

## ***How We Came To Eye Tracking Animation: A Cross-Disciplinary Approach to Researching the Moving Image - Craig Batty, Claire Perkins, & Jodi Sita*** (<http://refractory.unimelb.edu.au/2015/02/06/batty-perkins-sita/>)

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### **Abstract**

*In this article, three researchers from a large cross-disciplinary team reflect on their individual experiences of a pilot study in the field of eye tracking and the moving image. The study – now concluded – employed a montage sequence from the Pixar film Up (2009) to determine the impact of narrative cues on gaze behaviour. In the study, the researchers' interest in narrative was underpinned by a broader concern with the interaction of top-down (cognitive) and bottom-up (salient) factors in directing viewers' eye movements. This article provides three distinct but interconnected reflections on what the aims, process and results of the pilot study demonstrate about how eye tracking the moving image can expand methods and knowledge across the three disciplines of screenwriting, screen theory and eye tracking. It is in this way both an article about eye tracking, animation and narrative, and also a broader consideration of cross-disciplinary research methodologies.*

### **Introduction**

Over the past 18 months, a team of cross-disciplinary researchers has undertaken a pilot eye tracking and the moving image study that has sought to understand where spectators look when viewing animation.[i] The original study employed eye tracking methods to record the gaze of 12 subjects. It used a Tobii X120 (Tobii Technology, 2005) remote eye tracking device which allowed viewers to watch the animation sequence on a widescreen PC monitor at 25 frames per second, with sound. The eye tracker pairs the movements of the eye over the screen with the stimuli being viewed by the participant. For each scene viewed, the researchers selected areas of interest; and for these areas, all of the gaze data, including the number and duration of each fixation, was collected and analysed.

Using a well-known montage sequence from the Pixar film *Up!* (2009), this pilot study focussed on narrative with the aim of discerning whether story cues were instrumental in directing spectator gaze. Focussing on narrative seemed to be useful in that as well as being an original line of enquiry in the eye tracking context, it also offered a natural connection between each of our disciplines and research experiences. The study did not take into account emotional and physiological responses from its participants as a way of discerning their narrative comprehension. Nevertheless, what we found from our data was that characters (especially their faces), key (narrative) objects and visual/scenic repetition seemed to be core factors in determining where they looked.[ii]

In the context of a montage sequence that spans around 60 years of story time, in which the death of the protagonist's wife sets up the physical and emotional stakes of the rest of the film, it was clear that narrative meaning relating to a character's journey/arc is

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important to viewers, more so (in this study) than peripheral action or visual style, for example. With regards to animation specifically, a form 'particularly equipped to play out narratives that solicit [...] emotions because of its capacity to illustrate and enhance interior states, and to express feeling that is beyond the realms of words to properly capture' (Wells, 2007: 127), the highly controlled nature of the sequence from which the data was drawn seems to suggest that animation embraces narrative techniques fully to control viewer attention.

In this article, three researchers from the team – A, a screenwriter, B, a screen scholar and C, an eye tracking neuroscientist – discuss the approaches they took to conducting this study. Each of us came to the project armed with different expertise, different priorities and a different set of expectations for what we might find out, which we could then take back to our individual disciplines. In this article, then, we purposely use three voices as way of teasing out our understandings before, during and after the study, with the aim of better understanding the potential for cross-disciplinary research in this area. Although other studies in eye tracking and the moving image have been undertaken and reported on, we suggest that using animation with a strongly directed narrative as a test study provides new information. Furthermore, few other studies to date have brought together traditional and creative practice researchers in this way.

What we present, then, is a series of interconnected discussions that draw together ideas from each researcher's community of thought and practice, guided by the overriding question: how did this study embrace methodological originality and yield innovative findings that might be important to the disciplines of eye tracking and moving image studies? We present these discussions in the format of individual reflections, as a way of highlighting each researcher's contributions to the study, and in the hope that others will see the potential of disciplinary knowledge in a study such as this one.

#### How 'looking' features in our disciplines, and what we might expect to 'see'

**Researcher A:** 'Looking' in screenwriting means two things: *seeing* and *reflecting on*. By this I mean that a viewer looks at the screen to see what is happening, whilst at the same time reflecting on what they are looking at from on a personal, cultural and/or political level. Some screenwriters focus on theme from the outset: on what they want their work to 'say' (see Batty, 2013); some screenwriters focus on plot: on what viewers will see (action) (see Vogler, 2007). What connects these is character. In Aristotelian terms, a character *does* and therefore *is* (Aristotle, 1996); for Egri, a character *is* and therefore *does* (Egri, 2004). The link here is that what we see on the screen (action) is always performed by a character, meaning that through a process of agency, actions are given meaning, feeding into the controlling theme(s) of the text. In this way, looking at – or seeing – is tied closely to understanding and the feelings that we bring to a text. As Hockley (2007) says, viewers are sutured into the text on an emotional level, connecting them and the text through the psychology of story space.

What we 'see', then, is meaning. In other words, we do not just *see* but we also *feel*. We look for visual cues that help us to understand the narrative unfolding before our eyes. With sound used to point to particular visual aspects and heighten our emotional states, we bestow energy and emotion in the visuality of the screen, in the hope that we will arrive at an understanding. As this study has revealed, examples include symbolic objects in the frame (the adventure book; the savings jar; the picture of Paradise Falls) that have narrative value in screenwriting because of the meaning they possess (Batty and Waldeback, 2008: 52-3). By seeing these objects repeated throughout the montage, we understand what they mean (to the characters and to the story) and glean a sense of how they will re-appear throughout the rest of the film as a way of representing the emotional space of the story.

Landscape is also something we see, though this is always in the context of the story world (see Harper and Rayner, 2010; Stadler, 2010). In other words, where is this place? What happens here? What cannot happen here? Characters belong to a story world, and therefore landscape also helps us to understand the situations in which we find them. This, again, draws us back to action, agency and theme: when we see landscape, we are in fact understanding why the screenwriter chose put their characters – and us, the audience – there in the first place.

**Researcher B:** In screen theory, looking is never *just looking* – never innocent and immediate. The act of looking is the gateway to the experience and knowledge of what is seen on screen, but also of how that encounter reflects the world beyond the screen and our place within it. Looking is over determined as *gazing*, *knowing* and *being*, endlessly

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charged by the coincidence of *eye* and *I* and of *real* and *reel*. Psychoanalytic theory imagines the screen as mirror and our identity as a spectatorial effect of recognizing ourselves in the characters and situations that unfold upon it, however refracted. Reception studies seeks out how conversely *real* individuals encounter content on screen, and how meaning sparks in that meeting—invented anew with every pair of eyes. Television studies emerges from an understanding of a fundamental schism in looking: where the cinematic apparatus enables a *gaze*, the televisual counterpart can (traditionally) only produce a broken and distracted *glance*.

All of these theories begin with the act of looking, and are enabled by it in their metaphors, methods and practices. But in no instance is looking attended to as anatomical vision – the process of the “meat and bones” body and brain rather than the metaphysical consciousness. As a scholar of screen theory, my base interest in eye tracking comes down to this “problem”. Is it a problem? *Should* the biology and theory of looking align? What effects and contradictions arise when they are brought together?

Phenomenological screen theory is a key and complex pathway into this debate, as an approach that values embodied experience, but discredits the ocular—seeking to bring the whole body to spectatorship rather than privilege the centred and distant subject of optical visibility (Marks, 2002: xvi). Vivian Sobchack names film ‘an expression of experience by experience ... an act of seeing that makes itself seen, an act of hearing that makes itself heard’ (Sobchack, 1992: 3). Eye tracking shows us the *act of seeing* – the raw fixations and movements with which screen content is taken in. In the study under discussion here it is this data that is of central interest, with our key questions deriving from what such material can verify about how narrative shapes gaze behaviour. A central question and challenge for me moving forward in this field, though, is to consider this process without ceding to ocularcentrism: that is, without automatically equating *seeing* to *knowing*. This ultimately means being cautious about reading gaze behaviour as ‘proof’ of what viewing subjects are thinking, feeling and understanding. This approach will be supported by the inclusion of further physiological measurements.

**Researcher C:** Interest in vision and how we see the world is an age-old interest, where it has been commonly held that the eyes are the windows to the mind. Where we look is then of great importance, as learning this offers us opportunities to understand more about where the brain wants to spend its time. Human eyes move independently from our heads and so our eyes have developed a specialised operating systems that both allows our eyes to move around our visual environment, and also counteract any movements the head may be making. This has led to a distinct set of eye movements we can study – *saccades* (the very fast blasts of movement that pivot our eye from focus point to focus point) – and *fixations* (brief moments of relative stillness where our gaze stops for a moment to allow the receptors in our eye to collect visual information). In addition, only a tiny area of the back of our eyeball, the fovea on the retina, is sensitive enough to gather highly ‘acuitive’ information, thus the brain must drive the eye around precisely in order to get light to fall onto this tiny area of the eye. As such, our eyes movements are an integral and essential part of our vision system.

Eye movement research has seen great advances during the last 50 years, with many early questions examined in the classic work of Buswell (1935) and Yarbus (1967). One question visual scientists and neuroscientists have been, and are still keen to, explore is why we look where we do: what is it about the objects or scene that draws our visual attention? Research over the decades has found that several different aspects are involved, relating to object salience, recognition, movement and contextual value (see Schütz et al., 2011). For animations that are used for learning purposes, Schnotz and Lowe (2008) discussed two major contributing factors that influence the attention-grabbing properties of features that make up this form. One is visuospatial contrast and a second is dynamic contrast; with features that are relatively large, brightly coloured or centrally placed, more likely to be fixated on compared to their less distinctive neighbours; and features that move or change over time drawing more attention.

Eye tracking research, which is now easier than ever to conduct, allows us to delve into examining how these and other features influence us, and is a unique way to gain access to the windows of the mind. Directing this focus to learning more about how we watch films, and in particular to animation, is what drove me to wanting to use eye tracking to better see how people experience these; and to delve into questions such as, what are people drawn to look at, and how might things like the narrative affect the way we direct our gaze?

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When looking around a visual world, our view is often full of different objects and we tend to drive our gaze to them so we can recognize, inspect or use them. Not so surprisingly, what we are doing (our task at hand) strongly affects how we direct our gaze; such that as we perform a task, our salience-based mechanisms seem to go offline as people almost exclusively fixate on the task-relevant objects (Hayhoe, 2000; Land et al., 1999). From this, one expectation we have when considering how viewers watch animation is that more than salient features, aspects relating to the narrative components of the viewer's understanding of the story will be the stronger drive. Another well-known drawcard for visual attention is towards faces, which tend to draw the eye's attention very strongly (Cerf et al., 2009; Crouzet et al., 2010). For animated films we were interested to see if similar effects would be observed.

Finally, another strong and interesting effect that has been discussed is a tendency for people to have a central viewing bias, in which a large effect on viewing behaviour has been shown to be that people tend to fixate in the centre of a display (Tatler and Vincent, 2009). As this study was moving image screen based, we were keen to compare different scenes and how the narrative affected this tendency.

### **How we came to the project, and what we thought it might reveal**

**Researcher A:** From a screenwriting perspective, I was excited to think that at last, we might have data that not only privileges the story (i.e., the screenwriter's input), but that also highlights the minutiae of a scene that the screenwriter is likely to have influenced. This can be different in animation than in live action, whereby a team of story designers and animators actively shape the narrative as the 'script' emerges (see Wells, 2010). Nevertheless, if we follow that what we see on screen has been imagined or at least intended by a 'writer' of sorts – someone who knows about the composition of screen narratives – then it was rousing to think that this study might provide 'evidence' to support long-standing questions (for myself at least) of writing for the screen and authorship. Screenwriters work in layers, building a screenplay from broad aspects such as plot, character and theme, to micro aspects such as scene rhythm, dialogue and visual cues. Being able to 'prove' what viewers are looking at, and hoping that this might correlate with a screenwriting perspective of scene composition, was very appealing to me.

I was also interested in what other aspects of the screen viewers might look at, either as glances or as gazes. In some genres of screenwriting, such as comedy, much of the clever work comes around the edges: background characters; ironic landscapes; peripheral visual gags, etc. From a screenwriting perspective, then, it was exciting to think that we might find ways to trace who looks at what, and if indeed the texture of a screenplay is acknowledged by the viewer. The study would be limited and not all aspects could be explored, but as a general method for screen analysis, simply having ideas about what might be revealed led to some very interesting discussions within the team.

**Researcher B:** All screen theories rest upon a fundamental assumption that different types of content, and different viewing situations, produce different viewing behaviours and effects. Laura Mulvey's famous theory of the gaze stipulates that classical Hollywood cinema and the traditional exhibition environment (dark cinema, large screen, audience silence) position men as bearers of the look and women as objects of the look, and that avant-garde cinemas avoid this configuration (Mulvey, 1975). New theories of digital cinema speculate upon whether a spectator's identification with an image is altered when it bears no indexical connection to reality; that is, when the image is a simulated collection of pixels rather than the trace of an event that once took place before a camera (Rodowick, 2007). The phenomenological film theory of Laura Marks suggests that certain kinds of video and multimedia work can engender haptic visuality, where the eyes function like 'organs of touch' and the viewer's body is more obviously involved in the process of seeing that is the case with optical visuality (Marks, 2002: 2-3). It made sense to begin our study into eye tracking by thinking about these different assumptions regarding content and context and formulating methods to analyse them empirically.

For our first project we chose to focus on an assumption regarding spectatorship that is more straightforward and essential than any listed above: namely that viewers can follow a story told only in images. This is an assumption that underpins the ubiquitous presence of the montage sequence in narrative filmmaking, where a large amount of story information is presented in a short, dialogue-free sequence. We hypothesized that by tracking a montage sequence we would be able to ascertain if and how viewers looked at narrative cues, even when these are not the most salient (i.e., large, colourful, moving)

features in the scene. The study was in this way designed to start investigating how much film directors and designers can control subjects' gaze behaviour and top-down (cognitively driven) processes.

The sequence from *Up!* was chosen in part to act as a 'control' against which we could later assess different types of content. The story told in the 4-minute sequence is complex but unambiguous, with its events and emotive power linked by clear relationships of cause and effect. It is in this way a prime example of a classical narrative style of filmmaking, where the emphasis is on communicating story information as transparently as possible (Bordwell, 1985: 160). Our hypothesis was that subjects' gaze behaviour *would* be controlled by the tightly directed sequence with its strong narrative cues, and that this study could thereby function as a benchmark against which different types of less story-driven material could be compared later.

**Researcher C:** A colleague and I set up the Eye Tracking and the Moving Image (ETMI) research group in 2012, following discussions around how evidence was collected to support and investigate current film theory. These conversations grew into a determination to begin a cross-disciplinary research group, initially in Melbourne, to begin working together on these ideas. I had previously been involved in research using eye tracking to study other dynamic stimuli such as decision making processes in sport and the dynamics of signature forgery and detection, and my experience led to a belief that the eye tracker could have enormous potential as a research tool in the analysis and understanding of the moving image. Work on this particular study was inspired by the early aims of a subgroup (of which the other authors are a part), whose members were interested to investigate, in a more objective manner, the effect that narrative cues had on viewer gaze behaviour.

### **Existing research in our disciplines, and how that influenced our approaches to the study**

**Researcher A:** While there had been research already conducted on eye tracking and the moving image, none of it had focussed on the creational aspects of screen texts: what goes into making a moving image text, before it becomes a finished product to be analysed. Much like screen scholarship that studies in a 'post event' way, what was lacking – usefully for us – was input from those who are practitioners themselves. The wider Melbourne-based Eye Tracking and the Moving Image research group within which this study sits has a membership that includes other practitioners, including a sound designer and a filmmaker. Combined, this suggested that our approach might offer something different; that it might 'do more' and hopefully speak to the industry as well as other researchers. As a screenwriter, the opportunity to co-research with scholars, scientists and other creative practitioners was therefore not only appealing, but also methodologically important.

As already highlighted, it was both an academic and a practical interest in the intersection of plot, character and theme that underpinned my approach. As Smith has argued, valuing character in screen studies has not always been possible (1995); moving this forward, valuing character, and in particular the character's journey, has recently become more salient (see Batty, 2011; Marks, 2009), adding weight to a creative practice approach to screen scholarship. In this way, understanding the viewer's experience of the screen seemed to lend itself well to some of the core concerns of the screenwriter; or to put it another way, had the ability to test what we 'know' about creative practice, and the role of the practitioner. Feeding, then, into wider debates about the place of screenwriting in the academy (see Baker, 2013; Price, 2013; 2010), it was important to value the work of the screenwriter, and in a scholarly rigorous – and hopefully innovative – way.

**Researcher B:** The majority of research on eye tracking and the moving image to date has been designed and undertaken as an extension to cognitive theories of film comprehension. Deriving from the constructivist school of cognitive psychology, and led by film theorist David Bordwell, this approach argues that viewers do not simply absorb but *construct* the meaning of a film from the data that is presented on screen. This data does not constitute a complete narrative but a series of cues that viewers process by generating inferences and hypotheses (Elsaesser and Buckland, 2002: 170). Bordwell's approach explicitly opposes psychoanalytic film theory by attending to perceptual and cognitive aspects of film viewing rather than unconscious processes. Psychologist Tim Smith has mobilized eye tracking in connection with Bordwell's work to demonstrate how

this empirical method can “prove” cognitive theories of comprehension—showing that subjects’ eyes do fixate on those cues in a film’s mise-en-scène that the director has controlled through strategies of staging and movement (Smith, 2011; 2013).

The *Up* study was designed to follow in the wake of Smith’s work, with a particular interest in examining the premise of Bordwell’s theory – which is that narration is the central process that influences the way spectators understand a narrative film (Elsaesser and Buckland, 2002: 170). With this in mind, we deliberately chose a segment from an animated film, where the tightly directed narrative of the montage sequence is competing with a variety of other stimuli that subjects’ eyes could plausibly be attracted to: salient colourful and visibly designed details in the background and landscape of each shot.

We were also interested in this montage sequence for the highly affecting nature of its mini storyline, which establishes the protagonist Carl’s deep love for his wife Ellie as the motivation for his journey in *Up!* itself. The sequence carries a great deal of emotive power by contrasting the couple’s happiness in their long marriage with Carl’s ultimate sadness and regret at not being able to fulfill their life-long dream of moving to South America before Ellie falls sick and dies. Would it be possible to ‘see’ this emotional impact in viewers’ gaze behaviour?

#### **How we reacted to the initial data, and what it was telling us.**

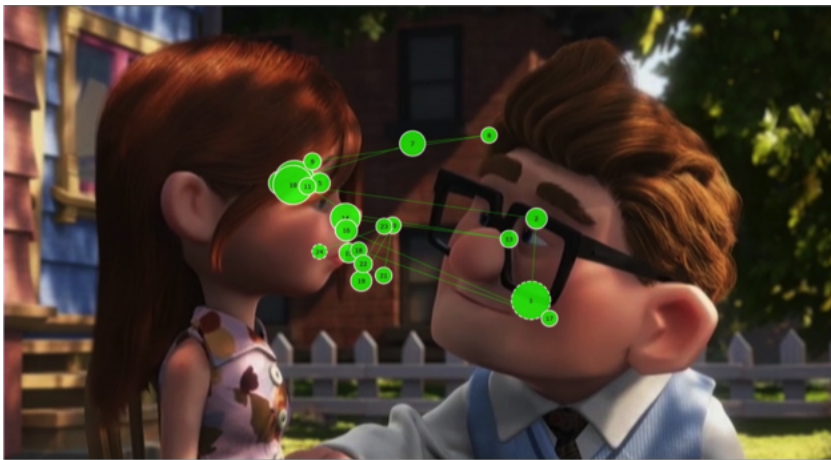
**Researcher A:** When looking at data for the first time, I certainly saw a correlation between what we know about screenwriting and seeing, and what we could now turn to as evidence. For example, key objects such as the adventure book, the savings jar (see Fig. 1) and the picture of Paradise Falls – all of which recurred throughout the montage sequence – were looked at by viewers intensely, suggesting that narrative meaning was ‘achieved’.



(<http://refractory.unimelb.edu.au/wp-content/uploads/2015/02/Fig-1-Batty-et-al.png>)

Fig. 1. A heat map showing the collective intensity of viewers’ responses to the savings jar.

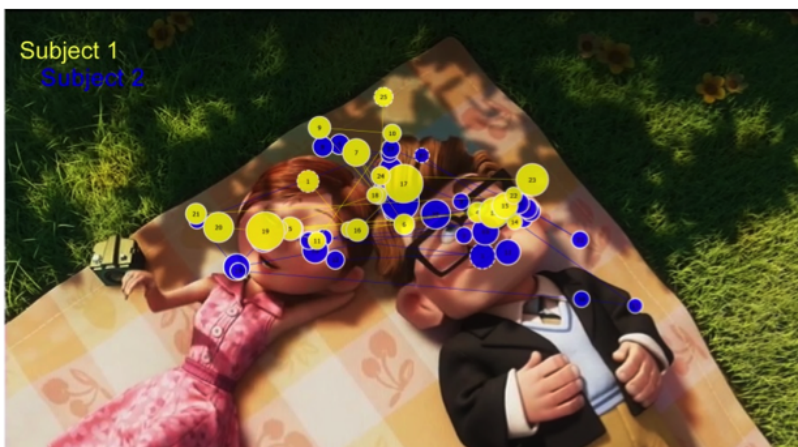
As another example, when characters were purposely (from a screenwriting perspective) separated within the frame of the action, viewers oscillated between the two, eventually settling on the one they believed to possess the most narrative meaning (see Fig. 2). This further implied the importance of the character journey and its associated sense of theme, which for screenwriting verifies the careful work that has gone into a screenplay to set up narrative expectations.



(<http://refractory.unimelb.edu.au/wp-content/uploads/2015/02/Fig-2-Batty-et-al.png>)  
 Fig. 2. A gaze plot showing the fixations and saccades of one viewer in a scene with the prominent faces of Carl and Ellie.

**Researcher B:** We chose to analyse the data on *Up!* by examining how viewer attention fluctuated in focus between Carl and Ellie across the course of the montage sequence. The two are equal agents in the narrative at the beginning, but the montage's story unfolds through the action and behaviour of each as it continues – that is, each character carries the story at different points. Overwhelmingly, the data supported this narrative pattern by showing that the majority of viewers fixated on the character who, moment by moment, functions as the agent of the story, even when that figure is not the most salient aspect of the image. Aligning with Bordwell's cognitive theory of comprehension, this data confirms that viewers do rely principally on narrative cues to understand a film. As a top-down process of cognition, narrative exerts control over viewer attention to keep focus on the story rather than let the gaze wander to other bottom-up (salient) details in the mise-en-scène. It is this process that allowed Smith to show that viewers overwhelmingly will not notice glaring continuity errors on screen (Smith, 2005). As in the famous 'Gorillas in our Midst' experiment (Simons and Chabris, 1999), viewer attention is focused so closely on employing narrative schema to spatially, temporally and causally linked events that the salient stimuli on screen appears to be completely missed.

**Researcher C:** Initially I was quite interested to see the attention paid to faces, and in particular, characters' eyes and mouths. Being animation, I had been keen to see if similar elements of faces would draw viewers' eyes in the same ways that we look at human faces, where eyes and mouths are most viewed (Crouzet, et al., 2010). Here, even though the characters were not engaging in dialogue, their mouths as well as their eyes were still searched. Looking at eyes has been linked to looking for contextual emotional information (Guastella et al., 2007), and so with this montage sequence being non-verbal, it was not surprising to see much of the focus on characters' eyes as viewers attempted to read the emotion through them (see Fig. 3).



(<http://refractory.unimelb.edu.au/wp-content/uploads/2015/02/Fig-3-Batty-et-al.png>)  
 Fig. 3. Two viewers' gaze plots depicting the sequence of fixations made between Carl and Ellie.

Other areas I was interested to observe were instances when other well-known features drew strong viewer attention, such as written text and bright (salient) objects. Two particular scenes we examined contained examples of these. In one scene, in which the

savings jar sits at the back of a dark bookshelf, viewers were both drawn to look at the bright candle in the foreground and also to the savings jar. The jar was in the dark, however with narrative cues to draw attention to it as well as the fact that it contained text, viewers were drawn to look at it (see Fig. 1). Surprisingly, in this scene other interesting objects are easily discernible – a wooden colourful bird figure; a guitar; a compass – yet the savings jar as well as the bright candles were viewed. The contextual information, the text and the salience appear to be working here to drive the eye, all within a few seconds of time.



(<http://refractory.unimelb.edu.au/wp-content/uploads/2015/02/Fig-4-Batty-et-al.png>)

Fig. 4. Gaze plots of fixations made by all viewers over the scene in which Carl purchases airline tickets.

The second scene to see text working as a cue for the eye was in the travel shop scene (Fig. 4). Here, viewers were drawn to look at two text-based posters placed on the back wall of the shop. Again, this scene was only shown momentarily, yet glances towards the text and images, as well as the exchange between the characters, give viewers the elements of the story they need to glean so that they know what is going on, and where the story will go next (Carl's surprise for Ellie).

#### **How over time we better understood the data, and what we began to know more**

**Researcher A:** I was interested to see that some viewers spent time looking at the periphery. The *Up!* montage sequence did not necessarily offer 'alternative' layers in the margins of the screen, though given its created and controlled animated nature, it perhaps should not be a surprise that away from the centre of the screen there were visual delights, such as the sun setting over the city and a blanket of clouds that changed shape, from clouds to animals to babies. This suggested to me that in animation, because viewers know that images have been created from scratch, there is an expectation that the screen will offer a plethora of experiences, from narrative agency to visual amplification. This, in turn, suggested that in further studies, it might be useful to contrast texts that use the potential of the full screen to engage viewers with those that go in close and privilege the centre. Genre would most likely play a key role in this future endeavour.

**Researcher B:** As hoped, this pilot study has been instructive as a base from which we can now expand. It has raised many questions. One issue is that this data cannot 'prove' subjects were not seeing those elements on-screen that were not fixated upon – were they perhaps seeing them peripherally? This could only be confirmed by conducting interviews after the eye tracking takes place, and could instructively inform an understanding of how story information that is layered in the *mise-en-scène* (for instance in setting, lighting and costume) contributes to overall narrative comprehension. We are also very interested to determine how the context of viewing affects gaze behaviour. For instance, would subjects still fixate overwhelmingly on narrative cues when watching this sequence in a cinema environment on a large – even an IMAX – screen? In this environment the image on screen is larger and the texture more palpable. Would viewers here perhaps be more focused on these salient pleasures of the image and engage in a different, less cognitive experience of the film; letting their eyes roam across the *grain* of the shot in its colours, shapes and surfaces? Would results alter between an animated and live action film? Psychoanalytic film theory tells us that the cinematic apparatus promotes identification with characters and, by extension, the ideologies of the social



system from which they are produced (Mulvey, 1975). Eye tracking can potentially intervene in this powerful theory of spectatorship by showing if and how viewers do fixate on the cues that give rise to this interpellation.

**Researcher C:** After looking at some of early scene analyses, I was somewhat surprised by how many eye movements could be made in fleetingly fast scenes, and at how many items in these scenes one could fixate on, if only briefly. I had expected viewers to be taking in some of the surrounding items in a scene using their peripheral vision, and to see more of the centralisation bias (Tatler and Vincent, 2009). Yet for some scenes, in particular for the two scenes in which Carl purchases the surprise airline tickets (see Figs 4 and 5), we see how viewers were drawn to search for narrative clues by looking around the scene.



(<http://refractory.unimelb.edu.au/wp-content/uploads/2015/02/Fig-5-Batty-et-al.png>)  
Fig. 5. Gaze plot showing the fixations made by all viewers as they briefly see the contents of the picnic basket.

In the first scene (see Fig. 4), Carl is seen in a shop, facing the shop assistant. Viewers had previously seen him in the midst of coming up with a bright idea. This scene thus gives the viewer a chance to work out what his idea was. What can be seen is that most viewers scanned the surrounds for clues. A similar pattern is seen in the next scene, in which we quickly glance at the contents of a picnic basket being carried by Carl (see Fig. 5). In the basket, which is seen close up, viewers scan the basket's contents. It contains picnic items and the surprise airline ticket, and even though some glances went to other basket items, it was the ticket that captured most of the attention; the item that held the most narrative information. This item was also the most salient, being the clearest and brightest item in the basket, and, importantly, the only item to contain written text. In a very short glimpse of a scene, these features almost ensured that viewers' eyes were directed to look at and acknowledge the ticket.

#### **What excites us about the future of work in this area, and where we think it might take our own disciplines**

**Researcher A:** If we are to fully embrace the creative practice potential of studies such as this, then we might look to creating new texts that can then be studied. If, in 1971, Norton and Stark created simple drawings to test how their subjects recognised and learned patterns, then over 40 years later, our approach might be to develop a short moving image narrative through which we can test our viewers' gaze. For example, if we were to develop a short film and play it out of sequence (i.e., narrative meaning altered), might we affect where viewers look? Might they look differently: in different places and for different lengths of time? Similarly, what if we were to musically score a text in different ways, diegetically and non-diegetically? Might we affect the focus of viewer gaze? If so, what might this tell us about narrative attention and filmmaking techniques that sit 'beyond the screenplay'?

For screenwriting as a discipline, studies such as these would serve two purposes, I feel. Firstly, they would help to strengthen the presence of screenwriting in the academy, especially in regard to innovative research that privileges the role of the practitioner. Accordingly, these studies could provide a variety of methodological approaches that might be of use to other screenwriting scholars; or that might be applied to other creative practice disciplines, in which researchers wish to understand the work that has gone into the creation of a text that might otherwise only be studied once it has been completed. Secondly, and perhaps more importantly, such studies might yield results that benefit, or

at least inform, future screenwriting practices. Whether industry-related practices or otherwise, just like all 'good' creative practice research, the insights and understandings gained would contribute to the discipline in question in the form of 'better' or 'different' ways of doing (Harper, 2007). For me, this would reflect both the nature and the value of creative practice research.

**Researcher B:** All of the potential avenues for future research in this field take an essential interest in how moving images on screen produce a play between top-down and bottom-up cognition. In this, a larger issue for me – going back to the points I raised at the beginning of my section – is how the data can be mobilized beyond a strictly cognitive framework and vocabulary of screen theory. As indicated, the cognitive approach offers a deliberately 'common sense' counterpart to a paradigm such as psychoanalysis, with its reliance on myth, desire and fantasy (Elsaesser and Buckland, 2002: 169). Cognitive theory understands a film as a data set that a viewer's brain processes and completes in an active construction of meaning – an understanding that eye tracking and neurocinematics is very well placed to support and expand. But most screen scholars appreciate and theorize film and television texts as much more than mere sets of data. The moving image is an experience that only 'works' by generating emotional affect, by engaging the viewer's attachments, memories, desires and fears. Film theorist Linda Williams proposes that our investment in following the twists and turns of a narrative is fundamentally reliant upon the emotion of pathos: we continually, pleasurably invest in the expectation that a character will act or be acted upon in such a way that they achieve their goal, and continually, pleasurably have that expectation obscured and dashed by the story (Williams, 1998). So viewer attention is driven not just by a drive to *know* but also by a desire to *feel*: to be swept up in waves of hope and disappointment.

The mini storyline of the *Up!* montage sequence relies entirely on this dialectic of action and pathos. Carl and Ellie's hopes are repeatedly frustrated, and Carl is finally unable to redeem this pattern before Ellie dies – producing a profound sense of pathos and regret as the defining theme of the sequence. We can see that our subjects' fixations fell in line with this pattern as the sequence unfolded, consistently focusing on the character who was triggering or carrying the emotional power. But how do we distinguish the 'felt' dimension of this gaze out from the viewer's efforts to simply comprehend what is happening by following characters' movements, facial expressions or body language? How, that is, can we 'see' emotional engagement, and start to appreciate how this crucial dimension of spectatorship – based on *feeling* not *thinking* – governs the play between top-down and bottom-up cognition in moving pictures? For me, grappling with this problem – and perhaps experimenting with further measurements of pupil dilation, heart rate and brain activity – offers a fascinating pathway into understanding how eye tracking can move beyond an engagement with cognitive film theory to contribute to phenomenological thinking on genuinely embodied seeing and experience.

**Researcher C:** There is so much that can be done in this area, and that makes it an exciting pursuit; yet what makes it even more motivating is the way that we hope to go about it: collaboratively. One of the core aspects that members of ETMI are very passionate about is working together, bringing in different fields, different disciplines, different ways of seeing things, and building bridges between them. This work is not only about learning more about how we watch and interact with films, but also about having different perspectives on those insights. Work I would personally like to see undertaken in this way is to explore how black and white viewing compares to colourised viewing, and to explore whether and how 3D viewing affects how we gaze about a scene. To compare the gaze and emotional responses of children and adults to the same visual content, and similarly compare visual and emotional responses to material between males and females, and between genre fans and haters, is also an interesting possibility.

Finally, adding to these, I am excited about the potential collection and analysis of other physiological measures to better gauge emotional engagement. These include blood pressure, pupillometry, skin conduction, breathing rate and volumes, heart rate, sounds made (gasps, holding breath, sighs etc.) and facial expressions made.

## Conclusion

By reflecting on each of our research backgrounds, experiences and expectations, what this article has revealed is that while we might have all come to the study with varied approaches and intentions, we have come out of the study with a somewhat surprisingly harmonious set of observations and conclusions. Without knowing it, perhaps, we were all interested in narrative and the role that characters play in the agency of it. We were

also similarly interested in landscape and the visual potential of the screen; not in an obvious way, but in relation to subtext, meaning and emotion. The value of a study like this, then, lies not just in its methodological originality, but also in its ability to stir up passions in cross-disciplinary researchers, whereby each can bring to the table their own skills and ways of understanding data to reach mutual and respective conclusions. Although we 'knew' this from undertaking the study, the opportunity to reflect fully on the process in the form of an article has given us an even greater understanding of the collaborative potential of cross-disciplinary researchers such as ourselves.

## References

- Aristotle. (1996). *Poetics*. Trans. Malcolm Heath. London: Penguin.
- Baker, Dallas. (2013). Scriptwriting as Creative Writing Research: A Preface. In: Dallas Baker and Debra Beattie (eds.) *TEXT: Journal of Writing and Writing Courses*, Special Issue 19: Scriptwriting as Creative Writing Research, pp. 1-8.
- Batty, Craig, Adrian G. Dyer, Claire Perkins and Jodi Sita. (Forthcoming). Seeing Animated Worlds: Eye Tracking and the Spectator's Experience of Narrative. In: CarrieLynn D. Reinhard and Christopher J. Olson (eds.). *Making Sense of Cinema: Empirical Studies into Film Spectators and Spectatorship*. New York: Bloomsbury.
- Batty, Craig. (2013) Creative Interventions in Screenwriting: Embracing Theme to Unify and Improve the Collaborative Development Process. In: Shane Strange and Kay Rozynski. (eds.) *The Creative Manoeuvres: Making, Saying, Being Papers – the Refereed Proceedings of the 18th Conference of the Australasian Association of Writing Programs*, pp. 1-12.
- Batty, Craig. (2011). *Movies That Move Us: Screenwriting and the Power of the Protagonist's Journey*. Basingstoke: Palgrave Macmillan.
- Batty, Craig and Zara Waldeback. (2008). *Writing for the Screen: Creative and Critical Approaches*. Basingstoke: Palgrave Macmillan
- Bordwell, David. (1985). *Narration in the Fiction Film*. London: Routledge.
- Buswell Guy. T. (1935). *How People Look at Pictures*. Chicago: Chicago University Press.
- Cerf, Moran, E. Paxon Frady and Christof Koch. (2009). Faces and text attract gaze independent of the task: Experimental data and computer model. *Journal of Vision*, 9(12): 10, pp. 1–15.
- Crouzet, Sebastien M., Holle Kirchner and Simon J. Thorpe. (2010). Fast saccades toward faces: Face detection in just 100 ms. *Journal of Vision*, 10(4): 16, pp. 1–17.
- Egri, Lajos. (2004). *The Art of Dramatic Writing*. New York: Simon & Schuster.
- Elsaesser, Thomas and Warren Buckland. (2002). *Studying Contemporary American Film: A Guide to Movie Analysis*. London: Hodder Headline.
- Guastella, Adam J., Philip B. Mitchell and Mark R Dadds. (2008). Oxytocin increases gaze to the eye region of human faces. *Biological Psychiatry*, 63, pp. 3-5.
- Harper, Graeme and Jonathan Rayner. (2010). *Cinema and Landscape*. Bristol: Intellect.
- Harper, Graeme. (2007). Creative Writing Research Today. *Writing in Education*, 43, p. 64-66.
- Hayhoe, Mary. (2000). Vision using routines: A functional account of vision. *Visual Cognition*, 7, pp. 43–64.
- Hockley, Luke. (2007). *Frames of Mind: A Post-Jungian Look at Cinema, Television and Technology*. Bristol: Intellect.
- Land, Michael F., Neil Mennie and Jennifer Rusted. (1999). The roles of vision and eye movements in the control of activities of daily living. *Perception*, 28, pp. 1311–1328.
- Marks, Dara. (2009). *Inside Story: The Power of the Transformational Arc*. London: A&C Black
- Marks, Laura U. (2002). *Touch: Sensuous Theory and Multisensory Media*. Minneapolis: University of Minnesota Press.
- Mulvey, Laura. (1975). Visual Pleasure and Narrative Cinema. *Screen*, 16(3), pp. 6-18.

Norton, David, and Lawrence Stark. (1971). Scanpaths in eye movements during pattern perception. *Science*, 171, pp. 308–311.

Price, Steven. (2013). *A History of the Screenplay*. Basingstoke: Palgrave Macmillan.

Price, Steven. (2010). *The Screenplay: Authorship, Theory and Criticism*. Basingstoke: Palgrave Macmillan.

Rodowick, David. (2007). *The Virtual Life of Film*. Cambridge, MA: Harvard University Press.

Schnotz, Wolfgang and Richard K. Lowe. (2008). A unified view of learning from animated and static graphics. In: Richard K. Lowe and Wolfgang Schnotz (eds.). *Learning with animation: Research implications for design*. New York: Cambridge University Press, pp. 304-356.

Schütz, Alexander C., Doris I. Braun and Karl R. Gegenfurtner. (2011). Eye movements and perception: A selective review. *Journal of Vision*, 11(5), pp. 9, 1–30.

Simons, Daniel J. and Christopher F. Chabris. (1999). Gorillas in our Midst: Sustained Inattentive Blindness for Dynamic Events. *Perception*, 28, pp. 1059-1074.

Smith, Murray (1995). *Engaging Characters: Fiction, Emotion, and the Cinema*. Oxford: Oxford University Press.

Smith, Tim J. (2005). An Attentional Theory of Continuity Editing ([https://www.era.lib.ed.ac.uk/bitstream/1842/1076/1/smith\\_ATOCE\\_0506.pdf](https://www.era.lib.ed.ac.uk/bitstream/1842/1076/1/smith_ATOCE_0506.pdf)). [accessed October 17, 2014].

Smith, Tim J. (2011). Watching You Watch (<http://www.davidbordwell.net/blog/2011/02/14/watching-you-watch-there-will-be-blood/>) *There Will Be Blood*. [accessed August 22, 2014].

Smith, Tim J. (2013). Watching you watch movies: Using eye tracking to inform cognitive film theory. In: A. P. Shimamura (ed.). *Psychocinematics: Exploring Cognition at the Movies*. New York: Oxford University Press, pp. 165-191.

Sobchack, Vivian (1992). *The Address of the Eye: A Phenomenology of Film Experience*. Princeton, N.J: Princeton University Press.

Stadler, Jane (2010). Landscape and Location in Australian Cinema. *Metro*, 165.

Tatler, Benjamin W., and Benjamin T. Vincent. (2009). The prominence of behavioural biases in eye guidance. *Visual Cognition*, 17, pp. 1029–1054.

Tobii Technology (2005). User Manual. *Tobii Technology AB*. Danderyd, Sweden.

Vogler, Christopher (2007). *The Writer's Journey: Mythic Structure for Writers*. Studio City, CA: Michael Wiese Productions.

Wells, Paul (2010). Boards, Beats, Binaries and Bricolage – Approaches to the Animation Script. In: Jill Nelmes (ed.) *Analysing the Screenplay*, Abingdon: Routledge, pp. 104-120.

Wells, Paul (2007) *Basics Animation 01: Scriptwriting*. Worthing: AVA Publishing.

Williams, Linda (1998). Melodrama Revised. In: Nick Browne (ed.). *Refiguring American Film Genres: History and Theory*. Berkeley, CA: University of California Press.

Yarbus, Alfred L. (1967). *Eye Movements and Vision*. New York: Plenum.

## List of figures

Fig. 1. A heat map showing the collective intensity of viewers' responses to the savings jar. Source: author study.

Fig. 2. A gaze plot showing the fixations and saccades of one viewer in a scene with the prominent faces of Carl and Ellie. Source: author study.

Fig. 3. Two viewers' gaze plots depicting the sequence of fixations made between Carl and Ellie. Source: author study.

Fig. 4. Gaze plots of fixations made by all viewers over the scene in which Carl purchases airline tickets. Source: author study.

Fig. 5. Gaze plot showing the fixations made by all viewers as they briefly see the contents of the picnic basket. Source: author study.

## Notes

[i] A full analysis of this study, 'Seeing Animated Worlds: Eye Tracking and the Spectator's Experience of Narrative', will appear in the forthcoming collection *Making Sense of Cinema: Empirical Studies into Film Spectators and Spectatorship*, edited by CarrieLynn D. Reinhard and Christopher J. Olson.

[ii] See Batty, Craig, Dyer, Adrian G., Perkins, Claire and Sita, Jodi (forthcoming) for full results.

## Bios

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**Dr Jodi Sita** is Senior Lecturer in the School of Allied Health at the Australian Catholic University. She works within the areas of neuroscience and anatomy, with expertise in eye tracking research. She has extensive experience with multiple project types using eye tracking technologies and other biophysical data. As well as her current research using into viewer gaze patterns while watching moving images, she is using eye tracking to examine expertise in Australian Rules Football League coaches and players, and to examine the signature forgery process.



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