected unprovable inner knowledge, now time and reason has moved on as we generally now embrace the belief that we are not apart from the world - we are of it – materiality is part of

thought, thought and language are conjoined. The observer affects the experiment.

So the proposition that we can reveal truth from an internal position, recognises that the construction of our physical selves has developed over time, our sensorium is constructed from the same stuff that we use to apprehend and interact with in the world and therefore this has validity. What we can assert is: that we are here now and we are an interconnected part of now. This became my basis for speaking not only about practical issues: 'tighten this nut here, move the filter down a little', but also connecting a deeper meaning to those empirical gestures. In the act of constructing this camera, the tool, we are also assembling an ideological, and metaphysical construct. After 3 years of research I knew on a ratiocinatory level, that besides discovering empirical things about the world, the behaviour of practice as research also revealed glimpses of the nature of the ontology of the sensorium we inhabit and this had to become part of the knowledge to be exchanged.

TRANSFERENCE OR EXCHANGE?
I am aware that knowledge about Digital Cinematography, in the very recent past, was considered as esoteric as the definitions of what the medium is, what its relationship to first digital video and what preceded it were unavailable. So unless people are using this new equipment 'in anger' on projects at the highest level, where you simply have to get it right – then there are still huge amounts of disinformation to be found flowing and consumed in many sectors of engagement with this equipment.

For instance: until recently many manufacturers used chips with a size of about half to two thirds of an inch. This Charge Couple Device (CCD) size was approximate to the optical pathway of early television plumbicon tubes that themselves corresponded to the optical pathway of 16mm film. This characteristically generates a large depth of field. Each camera used three chips to derive the three colours from which a colour image could be reconstructed and this imitated developments in colour film where three emulsions delivered the colour image. When Red introduced the Red One, it began with a single 35mm sized single CMOS (Complimentary Metal-Oxide-Semiconductor) that used a Bayer filter to extract colour information. Bryce Bayer invented this system for Eastman Kodak in 1976 – primarily to extract information from scanned film images. 35mm has an area four times the area of 16mm film (as early industrial processes took the 35mm film strip and split it down the middle and the first 17.5mm camera appeared in 1899 and split once more for 9mm, 8.5 or 8mm film) .

With the above in mind, and listening to the conversations of professional cinematographers[*6,] I constructed a set of governing and defining principles for Digital or Data Cinematography:

> a) the optical pathway shall be 35mm or above (derived from technical and
> industrial limitations possible at the time of origination for manufacturing
> photo-chemical negative).

b) Digital Cinematography generates a progressively based non-compressed data/image flow relating to a specific time-base as opposed to an interlaced image flow characteristic of video (one full frame of information at a time rather than a field-based workflow)

c) like one of its predecessors, film, Digital Cinematography holds the image in a latent state until an act of rendering is applied - *but unlike film development* - is non-destructive of its prior material state

d) Digital Cinematography's capture mechanism, though generating a nondestructive, *non-compressed* data pathway from which an image can be reconstructed, is not its sole intent as a method of capture (but is distinguished from digital video, the sole intent of which is to generate images in a compressed manner from less than 35mm optical pathways)

Several of these qualities are also characteristics of many developing digital technologies – for instance real-time mapping of environments requires a capture of infra-red imaging sources (cameras used as sonar devices) running at or above 25 fps. Using this criteria, digital cinematography is about more than just capturing images - it's a portal onto the digital landscape so far unexplored due to its apparent function as an image capture medium.

THE LOOK FROM CAPTURE TO DISPLAY: A SYMPOSIUM

As an early gesture and to set the tone for the fellowship, I proposed to a colleague, Dr Richard Misek, the co-organisation of 'The Look from Capture to Display' a symposium which would take place in early 2011 at the Watershed In Bristol[*7]. My intent was to lay out my understanding of data pathways to production through its dissection into 4 segments and plenary. Each of the four sessions comprised a presentation by an academic to open up wider questions, a presentation by a film industry professional, and then a dialogue between the two. The intention was to introduce the practice of each to the other and of both to the general public, facilitating an open conversation about the aesthetic issues, pressures, technologies, and production roles involved in contemporary film production. We felt that, importantly, we should discover and reveal a language common to both.

We also set up an evaluation of this event and from the comments received concluded that we were going in the right direction. Those results will be encoded in the design of an international forthcoming conference on the nature of moving image training [*8].

INSIGHTS DERIVED FROM THE SYMPOSIUM AND FOLLOW-UPS

I realised from staging the symposium that I needed to know more about the sector and whether early adopters had taken up the challenge of Digital Cinematography so I created an online survey to try to find out roughly how many digital cinematography units were present in UK HEI's – this was only to be a snapshot. There are currently over 370 Universities and Institutions of Higher Education in the United Kingdom and Eire

(depending on how you count and who you include). In an unpublished consultation document that I was writing to interest a group of universities in setting up a Digital Cinematography Research Unit (DCRU, Mid 2011), I wrote the following concerning the level of equipment in England:

> Delivering access to research, skills and equipment to HEI's in the subject area of Digital Cinematography is problematic for various reasons but at a basic level a single Digital Cinematography kit is expensive at around £50,000 each unit and £70,000 if you introduce post-production into the equation. There are currently 10 camera units in education; there will be 13 by the end of the year. University of Bristol has two of these units - the current 10 units are situated: 4 in media departments, 3 in film schools, 2 in engineering departments, 1 with an KE Fellow (myself, Bristol). By the end of the year 3 other DC kits will arrive in 3 more film schools and after this years NAB (in Las Vegas), because newer equipment is cheaper, penetration into HEI's will increase - this increase needs to be accompanied by knowledge and skills as these newer kinds of equipment utilise data production rather than image production. There is an argument that British moving image training needs a radical overhaul.

My agenda for the creation of a Research Unit was twofold, that acting together, we could be in accord with Research Council goals of amortizing costs for equipment between universities and secondly we could jump start the unification of teaching practice around moving image training. Duncan Petrie, Professor of Film and Television at York University and Professor Rod Stoneman, Director of the Huston School of Film & Digital Media at the National University of Ireland allowed me to see part of their argument from their forthcoming book, Cultivating Film-Makers' [*9] in which they discuss some of the reasons why moving image training in the UK is constructed as it is. I wrote the following with what I had seen of their argument in mind:

> The education and training of film and television-makers in the UK is arguably in a state of crisis. The sector comprises a rag-bag assortment of different kinds of provision: from long standing single-discipline institutions such as the National Film and Television School and the London Film School specialising in postgraduate industry-related training, to University departments offering a wide variety of theoretically and practically oriented programmes in film, television and media studies at bachelors, masters and even doctoral level, to an array of Further Educational colleges specialising in various kinds of technical skills-training. In 2003 Skillset, the sector skills council for the creative industries, and the UK Film Council published a national training strategy that claimed many existing media courses were of poor quality and irrelevant to the needs of industry. However, this strategy entailed its own limitations and flaws. The view of education it espoused was overtly instrumentalist, equating the formation of future practitioners with industry-relevant 'skills-training'. Moreover, it ignored more than a half-century of the development and impact of film schools, not just in the UK but also around the

world.

This also required the additional thought, that the Arts require a different attitude to training than the idea of 'craft-training', to take account of the peculiarities of 'Glitch Art' and what crafts people see as low craft-focused image production which deals in the peripheries and inconsistencies of the media used. I would also argue the sector was also then profoundly ignorant of the tsunami-like development of digital and pervasive media and their impact on media training: that the speed-blindness, or velocitization of technological impact (including the lazy quoting of Moore's law as a self-fulfilling prophecy of continuous inability to deal with the flow of technology) may be a governing factor of the crises we are in. In my consultation document I built upon Petries and Stoneman's insight to bolster the rationale for the research unit and also for a forthcoming conference:

> A newly formulated Digital Cinematography Research Unit can relieve the pressure which produces the dichotomy between the needs of both the academic and the creative, where the current situation in film schools in Britain and elsewhere is predicated on a conceptual division between skills training and academic education, which in turn relates to a broader division between intellectual and creative endeavor within the educational process. Particular problems would be examined through papers, conferences and symposia. A major conference in collaboration with other HEI's will be organised to examine the teaching landscape of British moving image. One of the main subjects to be examined (with reference to Petrie and Stoneman once more) is the role of categorisation and exclusion in relation to 'instrumentalised notions of skills and aptitudes - even at the level of primary and secondary education nearly everyone is taught that they can't draw / paint / make art, that they are not 'creative'[*10].

THE PRACTICE OF EXCHANGE OF KNOWLEDGE
As mentioned at the beginning of this article:

> *One of the conundrums of Knowledge Exchange in relation to traditional academic behaviour is a dispassionate pedagogic stance that has to be assumed, that inevitably rests upon personal interactions. It is on this basis that 'I' am present within the article. In my case, academic and artistic concerns are always at play and it is through this combination and the understanding it generates that I seek to understand the world.*

With the above in mind, I had decided I would commit myself to a mixed practice, but which featured a series of workshops. These would practically engage those attending whilst at the same time reveal the mysteries of complex ideas like Modular Transform Function, the Nyquist-Shannon Sampling Theorem, Bayer Patterns Filters, Fourier Discrete Cosine Transforms and the development of Wavelet theory (explanations of which can be found in the Notes on Digital Pathways which you can download[*2]). I decided I would have faith that whoever attended, came because they wanted to learn the

mysteries revealed and that they would come with bright and open minds. Having taken people through that level of Engineering I would them proceed through film grammar, then Film Theory.

The workshop consisted of the construction of the camera from out of the carry-case (built from the ground up) and with every additional piece of equipment being added, the lens, the matte box, the battery, the hard drives, the electronic viewfinder etc, this then afforded a means to introduce each new subject: Light into glass, optics, optical pathways, sensors, different kinds of sensor, Bayer pattern filters to generate the idea of colour, colour space, photosites, conversion of light to voltage, voltage to data, recording data, compression, display technologies, audiences, perception, mirror neuron function, immersion, film theory, signs and symbols, mis-en-scene and so on.

In physical terms we went though capturing and processing the data and finally post producing, one-light grading and editing. The idea being that we would reveal the simplicity of the pathway. Everyone then saw Digital Cinematography from concept to displaying the images they captured on a screen. People are very bright if you speak to them in the right way. The idea that slower thinkers equals lack of inherent intelligence is wrong, it just takes longer with further use of metaphor to get complex ideas across – and through practice, further knowledge is gained. Equally, direct fact can be relayed in a way that exposes meta-levels of meaning. Often the workshops were attended by people who knew quite a lot in one area, including professionals, plus there were undergraduate, graduate and doctoral students – there were hardly any people attending with little knowledge about the subject.

EVALUATING THE WORKSHOPS

In total there were 19 workshops, with an average of six people attending each. To ensure depth of knowledge and deeper spread, I decided to limit attendance to a small number so that people would more easily glimpse the possibilities of the medium and then virally spread the information (if I managed to motivate them). I also decided I would try to evaluate the level of learning that would be achieved, so I set about constructing an evaluation process comprised of a pre-workshop and post-workshop questionnaire where I could have people self-evaluate their knowledge beforehand – and similarly self-evaluate their knowledge after the workshop.

The entry requirement for the workshop process became:

i)   Take the pre-workshop questionnaire
ii)   Read the pathways to production pdf I made available before the workshop[*2]
iii)   Take the workshop
iv)   Re-read the pathways to digital production pdf[*2]
v)   Take the post workshop evaluation questionnaire

I constructed a set of questions that had a ten point answer i.e. 'do you know how to

expose film?' where 0 is knowing nothing and 10 is understanding everything. Of course, that's different from 'do you really *understand* how to expose film to produce exact results' and equally different from 'do you know what happens photo-chemically when you expose film to light?' But given the minefield of associations, intents, misunderstandings and all the rest that can occur with a simple question, I chose questions that allowed there to be a difference between 'before' and 'after' the workshop. At this point, to better understand what follows, you can go to the URL referred to in the notes to take the evaluation yourself: [*11]

A lot of my training is based on the idea that the understanding of digital cinematography can be enhanced, by understanding principles of film production. Not the least because the manufacturers of digital cinematographic equipment have tried to follow a through-line about light, the means of capture of its values, rendition of what has been captured and treatments that enable a flow of images that accrues to what we are 'used to'. As an example of this a film camera uses a 'shutter' which revolves, half of it clear to allow light through for exposure, half of it closed to shut out light as the film is moved on. Each revolution of the shutter takes (for example) a 25th of a second if the shutter was set at exactly half the spinning wheel (one half of 360 degrees is 180 degrees). Therefore the shutter angle of 180 degrees takes one fiftieth of a second. Thus time and angle have a correspondence. The sensor does not have a shutter, but it does switch on for a certain amount of time. With 25fps this is a fiftieth of a second and with 24fps a forty-eighth of a second – shutter angle being half the frame rate. Cinematographers always experiment and for instance work out that if you lessen or decrease the shutter angle (time of exposure) you can increase sharpness of image and get an effect similar to that in 'Saving Private Ryan' where explosions and the detritus generated, the dirt flying towards you for instance, is rendered with greater sharpness, or increase the shutter angle or time of exposure to increase motion blur and soften the viewing experience.

WAS KNOWLEDGE TRANSFERRED?
During the 19 workshops, 102 people from industry and universities took part and I compute from 18 questions that overall knowledge of cinematography across all classes of attendees held before the workshop was 30%, which rose to 67% after the workshop. I also asked a general question of people who had taken the workshop to estimate their own knowledge prior to the workshop (which computed to 41%) and then what they thought they knew after the workshop (which was 69%). That's a 28% increase which is different from the more extensive calculation of 37% which I had made from the 18 questions – and that I believe relates to the following:

In examining the 'data' generated from a questionnaire about knowledge held, there were obvious inconsistencies. For instance, with regard the simple question: 'Do you know how to expose film?' I had said in the evaluation that the student should give a value between zero and ten. In the questionnaire before the workshop the students might answer 10 before and in the questionnaire afterwards, they might answer 7. So what's going on here? One answer is that they realised what they didn't know by being exposed to more knowledge

than they thought existed.

So that conditional answer takes in all of that experience and is an expression of knowing about the complexities that an experienced person is aware of (and also the presence of Murphy's law that if anything can go wrong, it will go wrong). But aside from that, one can never know the complete answer. I also believe that if Roger Deakins were to fill in this questionnaire he might write down 9. We would believe him but wonder why he didn't write 10. But Deakins is no fool, he knows that the master of the form can only know *nearly everything* about the form but not all. One must always keep '1' behind in the storehouse for the unexpected. There are many other conclusions one can draw from this system and I shall do further work on the figures to extrapolate meaning – but the response of the students at the time and the comments that followed told me what had happened in terms of delivery of both technical and contextual information.

The base line though, is that my overall calculation of the increase of knowledge using all of the answers came out came out at 30% knowledge held before with a 37 knowledge gained, which totals 67%. The single question evaluation taken after the workshop where I asked people to evaluate what they thought they knew before and then what they thought they knew after, came out at 69%. That's within a plus or minus 2% error margin when compared to the more extensively computed result of 67%. But of course whilst looking like a highly successful control for the figures, this really means very little. At the actual events the expressions of realization were my confirmation of what was being learned. Please go to this URL for comments about the workshops from Filmmakers: http://www.visualfields.co.uk/DIRECTworkshopfilmakers.html

APPRAISAL
To sum up and evaluate the process, here are some thoughts on Knowledge Transfer:

SURGERIES
These have short term worth on one level, because they are about imparting information with regard a specific request or problem – however, one would expect the knowledge to disseminate virally from individual contacts as knowledge spreads.

SYMPOSIA
This was a very beneficial event for all involved. I conducted an online appraisal where people again filled in an evaluation form and the results came in at around 70% approval for the event with various constructive comments to improve it so that the next would be a better experience. The event also had real impact of those taking part. Academics spoke about a new way forward where we exchange real-world knowledge with our industry counterparts and people from industry spoke about their own practice being enriched and that they would think again before their next set of acts.

From this experience I developed the view that conferences or symposia with multiple events happening at the same time split the audience and do not allow for knowledge

building by denying the voice of those attending by limiting audience dialogue times. It could be argued that conferences of two days should use at least half a day of presentations for pump priming on day two concerned with dialogue and resolutions to action.

WORKSHOPS AND THEIR EVALUATIONS

Workshops do much the same as surgeries in terms of viral distribution of knowledge. On a deep level a workshop can change a life, as one did for me some 30 years ago. Evaluations and questionnaires can always be improved upon, but in they end they produce a simplified picture of growth of understanding. In that sense all of my workshops generally increased the knowledge of those that attended by roughly one third, however, I am aware as a teacher that I reached beyond a measurable set of co-ordinates to reveal the landscape that I can see and that those that attended will also speak of this new landscape. Was knowledge exchanged in a two-way process? I can say with certainty that as the workshops progressed I fine-tuned my concepts around the transference of information and this was based upon direct feedback from the continual evaluation process. Did I really learn anything from the process? I learnt that disinformation is a continuous problem around complex and new subject areas.

ONLINE RESOURCES

I have been publishing outcomes online from 2007 onwards; though recognizing traditional forms of academic dissemination as important, there is a real problem around the publication of a monograph that costs £75 and up and few copies are printed for use in reference libraries. I have maintained a blog – and yes, arguably this is to a limited academic standard – but it allows a freer flow of thought and information and also allows one to create the ideas that later appear in peer-reviewed form[*12]. Early film has little or no verbatim reports from its beginning and so in a similar period of development (almost 100 years on), I have maintained the 'Verbatim History of Digital Cinematography'[*13]. This is an online resource for researchers where I've interviewed people that I believe have something to say with regard the development of the subject area.

As to the worth of the online resources, at the time of writing on looking on my academia page I see that I have 11 notifications which tells me when I view the stats: 3 people from India, two people from the United States, and one person each from Belgium, the UK, South Africa, Italy, Turkey and Canada have viewed the page in the last 2 days. So with regard online resources from the KT Fellowship – I can see the numbers and the fact that these numbers are by inference international, heartens me to believe that online resources have a much wider reach than traditional academic forms of dissemination.

CONCLUSION

In terms of evaluating and reflecting upon the whole gesture of a KT Fellowship I need to step sideways once more into a personal reflection: A few weeks ago, as I began to try to come to grips with some deeper issues before beginning this article, I noticed the December issue of America Cinematographer, still unopened from a week before[*14]. So in a gesture of displacement from the task at hand, I opened it up and glanced through. This

was replete with advertisements for Red, Alexa, and all the Sony variants, F5, F55 and F65. Ironically it is now Sony who are trying to catch up now as it was Sony with their CineAlta Brand that first took on Kodak and the photo-chemical dominance of the motion imaging market 25 or more years ago. Looking deeper into the ASC magazine, 'Skyfall' is given 15 pages (which shot this huge franchise not on 35mm but on the 2K Alexa even though it had to be artificially enhanced in resolution to show in iMAX cinemas). Of course 'Pirates of the Caribbean 3' and 'The Social Network' championed the Red One, as 'Prometheus' and 'The Hobbit' trilogy championed the Epic – as years before 'Star Wars' pushed the Sony 900 into the frame (later followed by 'Avatar').

But further on in the American Cinematographer Magazine, almost as an act of 'balance', Seamus McGarvey BSC is described using Kodaks's Vision 3 stock to shoot 'Anna Karenina'. But that choice may be about a deep need to reference David Lean's 'Doctor Zhivago', to confer the aura of the original gesture though it's medium of capture, that the deep human psychological expression exemplified by Russian Romanticism should use film stock and not the clinical new medium - as more of a marketing principle than a formal necessity. The only real way that the question of the appropriateness of film or digital can be dealt with is if a Digital camera were placed side-by-side with the Panflex Millenium on a shoot such as this, or 'Lincoln', (in the same magazine) or even 'Cloud Atlas' all of which have been shot on 35mm. The ASC and BSC side-by-side tests of digital cinematography cameras only pointed a gesture of small understanding towards the new medium - but Roger Deakins grand statement is the one that is eye catching, as the acknowledged master of the medium (10 Oscar Nominations for Best Cinematography) speaks to the world about what he can do and more to the point, is prepared to do with this new medium, and in particular, this new Digital Cinematography camera.

THOUGHTS ON FUTURE DEVELOPMENTS
> *The camera introduces us to unconscious optics as does psychoanlysis to unconscious impulses*[15]

From many news reports it would seem that Peter Jackson's trial of a new display rate of 48fps on 'The Hobbit' is in trouble. The media is telling us that apparently we don't like 48 frames per second (but then this production is being screened at 2k and if one were following through and multiplying from 24 fps at 2k, one would then project at 48fps at 4k, instead of artificially increasing resolution to 4k) – there are even assertions that consciousness occurs at 40 frames per second in the popular press*[16]. With artificial increases like this there is a simple electronic truth: if the resolution is not there in the first place, it cannot be added*[17].

Looking at the cinematography of 'The Hobbit', what has been achieved by Andrew Lesnie using an Epic, with less fanfare than Roger Deakins use of the Alexa on 'Skyfall', is that Lesnie achieves as much of a painterly image in a Digital Cinematographic medium as he did on 'Lord of the Rings' on 35mm*[18]. I saw the 24fps version and it looked cinematographic and then walked into the next cinema to see part of the 48fps version

which looked much more like video. Because of my training/conditioning I liked the filmic version, but friends who are used to gaming at high frame rates didn't mind the 48fps version. They did however add that the interior scenes were problematic because scenery does not stand up to scrutiny in terms of suspension of disbelief – but the graphics sequences were more heightened visually.

Jackson maintains – as does James Cameron with the forthcoming 'Avatar 2'– that we will get used to high frame rates: 10 – 15 minutes is currently recommended for adjustment *[19]. Before them, Douglas Trumbull championed Showscan, a 65mm film system running at 60 frames per second. But pushing that amount of expensive film stock through a camera proved ridiculously expensive - And here's much of the rub around digital cinematography: The dreams of film can be realised at proportionately little extra cost in this new form. Jackson and Cameron, in terms of late-capitalist production of not only entertainment, but 'film practice' itself, have their fingers on the pulse of the popular mind in a way that all the nay-sayers of change put together, cannot really challenge.

LATEST RESEARCH

My current research, and site of Knowledge Exchange, is a collaboration with Faculty of Engineering at University of Bristol and BBC Research and Development. This research concerns Higher Frame Rates (HFR), Higher Resolution (HR) and Higher Dynamic Range Capture and Display (HDRC or HDRD) – it is about the combination of all three – or rather the *calibration* of all three to create the most immersive form of that combination.

If you look at this diagram (Fig1) it shows that the human eye/brain pathway uses 5 out of a 14.5 order of magnitude scale, sliding this instantaneous facility up and down the scale to deal with starlight at one end and desert sun at the other. All contemporary displays only currently exhibit between 2 – 3 orders of this scale, but one of a new series of prototypes, held at University of Bristol, displays across 5 orders of magnitude and BBC R&D in turn have created a 200 frame per second projector where we intend to display images upon higher than seen before. By combining variants of frame rate, resolution and dynamic range, we should be able to effectively produce a deeply immersive picture by then calibrating these functions to produce a combination that best resonates with our eye/brain pathway - and therefore conscious awareness.

The proposition we are constructing is that if we can manipulate *all* the factors of the construction of the image, then improved immersion may follow, providing people have gotten used to what it is they are seeing (including the perceptual issues around signal compression and human visual acuity) *[20]. At the end of November 2012 we managed to capture the first version of these kind of moving images and in January 2013 an immersion lab was constructed at University of Bristol to examine audience response to this new form. In April 2013 we created our second set of images with a pyro-technician to exploit higher ranges of capture and display. We hope shortly, to be joined by some prominent industry names in this enquiry and no doubt, those interested in the future of cinema (and whatever it might turn into) will be interested in this work. It is our intent to maintain the visibility of the research so that it has a relationship to the classroom, as we feel that the velocitization of the relationship between research and knowledge exchange is so fast, that research becomes 'knowledge', immediately. However – we are aware that critical reflection and corroboration of evidence, as much as the discursive theoretical tradition, is as important as ever it was.

NOTES AND REFERENCES

[*1] Academy Colour Encoding System - Either type this URL into your browser
 http://www.oscars.org/science-technology/council/projects/aces.html
or go to http://www.visualfields.co.uk click DIRECT, then click 'Academy Colour Encoding System'. All references will appear at this URL for easy reference.

[*2] Notes on Digital Workflows, ******* 2011. Either type this URL into your browser
http://www.visualfields.co.uk/DIGITALWORKFLOWS.pdf or go to
http://www.visualfields.co.uk click DIRECT, then click 'Notes on Digital Workflows'

[3] 'Time and Resolution: Experiments in High Definition Image Making', Journal of Media Practice Volume 10 Numbers 2 and 3, 2009. Go to http://www.visualfields.co.uk click DIRECT, then click 'Time and Resolution'. As an addendum to this article, one of the pieces discussed, 'In Re Ansel Adams,' has been accepted into the Harris Museum in Preston's permanent collection and an installation, another, 'In Other People's Skins' has been seen as far afield as China, America, Italy, Norway, Sweden and the UK by over 300,000 people. Access this URL for a small video shown on Chinese TV: http://www.visualfields.co.uk/chinareports.htm

[4] 'Secret Knowledge, Rediscovering the lost techniques of the old masters', David Hockney, page 17, Thames and Hudson, 2001

[5] 'The Master and His Emissary', Professor Iain McGilchrist, Yale University Press (2010)

[6] For me 'The Cinematographers Mailing List', originally began by the respected Cinematographer Geoff Boyle, is a very important resource. Unlike many other online communities, serious working, and sometimes Oscar winning cinematographers, post on this site.

[7] Use this link for access to an online recording of the Symposium: The Look From Capture to Display - http://www.visualfields.co.uk/KTThelook.htm or go to http://www.visualfields.co.uk click DIRECT, click 'The Look From Capture to Display'.

[8] Please go to http://www.visualfields.co.uk and click D I R E C T for a link through to news about this conference – we expect this to take place in Spring 2014. In Bristol in the UK we are currently re-organising and co-ordinating our moving image festival events to produce a month full of moving image celebrations. In 2013 the short film and indie festival Encounters, as well as the Wildlife Festival, Wildscreen will both take place in September. We hope by 2014 to also begin two new festivals: The Golden Hour Festival of Cinematography and The Festival of Experimental Moving Images.

[9] 'Cultivating Film-Makers: The Past the Present and Future of Film Schools' (Working title), Professor Duncan Petrie, Professor Rode Stoneman, (Publisher, Intellect, 2014)

[10] DIRECT is University of the West of England's center for 'Data Imaging Research in Electronic Cinematography and Transmedia', which is open to creative collaborations with other HEI's worldwide. In Bristol UWE itself has 5 Digital Cinematography Units, University of Bristol has 4 DC Units, plus various peripherals, post units such as redrockets etc plus we will run a national survey of DC equipment soon. Go to http://www.visualfields.co.uk click DIRECT, then click 'International Survey of Digital Cinematographic Equipment'. A full website with DC resources both text and video will be available towards the end of the year.

*11 Workshop Evaluation Form. Either type this URL into your browser: https://docs.google.com/spreadsheet/viewform?formkey=dHB1czFQekdSUWhwQUk5Skx oemh5bUE6MA   or go to http://www.visualfields.co.uk click DIRECT, then click 'Workshop Evaluation Form'.

*12 Online Text Resources on the Subject of Digital Cinematography. Either type in this URL to your browser: http://www.visualfields.co.uk/KT2.htm or go to http://www.visualfields.co.uk click DIRECT, then click 'Online Text Resources'.

*13 The Verbatim History of Digital Cinematography. Either type in this URL to your browser: http://www.visualfields.co.uk/indexHDresource.htm or go to http://www.visualfields.co.uk click DIRECT, then click 'Verbatim History of Digital Cinematography'. We welcome interviews gathered to add to this resource.

*14 American Cinematographer Magazine, December 2012, Either type in this URL to your browser: http://www.theasc.com/ac_magazine/December2012/current.php or go to http://www.visualfields.co.uk click DIRECT, then click 'American Cinematographer'.

*15 Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit, originally published in Zeitschrift für Sozialforschung (1936) Walter Benjamin

*16 Online Article at Movieline.com: The Science of Frame Rates, Or Why The Hobbit Looks Bad At 48 fps'. Either type in this URL to your browser: http://movieline.com/2012/12/14/hobbit-high-frame-rate-science-48-frames-per-second/ or go to http://www.visualfields.co.uk click DIRECT, then click 'The Science of Frame Rates, Or Why The Hobbit Looks Bad At 48 fps'.

*17 Though shot at 4k, the pathway of production on 'The Hobbit' was 2k – so, to invoke the 'modular transform function' of the system (which is simply that of the lowest common denominator), then if you've thrown the resolution away at some point (in this case to post produce at 2k) then the resolution will from now on be 2k, regardless of artificially trying to make it once more, 4k.

*18 It's reported that between 6 and 12 terabytes per shooting day on 'The Hobbit'. With over 265 days of principle photography this means that between 1590 and 3180 terabytes – not including all the second unit shooting and pick up days would have been generated – but this pales into insignificance with the data levels generated on our current HDR, HFR research (not even 3D). We calculate around 1 terabyte *per minute* of *rushes* for the next level – if we can invent the means of recording this.

*19 Article in 3D focus magazine an online journal. Either type this URL to your browser:

http://www.3dfocus.co.uk/3d-news-2/3d-film/be-open-minded-says-schilowitz-from-red-about-hfr-3d/11469 or go http://www.visualfields.co.uk click DIRECT then click "Be open minded says Schilowitz from RED about HFR 3D"

*[20] With regard change to and adoption of new technologies, I have heard the mistaken view put forward: 'what's the point of 4k screens as our eyes are only 2k', apart from just being wrong factually – as the physiology of our eyes can perceive much higher resolution than 2k - sharpness and detail in the eye/brain system is a much more complicated issue that simply citing resolution as it's measure. There are many other issues that define perceptual acuity: for instance, contrast sensitivity function. This term describes the phenomenon that visual sensitivity to contrast is highest at lower resolutions, than the threshold where we no longer see contrast difference. This apparent contradiction illustrates the more complex reasons why resolution is not simply a measure of resolution. Also, the 'apparent resolution' of a screen is lost when the viewer moves back too far. There's a very good paper on the issue from Sony, which can be found at this URL: http://pro.sony.com/bbsccms/static/files/mkt/digitalcinema/Why_4K_WP_Final.pdf

Filmography
'Skyfall', Director Sam Medies, Cinematographer Roger Deakins, 2012
'Life of Pi', Director Ang Lee, Cinematographer Claudio Miranda, 2012
'Prometheus', Director Ridley Scott, Cinematographer Darius Wolski, 2012
'The Hobbit', Director Peter Jackson, 2012, Cinematographer Andrew Lesnie
'Pirates of the Caribbean 3: At the World's End', Director Gore Verbinski, Cinematographer Darius Wolski, 2007
'The Social Network', Director David Fincher, Cinematographer Jeff Cronenweth, 2011
'Star Wars 1: The Phantom Menace', Director George Lucas, Cinematographer Gail Tattersall, 1999
'Avatar', Director James Cameron, Cinematographer Mauro Fiore, 2009
'Anna Karenina', Director Joe Wright, Cinematographer Seamus McGarvey, 2012
'Doctor Zhivago', Director David Lean, Cinematographer Freddie Young, 1965
'Lincoln', Director Stephen Spielberg, Cinematographer Janusz Kaminski, 2012
'Cloud Atlas', Directors Lana Wachowski, Tom Tykwer, Andy Wachowski, Cinematographers Frank Griebe, John Toll, 2012
'Avatar 2, Avatar 3', Director James Cameron, Cinematographer Mauro Fiore, 2014, 2015