

### **Catherine Baker**

School of Art & Design  
Norwich University College of the Arts  
c.baker@nuca.ac.uk

**Abstract:** The traditions of drawing most commonly involve a three way process between the eye, brain and hand. However such a restricted view can deny the possibility of interpreting drawing within a wider domain; beyond process and as a performative act that embraces methodology found within disciplines beyond the creative arts. Scientific methodology and technological advances have made it possible for artists to develop new ways of interpreting the language of drawing through an exploration of an engagement between world, mind and body operating in space and time. In essence this paper seeks to present an overarching idea relating to the role of physical movements as drawing; questioning the conventions of drawing as a traditional three-way process combined in the act of making marks upon a given surface. This paper will present my own drawing practice and those of contemporary British artists Claude Heath and James Wood whilst positioning the works of key international artists Richard Long and Hamish Fulton for their early contribution to what would become an established genre. In particular the relationship between art and phenomenological experiences of place will be introduced taking into account the value of *experience* within the production of art. In addition the philosophical notion of absence and presence within perception will be briefly referenced within the context of the artworks outlined.

**Key words:** Drawing, eye tracking, perception, scanpath, vision

## **Tracing the Physical**

### **Introduction**

Drawing, as a tool and method of expression, possesses an almost unique quality of comprehensibility. From a very young age we are able to grasp the conventions of drawing and typically actively engage in the interpretation and production of drawings. At its most conventional, drawing is the making of marks on paper, however such a narrow conception of drawing belies the complexity of the processes involved. Our scientific understanding of drawing processes and particularly the active way in which we interact with visual material suggests that drawing itself is occurring as our eyes move over a scene. This paper attempts to position this theoretical notion by discussing scientific methods available to artists and reporting on individual and collaborative practices that can be used to map our unique interaction with the world and examine our responses to it.

### **Autonomy**

Historically drawing has been considered to be a preparatory stage of artistic production or as a by-product of the process of making. Over the years many authors from Ruskin to De Zegher have written about the importance of drawing within particular genres and eras. However most seem to agree that since the mid 1990's drawing has emerged as an autonomous subject within the creative disciplines. As a result the topic has received greater theoretical consideration

and in turn this has provided a platform for artists to explore new approaches to the discipline. Many still work within the conventions of drawing as even the so-called 'simple' graphite pencil has an enormous range and can respond in sophisticated ways to the intentions of the maker. Drawings' history 'as an under-regarded and under-theorized backwater that gave artists freedom, allowing the field to be open for artists to make of it what they chose' Dexter (2005) paved the way for artists to reinvent the subject using new technologies and approaches. There is still an on-going debate regarding what constitutes drawing practice; questions regarding an agenda for drawing will likely be raised. In the introduction to *Writing on Drawing* (2008), Steve Garner writes about the problems regarding drawing as a distinctive domain.

Drawing practice and drawing research are increasingly viewed as symbiotic. Traditional boundaries, such as between art and design, have been eroded. Today drawing is of interest to communities in computer science, history, psychology and education as well as the fine arts. But if drawing is to emerge as a distinct domain those who operate within it need somehow to document its corpus of knowledge. In short we need a map: to chart relationships between disparate drawing fields, to facilitate communication, to suggest borders where the drawing world abuts the worlds of other disciplines, and to suggest where we might or should explore. (p.13)

Indeed the act of drawing traverses many disciplines as seen in exhibitions such as *Lines of Enquiry: thinking through Drawing* held at Kettles Yard, University of Cambridge (2006) where the works of physicists, surgeons, geologists and mathematicians were exhibited alongside those of international artists such as Mark Wallinger and Claude Heath. This exhibition addressed drawing as a means-to-an-end, each of the exhibited drawings was 'a working sketch' a diagram in many ways, an explanation or part of a larger project or enquiry. This exhibition could be seen to undermine the autonomy of drawing; does it position the status of drawing as a preparatory stage and therefore somehow less important? Or does it highlight the interest in drawing from a wider field of disciplines and acknowledge the role of collaboration between artists and other professions?

### **Drawing and Looking**

Historically drawing is often allied with looking both in critical texts, and within and beyond the drawing studio. Indeed the instruction I received as a student supports this statement and there are artists worldwide whose primary concerns are vision and the act of looking. British artist Claude Heath produced a series of works dependant on the relationship between the eye and the brain in order for them to be fully realized. Figure I illustrates a drawn installation in which the viewer is required to look through a stereoscopic viewing device mounted atop a tripod. After a short while of looking into the viewer the marks upon the walls suddenly shift from being 'wall mounted' to occupying the space within the room; the drawing becomes three-dimensional through the act of looking. Curiously Heath spent a number of years dedicated to drawing without sight. He produced a substantial body of work blind-folded using only his 'internal-vision' and touch to navigate his way around the working surface of both the object and the drawing support. At the end of Heath's residency at Kettle's Yard, Mel Gooding, art critic and writer wrote for the exhibition publication and concentrated much of his essay on looking 'As time goes by, the very way we look at the world is subject to continuous modification, sometimes subtle and imperceptible, at certain moments drastic and surprising: we are constantly seeing things differently'.



Figure I. © Claude Heath 2006-7 Image courtesy of the artist

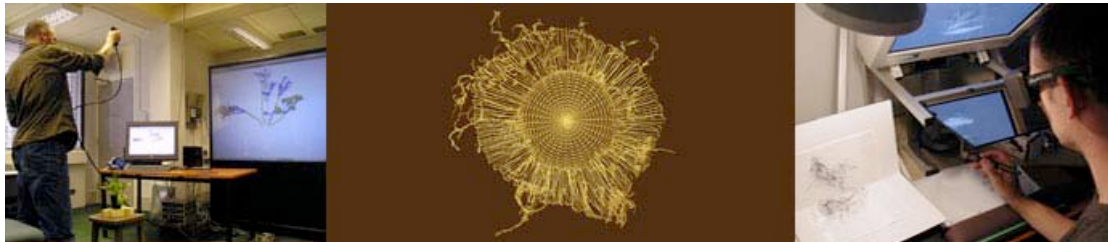


Figure II. © Claude Heath. Image courtesy of the artist

In 2006 Heath worked with a team from Edinburgh School of Art and The University of Leeds using a system developed by computer scientists for drawing in space (see figure II). Artists such as Heath and Jeremy Wood, whose work will be introduced later in this paper, have been inspired to adapt technologies used within scientific domains. Indeed my own research over the past six years working with a scientist from the University of Bristol has been similarly inspirational. Early in this period I came across statements which seemed so poetic and were able to articulate my working thoughts perfectly that I believed they were written by artists possessing in depth knowledge of the relations between drawing and looking. However the truth is that the most poignant and accurate writing about drawing and looking for me has come mostly from scientists and philosophers. In his seminal text *Visual Thinking*, Arnheim writes:

In looking at an object we reach out for it. With an invisible finger we move through the space around us, go out to distant places where things are found, touch them, catch them, scan their surfaces, trace their borders, explore their texture. It is an eminently active occupation. Impressed by this experience, early thinkers described the physical process of vision accordingly, for example, Plato in his *Timaeus* asserts that the gentle fire that warms the human body flows out through the eyes in a smooth and dense stream of light. Thus a tangible bridge is

established between the observer and the observed thing, and over this bridge the impulses of light that emanate from the object travel to the eyes and thereby to the soul. (p.19)

This statement encapsulates all that I believe observational drawing to be about and in many ways it provides the basis for my own experiments with Professor Iain Gilchrist from the Department of Experimental Psychology at the University of Bristol in the UK. My work prior to this period responded to scientific theories but was not scientific in its methodology (see figure III), our collaboration developed out of the ideas I was exploring visually regarding visual perception and enabled me to experiment with new approaches.



Figure III. © Catherine Baker 2005. Plotted Drawing No. 3 (detail).

### **Eye movements**

Although the visual world appears to be stable the sensory system we use to detect the visual world – the eye – is constantly moving (see Findlay & Gilchrist, 2003). These movements are achieved by a set of six muscles that are attached to the eyeball. In humans, the eye generates a limited set of types of movements which all have distinct functions. These types of movements can be distinguished by the nature of the movement generated and the properties of the visual world that lead them to occur. The types of eye movements can be broadly classed into movements that keep the eye stable in relation to the world and movements that point the eye in a new direction towards something of interest (Walls, 1962). The vestibular-ocular reflex counter rotates the eye in response to a movement of the head and so keeps the eye pointing in the same direction, this simple reflex is very effective.

The ability to continue to read on a moving train or bus is a testimony to this systems ability to correct for every jolt and pothole. Smooth pursuit movements allow a moving object to be tracked by matching the movement of the eye to the movement of the object and as a result keep the object at a fixed location on the retina. Optokinetic nystagmus occurs when the whole visual world moves; under these circumstances the eyes move in a saw-tooth pattern to track the world.

Vergence movements move the two eyes together, but in opposite directions to maintain both eyes pointing at an object of interest as the object moves towards or away from the eyes. And finally, when the world is stationary, saccadic eye movements move the eyes to point at regions of interest in the environment. Saccadic eye-movements are fast ballistic movements and are followed by a period of time when the eye is stationary called a fixation. Vision is not possible during the saccade so it is during these periods of fixation that information is gathered by the visual system (figure IV). Fixations can vary considerably in their duration, from as little as 1/10 second to over a second. Saccades are required because toward the central part of vision, or the fovea, visual ability and particularly the ability to resolve fine detail improved dramatically. As a result of this drop off of visual ability away from the central visual axis we simply cannot see very much away from the current point of fixation. The illusion of being able to see everything with fine detail at once is just that – an illusion.

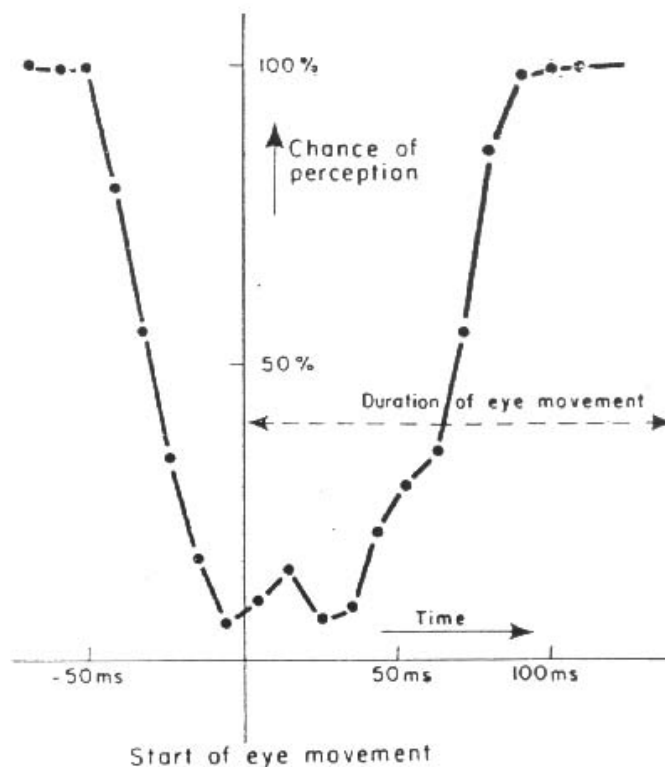


Figure IV. Taken from Latour (1962), Vision during the saccade

### Scanpaths

When scanning a static scene the eyes make a sequence of saccades and fixations. An example of such a sequence is illustrated in Figure V. The term *Scanpath* was used by Norton and Stark (1971) to describe this chain of fixations and saccades. What is clear, even from Figure V, is that the eyes are not moving completely randomly around the scene – instead the eyes tend to land on important and meaningful parts of the picture. As a result the sequence location and durations of the fixations carry something of the structure of the picture.



it is unable to maintain its structure, thus the drawing is made physically and directly. The resulting drawing is of course ephemeral: it would not be long before the grass would be able to regain its composition and the evidence of the act would be lost. Long went onto make many traces with walking as the primary act, tracking his engagement with the land. Long's work is often linked with photography which in ways undermines the temporal but technological advances have made it possible for artists who track their engagement with the environment to make their works more permanent as an output. British Artist Jeremy Wood uses GPS technologies to map his physical movements in space. On his website Wood states "All my journeys are recorded with GPS to make visual journals that document a personal cartography. The work is located in the actions and methodologies of geodesic drawing and physical map-making". His work combines the act of performative drawing with GPS advances; resulting artworks are both paradoxically intimate whilst the technology simultaneously 'removes the personal'. In many ways he becomes the metaphorical pencil, marking the land by simply moving through it (see figure VI).



Figure VI. © Jeremy Wood 2009, GPS Drawing. Image courtesy of the artist

Irrespective of their differing agendas what ties the practices of artists such as Heath and Wood together is that they have taken technological advances exploring them through a language of artistic discovery to create images unrivalled by scientific explanation. Far less influenced by scientific methods but sharing concerns relating to interpreting an experience sits the work of internationally renowned artist Hamish Fulton whose practice primarily involves the act of walking. Like Long there are many parallels to be found here however Fulton's practice seems far more centered on phenomenological concerns and the notion of absence and presence seems to dominate his practice and the resulting artworks. Like many of the artists within this paper their practice is influenced by the presence, an act in space that rapidly becomes absence from them and what remains or develops into an artwork is a trace of that event, presented to us, as audience, in its absence. Proximity to the work or to its reproduction in a book offers us the chance to experience the unity of absence and presence. Robert Sokolowski (2000) offers that all experience involves a blend of presence and absence. He states:

'We do intend absence, and it is phenomenologically false to deny it absence is a phenomenon. We shy away from absence even though it is all around us and preoccupies us all the time'. (p.36)

### **Scanpaths and drawings**

Professor Gilchrist and I share an interest in the relations between eye movements and drawing; developing ideas that a physical act, such as walking or moving the eyes can in and of itself be the drawing of lines in space. There have been a number of studies of the scanpaths that are generated when drawing (Tchalenko, 2007; Miall & Tchalenko, 2001). In contrast the focus of our collaborative work has been to investigate the extent to which scanpaths themselves are a way of drawing. Admittedly, a rather direct and unconventional way of drawing but one that has a resonance with the work of Long and others discussed above. In our work we have investigated if the eye movements themselves can become the metaphorical mark.

### **The work**

The difficulty here is how do we define the act of seeing? As the description of the active processes of seeing above illustrated, it is far more complex than it may initially appear, after all it is a question which has provoked the thoughts of artists, scientists, psychologists and philosophers for centuries. In the same way that a child may use the process of drawing to learn something about the world, we use our sight to make sense of our complex and visually demanding world.

My understanding of vision and the complex ways in which it works provides valuable insights to understanding ways in which we can map our unique engagement with the world in which we live. I found working with drawn data from the eyes to be honest, direct and unaltered. In more conventional approaches as soon as a mark is made on any surface we respond to it with all that we have ever witnessed before; the mark becomes loaded with a history so complex how can it remain impervious? From the outset I was interested in developing a way of drawing that was less affected; that was not subject to modification or addition albeit by an exaggerated memory or an aesthetic judgment. I understand that there is more to this awareness of the world than the selective information that my eyes gather but it serves as a basis for understanding visual perception as visual thinking.

It is not my intention to undermine drawing activity that has a traditional basis but I sought to make drawings that not only bypass the hand but that are a direct



outcome of my thinking; aligning drawing with thinking rather than with representing the appearance of objects. In the abstract for her thesis Patricia Cain wrote:

'This thesis is my experiential account as a drawing practitioner of investigating the relationship between drawing and thinking, and what it is that I have come to know by drawing but could not previously make explicit to myself or others. By considering thinking as process, my research suggests that experientially engaging in the practice of drawing invokes an inherent reflexive mode of thinking in us, which makes visible to us how we make sense of what we do. This depends on thinking as doing, which makes us consider what form knowledge in activity might take'.

My working practice as an artist has had to accommodate working within the scientific community and the journey has been truly valuable. *Second Sight 2007* is one piece of work that grew out of this inquiry into scanpaths (see Figure VII). It is an installation that consists of 170 solid resin orbs, which range from 22 - 150mm diameters. The orbs were hung to reflect a one-minute scanpath, they show the relationship between objects in a space and the very nature of their existence creates a new form of scanpath from the viewer as they connect with and 'see' the piece. The conception of this artwork was developed from a five-minute scanpath and was an attempt at a three-dimensional representation of how we might be 'reading' our environment. Each orb signifies a single fixation, the size dictating the duration of the fixation. Each orb casts shadows over the environment in which it is housed and thus hundreds of overlapping circular or oval shadows, each a different intensity, smother the surfaces, in the same way our vision might. In addition, each orb acts like a lens, reflecting its surroundings and each of the other orbs in its surface, making a clear relationship apparent with each of the other fixations, accumulating to make a cohesive visual experience.



Figure VII. © Catherine Baker 2007, *Second Sight* Installation – Shadow Drawing

Figure VIII shows an in-progress video still which was developed to become *One Second Line 2007*, a three-minute multiple video projection that was developed as an animated drawing, which quite simply mapped pupil activity. This was recorded when looking at a rural landscape scene using mobile eye tracking equipment. The initial split screen video footage shows the eye on the left and the scene being tracked on the right. The scene was then removed to allow the eye movements to be seen independent of the original location with each sequence mapping the movements that took place over one second. Approximately five to seven movements took place each second and thus this generated a substantial amount of co-ordinates. The corresponding eye footage was projected on an opposing wall so that the invisible dialogue between the moving eye and moving lines could be visualised; the pupil movements creating the drawing thus the final outcome consisted of two parts.



Figure VIII. © Catherine Baker 2006. Split screen video - mobile eye tracking

### Conclusion

In this paper I have discussed relationships between artworks, process as an investigation, and the experienced event. The artists mentioned here have engaged with a number of differing approaches including GPS, computer software written to facilitate three-dimensional drawing or simply walking. The breadth of their outcomes encompass advanced specialist equipment through to the use of one's own body as tool. Under scrutiny their seemingly unconnected practices are closely allied, as it is their philosophical considerations regarding perceptual encounter that ties them together. It is what surrounds them and their understanding of it that formed their interpretations. Drawing and its capacity to explore these connections crossing differing fields of study provides us an insight into future articulations for the areas of both drawing research and contemporary drawing practices. Artists will seek to work within and against the boundaries of their discipline and the aim of this paper was, in part, to highlight what can be achieved when artistic enquiry meets scientific discovery. The two collaborators mentioned here, one an artist and one a scientist, have been working at the interface between science and art to explore the relationship between these two areas of enquiry and the interface between the incessantly moving eye and drawing.

## Notes

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