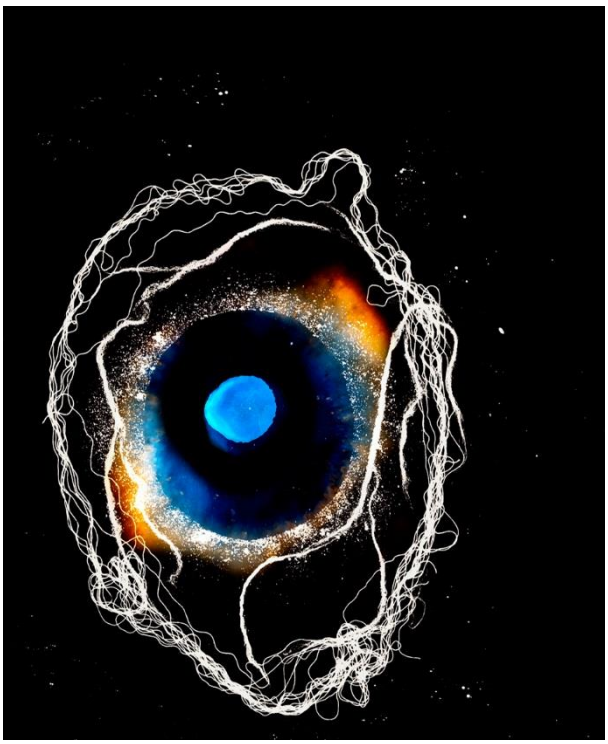
THE EYE'S MIND: VISUAL IMAGINATION, NEUROSCIENCE AND THE HUMANITIES

An international conference at the Sainsbury Centre for Visual Arts, University of East Anglia, Norwich, UK

21 - 22 May 2016



Susan Aldworth / GV Art

Arts & Humanities Research Council
University of East Anglia
University of Exeter Medical School
BRAIN

Programme – Saturday

09.00 – 09.20 **Registration**

09.20 – 09.30 **Adam Zeman* - Introduction and Welcome**

Imagination and the brain – Chair: Adam Zeman

09.30 – 10.10 **Paul Broks (keynote)**

Imaginal reality

Some scholars have argued (against the trend) that for a period in Greek history the gods appeared as vividly real persons and not merely personifications of abstract ideas. This is not to say that they were really, truly, objectively, *out there in the real world* but, nevertheless, they went well beyond products of the modern imagination, even to the extent of possessing an autonomous influence in shaping mortal minds and behaviour. In Charles Boer's terms, the gods were neither "real" nor purely "imagined" but, rather, figures of a third realm of "imaginal reality".

With the Greek gods as a backdrop, my aim is to examine the conventional partition of "real" and "imagined" and to show that in certain altered sates of consciousness, as experienced in sleep paralysis, for example, and psychosis, the partition breaks down. In conclusion, I will consider the general implications for an understanding of modern Western notions of selfhood and consciousness.

10.10 – 10.30 **Crawford Winlove***

The neural correlates of visual imagery

AIM: Visual imagery is a form of sensory imagination characterised by perception-like experiences in the absence of corresponding stimuli. Here, we report a co-ordinate-based meta-analysis of fMRI data that identifies the neural correlates of visual imagery. METHOD: Search terms were optimised using the Web of Knowledge and TAPoRware; calculations were performed using the Activation Likelihood Estimation algorithm (ALE, Turkeltaub 2012, implemented in GingerALE, v2.3.5), with a cluster-forming threshold of P=<0.001, and a cluster-level inference threshold of P=0.05 and 1000 repetitions. RESULTS: Searches identified 1554 papers on the 16th June 2015; on the basis of predetermined inclusion criteria, we extracted data from 45 papers, encompassing 762 foci and 510 participants. An overall comparison based on these studies identified 13 clusters of activation characteristic of visual imagery, within which there were 24 discrete foci. The largest clusters spanned contiguous areas of the left parietal lobule (encompassing BA7, BA40; 11,040mm3) and bilateral frontal areas (BA6; 6,552mm3). Other activations in prominently visual areas included the bilateral lingual gyrus (BA18), the right cuneus (BA17) and precuneus (BA7), and the bilateral fusiform gyrus (BA37). Finally, we found activation in the left claustrum, and both insulae. Differing patterns of activation were observed if the task required a decision based on the image, or accessed different memory systems. Conclusion: Visual imagery activates many of the same areas as visual perception, supporting a depictive interpretation for many of the underlying mental representations. Activity in other areas highlights the diversity of processes involved in the interpretation of these mental representations.

10.30 – 11.00 **COFFEE BREAK**

Imagination and representation – Chair: John Onians

11.00 – 11.20 Matthew MacKisack*

Imagery from Ancient to Modern, and Back

The past 25 years have seen a rapid growth of knowledge about brain mechanisms involved in visual mental imagery. These advances have largely been made independently of the long history of philosophical – and even psychological – reckoning with imagery and its parent concept 'imagination'. This presentation seeks to show how imagination's intellectual history both creates the conditions for – and presents challenges to – the modern scientific endeavour. It will focus on the neuroscientific literature's most commonly used task - *imagining a concrete object* – and examine the same basic act of imagining from the perspective of several key positions in the history of philosophy and psychology, presenting positions that, firstly, contextualise and inform the neuroscientific account, and secondly, pose conceptual and methodological challenges to the scientific analysis of imagery. The presentation will conclude by reflecting on the intellectual history of visualisation in the light of contemporary science.

11.20 – 11.40 Paul Worthington and Nanci Bell

Visual imagery: The nonverbal code for language and cognition

Imagery is the silent partner to language in human cognition. Behavioural neuroscience in America has validated the role of visual imagery in education as foundational to cognition, specifically for oral and written language comprehension. Recent neurological and behavioural research documents the role of visual imagery in remediating deficits in the area of visual imagination (such as aphantasia) as related to corresponding deficits in language comprehension. These studies are grounded in Dual Coding Theory (DCT), which posits that the dual coding of verbal and nonverbal information underlies human cognition. The application of DCT in a systematic instructional approach has successfully stimulated the nonverbal code of imagery for language in individuals of all ages. Based on 30 years of instructional experience with 35,000 children in the United States, the United Kingdom, and Australia, five important aspects of the imagery-language connection have been revealed: 1) there are dramatic individual differences in the ability to generate visual imagery, 2) there is a significant correlation between visual imagination and language comprehension, 3) individuals can be taught to consciously generate visual images, resulting in significant gains in reading and language comprehension, 4) linking the sensory input of imagery to language results in significant neurological changes and reading improvements in children with dyslexia, and 5) stimulating the imagery-language connection in children with autism spectrum disorder improves language comprehension that is accompanied by fundamental changes in the connectivity of the brain regions involved in reading comprehension.

11.40 – 12.00 Maithilee Kunda

Visual imagination: a view from artificial intelligence

Despite evidence for the importance of visual imagination from many of the cognitive sciences, the field of artificial intelligence (AI) has not yet provided a rigorous computational account of how the process of visual imagination works. Part of the problem comes from confusion in the AI literature between (1) tasks that are presented visually, in an external visual format, versus (2) tasks that are solved visually, using internal visual representations. There is a rich history of AI research in the first category, but the vast majority of these AI systems first convert visual inputs into internal propositional (i.e. abstract/symbolic) representations before solving

a task. Fewer studies fall into the second category, but these studies do provide insight into the computational nature of visual imagination and its role in intelligent behavior. I will present a synthesis of AI research into visual imagination over the years, including my recent work in developing AI systems that use purely visual representations to solve problems from standardized intelligence tests. Recent results include systems that perform at the level of average 16-year-olds, without using any type of logical- or language-based representations. In addition to opening new pathways for AI systems to achieve human-level intelligence, we are also using these AI systems to better understand populations with atypical dispositions towards visual imagination, such as certain people on the autism spectrum. In parallel with our research efforts, we are developing new educational projects to help computer science students increase their awareness of (and appreciation for) the power of visual imagination in AI systems. These projects have been rolled out to several hundred graduate students over the past four years, most recently as part of Georgia Tech's transformative Online Masters of Science in Computer Science (OMS-CS) program.

12.00 – 12.40 Michael Tye (keynote)

Visual imagination: an overview

My talk presents an overview of work on the visual imagination in philosophy and psychology. I distinguish two kinds of visual imagination, one of which has figured importantly in famous philosophical arguments and the other of which has been studied extensively by psychologists. Since the imagination typically employs mental imagery, I introduce and explain the picture theory of visual images and I consider both philosophical arguments for it and against it. I also discuss some famous recent experiments in psychology that are intended to support the picture theory and various responses to them. Along the way, I briefly consider the role that visual imagination has played in fiction.

12.40 – 14.00 LUNCH AND POSTER PRESENTATIONS

Imagination and art – Chair: Susan Aldworth

14.00 – 14.20 John Onians*

Art, the Visual Imagination and Neuroscience: *Mona Lisa*'s smile and Michelangelo's *terribilita*

The visual imagination has a central role in the history of art. All artists necessarily imagine some sort of outcome before they start work. We can witness this process in Palaeolithic paintings, where the imagination of the painter has often been stimulated by accidental markings in the rock surface, as in the cave of Chauvet 30,000 years ago. Much later, around 1500AD the Renaissance painter, Leonardo da Vinci, describes how his own imagination was often stimulated just by the sight of stains on walls. In both cases the process involved can be better understood in the light of the latest neuroscience, which also sheds light on the neural correlates of Michelangelo's creative activity as a draughtsman. No work, though, illustrates the need to appreciate the relevance of neuroscience more persuasively than the Mona Lisa. No-one has ever explained the unique ingredient that has made this work the most admired in the world. Neuroscience reveals the secret behind the masterpiece's distinctive power.

14.20 – 14.40 David Zagoury

The teratological imagination: *Fantasia* and the creation of monsters in Renaissance art theory

Most attempts by sixteenth-century physicians to explain birth defects invoked ill fantasies in the mother's imagination as the cause of her baby's anatomical abnormalities. Thus the chapter devoted to the 'facultas imaginatrix' in Marcello Donati's *De medica historia* (1568), one of the most extensive discussions of imagination in medical literature at the time, is essentially a compendium of pediatric oddities, including 'monstrous humans [...] with the feet or the head of a cow, a ram, or the like' (Lib. II, Cap. 1). The paper shows how this trend in Renaissance medicine is paralleled by a similar *topos* in art theory, namely the systematic association of the artist's *fantasia* with the act of designing monsters. Through reviewing visual material in conjunction with the writings of Italian art theorists such as Leonardo, A.F. Doni, Benedetto Varchi and Vincenzo Danti, we argue that the typical form of monsters depicted in art, namely the chimera or combination of various parts, reveals essential features of the Renaissance conception of imagination and its early reception by artists and art critics. Those features are shown to condition the period's notion of human creativity: one in which the mind, unlike in modern thought, cannot produce *ex nihilo*, but only by culling (*imaginatio retentiva*) and recombining (*imaginatio compositiva*). The paper further addresses their correlation with analogous features in medical accounts of abnormal births. Thus monstrosity in both art and life is argued to be at the crux of the early modern understanding of the mind's creative powers.

14.40 – 15.00 Juliana Dresvina

What Julian Saw: the re-examination of the bodily and ghostly sight in Julian of Norwich's "Showings"

Speaking in the hometown of the renowned English author and mystic, Julian of Norwich, I would like to suggest the use of John Onians's idea of neuro-art history in reading of Julian's "Book of Showings". Onians have recently argued that the origins of art in the Upper Palaeolithic period arises from the intense and repeated observation of groups of animals in a stressful environment. I believe that a significant part of Julian's visual images in the "Showings" may have derived from a close and repeated examination of an illuminated Psalter/Book of Hours, for which East Anglia was so famous in the first half/middle of the fourteenth century, in a stressful environment of frequent and forceful reminders of human sufferings, her own inadequacy, and guilt. At least some of Julian's seemingly peculiar images, such as the moss-begrown sea-bottom or the hazel nut, may have come straight from her visual familiarity with a medieval illuminated book. I then link Julian's attempts to re-imagine her visual experiences and structure them into a crossed-referenced narrative to Iain McGilchrist work on the specialisation of the brain hemispheres. I see Julian as essentially a right-brain type personality, desperately trying to fit her experience into a left-brain scholasticly-informed dividing discourse (McGilchrist too views medieval intellectual culture as mostly left-brain), and producing a compelling, yet in many ways controversial narrative. I will finally offer some potential reasons for Julian's privileged place in the popular and academic imagination.

15.00 – 15.30 COFFEE BREAK

Extreme Imagination – Chair: Fiona Macpherson

15.30 – 15.50 Adam Zeman*

Phantasia

Phantasia: visual imagery is a conspicuous element of much human experience. Variations in its vividness between individuals have been noted since Galton devised the first 'vividness questionnaire', observing that occasional participants lacked imagery altogether. A small neurological literature has documented patients who have lost their 'mind's eye' as a result of brain injury. The lifelong, congenital, absence of imagery has not been well described but may occur in 2-3% of the population. We recently coined the term 'aphantasia' to refer to the absence of the mind's eye, detailing its features in 21 individuals. The resulting publicity has led to several thousand further contacts, allowing us to expand our preliminary description. Given the complex neural network involved in visual imagery, we should expect aphantasia to be heterogeneous. Early findings point to associations between aphantasia and i) prosopagnosia (difficulty with face recognition), ii) autistic spectrum disorders, iii) (rather more tentatively) autobiographical memory difficulty. A family history of aphantasia is common, and there may be compensatory cognitive strengths. Dreams and involuntary imagery are often unaffected. 'Hyperphantasia', defined by scores towards the upper end of the subjective vividness spectrum, is more common than aphantasia and makes an informative contrast. In future work we will examine the objective associations of aphantasia and hyperphantasia using neuropsychological measures, for example of face recognition and visual and autobiographical memory, together with multimodal brain imaging to clarify the functional significance and neural basis of variations in imagery vividness.

15.50 – 16.10 Nick Watkins

Phantasia and SDAM: personal, scientific and human perspectives

My presentation will address three interlinked aspects of the diversity in our experiences of memory and the mind's eye, including:

- *The personal:* How I came to realise that I have what have recently been called aphantasia, and Severely Deficient Autobiographical Memory (SDAM) [1]. The trigger: a 1997 Independent column by Michael Bywater; and the trail: from Galton via Faw, Sacks and Tulving to today's meeting. What has the nature of my autonoetic experience, and my growing awareness of it, meant to me?
- *The scientific:* How my experience has made me curious about the role of imagery in mathematics and physics, and the opposite poles represented in science by Dirac (an imager who deprecated imagery) and Mandelbrot, Kekule and Feynman. How could science benefit from more awareness of the cognitive diversity of its practitioners?
- *The human:* What has been claimed about the uniqueness of autonoetic consciousness, including the speculations of Tulving and others about it as a "killer app" in competition with the Neanderthals. What are the limits of our inherited episodic and semantic capabilities as we become a planetwide species?

[1] D. J. Palombo et al, Neuropsychologia, 72, 105-108 (2015).

16.10 – 16.30 Jools Simner

Heightened visual imagination: the case of synaesthesia

People with synaesthesia experience unusual sensations when engaged in everyday activities like reading or listening to music. For example, reading words might cause sensations of taste in the mouth, or listening to music might cause colourful moving patterns to appear in the visual field. Synaesthesia has a known genetic and neurological basis, and a 200 year history in the psychological sciences. The majority of cases of synaesthesia involve visual associations over all other sensations, and these visual associations can involve colour, texture, shape, and patterns of movement. In my talk I'll describe findings from my lab about the unusual visual imagery abilities of synaesthetes, and describe how their mental imagery plays a role in their experiences. I'll show that synaesthetes report superior imagery in a range of domains and that this may give them a number of cognitive and behavioural benefits. I'll also describe how colour perception in the mind of the synaesthete can be susceptible to change, and how these changes mimic veridical colour perception of the outside world in average people.

16.30 – 16.50 Susan Aldworth*

The art of imagination

The visual imagination is a territory which I would expect visual artists to claim. But like consciousness it is a slippery customer; you know what it is until you try to describe it. For this project, I developed a questionnaire for artists to describe what visual imagination is for them, and how they use it in their practice. At the same time, they completed the VVIQ form, which is trying to measure vivid visual imagination scientifically. I hoped this interdisciplinary approach might bring us closer to finding the right questions to ask about what visual imagination is. The results were surprising. As were a number of the responses from artists to Adam Zeman's research into aphantasia. Many claimed that they did NOT have a visual imagination.

As an artist I am interested in exploring the nature of visual imagination, rather than drawing any firm conclusions about it. My research is deliberately anecdotal and is not offered as scientific evidence. Visual Imagination has many different narratives – artistic, philosophical, psychological and neuroscientific to name a few. But for me, personal narratives are the most interesting as it is necessarily a subjective experience – it is MY or YOUR visual imagination. An interdisciplinary approach to exploring the many narratives of what a Visual Imagination might be, is important. What is the point of scanning an individual's brain to see what is going on in there when we are imagining if we don't agree about what visual imagination is?

17.10 – 18.30 Drinks reception and poster presentations at the Sainsbury Centre for Visual Arts with viewing of the Sainsbury collection

19.00 – 22.00 Conference 3-course dinner with wine at the Modern Life Café in the Sainsbury Centre for Visual Arts

Programme Sunday

Imagery in art and science – Chair: Crawford Winlowe

09.30 – 09.50 Sandra Chapman

Electrodynamics and astrophysics: Thinking in pictures

Ask anyone about space plasma physicist Jim Dungey and reconnection and they are more than likely to make a sketch of magnetic field topology and dynamics. Topologies, symmetries, and dynamics are often easiest to see visually, in a series of drawings of snapshots of the magnetic field and flows. However, these sketches are more than illustrative, they are pictures that follow the rules of plasma electrodynamics and as such can be used as tools to further understanding. Jim Dungey solved one of the outstanding problems in the electrodynamics of astrophysical fields and flows by seeing a movie in his head, a movie where the magnetic field topology and dynamics followed the fundamental physical rules. The physics is described by fully non-linear equations for the fields and flows - these equations can only be solved directly by high performance computing and to this day, our computers are not large enough to fully obtain the solution that Jim Dungey was able to picture in his head.

This talk will explore the intimate relationship between topology and physics in astrophysical plasmas, and what we can learn by thinking in pictures. It is a non-technical version of the Royal Astronomical Society James Dungey Lecture that I gave in 2014.

09.50 – 10.10 Shaun May

Visual imagination in actor training: The importance of the 'Minds Eye' and the challenge of aphantasia

In this paper, I will look at the role that visual imagination plays in contemporary actor training practices and argue that most systems of actor training rely on (or at least presuppose) an ability to create mental images. Focusing on the influential works of Constantin Stanislavsky and Michael Chekhov, I will address the ways in which this presupposition informs the exercises that contemporary drama schools use in their work. As Sharon Marie Carnicke writes, 'Stanislavsky taught that an actor should not speak without an image in the mind's eye and suggests developing a 'filmscript' of images to accompany the performance of every role'. (Carnicke 2000:20) However, research by Zeman, Dewar & Della (2015) suggests that this ability to visualize is not universal, and that a small percentage of the population is are unable to do this – for which they coined the term 'aphantasia'.

Drawing on my own experience of attending drama schools whilst being unable to create mental images, I will argue that this presupposition is a disabling barrier in actor training analogous to those barriers faced by dyslexic actors. (c.f. Leveroy 2013) Insofar as one disagrees with Stanislavsky and Chekhov's view that visualization is necessary for acting, the condition of aphantasia raises some important questions about what would constitute a reasonable adjustment in our actor training practices.

10.10 – 10.30 Gyöngyvér Horváth

Visual imagination and the narrative image. The art historian's approach.

The experience of any narrative requires the use of the imagination. With a verbal narrative we have to use our visual imagination to bring both actions and their settings to life. With a visual narrative, such as a fresco cycle or a film, we can see selected actions and settings, but we have to imagine what is missing because the story may be less explicit. We do this

using skills developed by real experiences. We, humans, are taught from an early age to understand our constantly changing environment, both physically and mentally, because it is crucial for our survival. Scenarios in visual arts, such as narrative frescoes and panel paintings, are similar to real life situations in the way that they are also inhabited by acting humans, and are surrounded by objects, architectural or landscape elements. According to Ernst H. Gombrich, when interpreting these visual stories, we are guided by the 'principle of the primacy of meaning'. Gombrich's ideas on this process, which were supported by psychological experiments, help us to comprehend how narrativization might occur in images. Our imagination is led by the search for meaning, which can even be traced when we look at pictures that represent only movements or sequential but discrete abstract elements. Rudolph Arnheim used the notion of directed tension to explain how our imagination establishes narrative connections between purely geometrical shapes and how they form the very basis of abstract narratives. The talk will discuss the above mentioned theorists' view in the light of recent findings in neuroscience.

10.30 – 11.00 COFFEE BREAK

Words as images – Chair: Matthew MacKisack

11.00 – 11.20 Renate Brosch

What we 'see' when reading literary narratives: default visualization and vivid images

Visualization is defined as the production of mental images in the process of reading (Esrock 2005: 633). I propose that we distinguish between an ongoing largely automatic default visualization and vivid mental images that occur at significant stages in the narrative.

Neuroscientific studies of vision have collected a large and impressively varied body of experimental evidence for dual visual pathways which process object properties (such as shape and colour) and spatial properties (such as location and relation) in distinct systems. Further experiments distinguish different dispositional specializations: visualizers with a high spatial visualizing ability demonstrating a more efficient use of resources in the dorsal pathway, and those with a high object visualization and more efficient use of the ventral pathway (Kozhevnikov et al. 2010: 29). We can assume that both types of mental processing will be prompted in fictional narratives with differences in prominence depending on their authors' inclinations and the design and purpose of the narrative text.

According to Amedeo D'Angiulli and colleagues (2013: 7) who conducted elaborate tests of vividness in mental imagery using written descriptive passages as stimulus, dynamic imagery was significantly less vivid than static imagery. These results confirm the many instances cited in literary criticism based on intuition and introspection which present arresting detail and description of static objects as eliciting an especially lively imagination. Using text examples from Elizabeth Gaskell's *North and South*, I will show how narrative strategies create a fictional moment when object visualization is paramount.

In encouraging readers to shift now and then from the default mode of motion-oriented visualizing to a more conscious object visualization, literary fictions exercise their power to evoke imaginings that one would not generate by oneself. This may indicate that literary narratives can prove a training ground for expanding one's visualizing capacities.

11.20 – 11.40 Katharine Earnshaw

Blinding the mind's eye - enargeia, rhetoric, and poetry

This paper will consider the prospect of being invited to imagine momentary blindness within ancient poetic texts, where this is set within a context of rhetorical enargeia or demonstratio. Three examples will be taken from Lucan's Pharsalia, a poem renowned for its rhetorical features. The importance of rhetoric in our modern formulation of imagination as 'showing what is not there' will be outlined with particular regard to the ancient concern with enargeia in poetry and the bringing of images sub oculos subiectio. It will take examples from the poetry where eyes are cut out, fall out, or are pulled out, and where the character of the moment falls blind. It will argue in part that such moments draw attention to the interaction of vision and envisioning with other modalities, such that an enactive reading of the material may help to highlight how the euphantasiotos – the person who can conjure mental images that are more alike to hallucinations in their vivacity – draws on multisensory experience in order to create such a powerful incentive to visualise. It will also explore the imaginative conflict that these passages seemingly engender through consideration of how perspectival imagining informs fictional image-making. As the paper will necessarily encompass issues of memory and emotion, consideration will be given to the complicated nexus of cognitive factors at play when imagining and envisioning poetic scenes.

11.40-12.00 Alessia Pannese

Thomas De Quincey's architectural ekphrasis as visual imagination of the opium-addicted mind

In his autobiographical account Confessions of an English Opium-Eater (first published in 1821, and in revised form in 1856), Thomas De Quincey attempts to convey in visual terms his state of mind under the influence of opium by resorting to an architectural ekphrasis. The object of De Quincey's ekphrasis is Giovanni Battista Piranesi's Carceri d'Invenzione (first published in 1745, and in revised form in 1761), an enigmatic series of etchings depicting vast imaginary prisons, which Piranesi himself allegedly conceived during a state of delirium induced by opium. Hence, both De Quincey's ekphrasis and Piranesi's etchings deploy visual imagination as an expressive device whereby the phenomenological experience of opium-induced altered mental states is mapped onto a visible - or at least visualisable - architectural structure.

In this paper I will examine this transposition from inner states to outer space, and suggest that it achieves more than what it aims for. Specifically, I will argue that, both in De Quincey's ekphrasis and in Piranesi's etchings, the translation of mental states into imaginary architecture not only enables the visualisation of the workings of the mind under the influence of opium, but also offers a common representational platform bridging across different expressive mediums: text and images. By taking a comparative approach to De Quincey's Confessions and Piranesi's Carceri, I will expose this mediating potential, by which visual imagination acts as the locus of convergence of literature, architecture, and the neurobiology of opium addiction.

12.00 – 12.20 Nuala Watt

Visual imagination in the poetry of partial sight

This abstract proposes a reading and visual presentation of poems that express the role of partial sight in choices of poetic form and imagery. My practice-based research takes partial sight as a philosophical and creative starting point in the making of poems. Drawing on Merleau-Ponty's theory of embodied perspective I examine the influence of partial sight on poetic practice.

The page is a semantic site where spatial arrangements may have a formative role in the creation of meaning. The visual imagination works to embody the continuous process of construing a world governed by partial sight, where meaning is fluid and provisional. As a partially sighted poet and academic I have a related interest in imagery used to convey experiences of atypical vision. The poems presented will speak to both imagistic and formal concerns. This proposal casts visual impairment as the subject of poetic thought and practice, questioning cultural links between vision and knowledge, between biological and artistic vision.

Although there is a long history of representing visual impairment in poetry this research posits that experiences of partial sight have been insufficiently imagined. This is partly due to totalizing narratives of blindness as tragedy. These narratives have contributed to the relative invisibility of partial sight within culture. This project draws an analogy between partial sight and the partial apprehension that poets experience as they imagine a poem. The poems presented will show partial sight as an embodied writing practice but also as a generative force within all poetic composition.

12.20 – 12.40 Radu Leca

Spatial immersion through iconographic cues in seventeenth-century Japanese images

Recent research in neuroaesthetics has simulated the effect of deja-vu by displaying images with similar spatial structures. This research has the potential to change the way iconography is interpreted.

I focus on a case study from seventeenth-century Japan: the newly established prostitution quarter of Yoshiwara in the city of Edo was extensively visualized by the atelier of Hishikawa Moronobu, later hailed as the founder of the genre of 'images of the floating world'. I argue that Moronobu's images appealed to the visual imagination of their audience through depictions of prostitutes with spatially dynamic poses that created a feeling of familiarity with their physical presence. In other words, the images' iconographic structure had the capacity to simulate the experience of meeting the prostitutes even when that experience had not occurred. Another recent study has proven that watching scenes which included bended wrists activates the brain's motor centres corresponding to the wrists. For my study case, these results suggest that the accentuated sense of animation in the depictions of courtesans' dances activated memory and motor centres, thereby simulating the experience of visiting and experiencing the quarter with one's own body. This translated into a feeling of immersion on the part of the experiencer, who was momentarily transposed into a liminal state. I show how this immersion into the simulated space of the prostitution quarters was corroborated with allusions to narrative of religious encounters and to their potential of transforming the experiencer's identity.

12.40 – 14.00 LUNCH

Perception and imagination – Chair: Adam Zeman

14.00 – 14.20 Bence Nanay

Multimodal mental imagery: Unifying philosophical, psychological and neuroscientific perspectives

When I am looking at my coffee machine that makes funny noises, this is an instance of multisensory perception – I perceive this event by means of both vision and audition. But very often we only receive sensory stimulation from a multisensory event by means of one sense modality. If I hear the noisy coffee machine in the next room (without seeing it), then how do I represent the visual aspects of this multisensory event?

The aim of this paper is to bring together empirical findings about multimodal perception and empirical findings about (visual, auditory, tactile) mental imagery and argue that on occasions like the one described in the last paragraph, we have multimodal mental imagery: perceptual processing in one sense modality (here: vision) that is triggered by sensory stimulation in another sense modality (here: audition).

Multimodal mental imagery is rife. The vast majority of what we perceive are multisensory events: events that can be perceived in more than one sense modality – like the noisy coffee machine. And most of the time we are only acquainted with these multisensory events via a subset of the sense modalities involved – all the other aspects of these events are represented by means of multisensory mental imagery. This means that multisensory mental imagery is a crucial element of almost all instances of everyday perception, which has wider implications to philosophy of perception and beyond, to epistemological questions about whether we can trust our senses.

Focusing on multimodal mental imagery can help us to understand a number of puzzling perceptual phenomena, like sensory substitution and synaesthesia. Further, manipulating mental imagery has recently become an important clinical procedure in various branches of psychiatry as well as in counteracting implicit bias – using multimodal mental imagery rather than voluntarily and consciously conjured up mental imagery can lead to real progress in these experimental paradigms.

14.20 – 14.40 Fiona Macpherson*

Imagination and perception

I argue that imagination and perception interact. I examine ways in which they might do so. In light of that I discuss the similarities and differences between imagination and perception. I discuss what one should make of this role in the light of aphantasia.

14.40 – 15.20 Joel Pearson (keynote)

Mind control: measuring and manipulating the strength of the imagination

Mental imagery provides an essential simulation tool for remembering the past and planning the future, whose strength affects both cognitive abilities and mental health. Here I will introduce perceptual methods for measuring imagery strength and talk about new brain imaging and brain stimulation data that shows the brain's resting excitability levels play an important role in governing imagery strength. I will also discuss new fMRI and behavioural data showing how little control we have on when, and if, we create mental images. Together these data suggest a neurophysiological mechanism for imagery strength that contributes to the experience of some volition, however visual imagery evades complete voluntary control.

15.20 – 16.00 **General discussion (Eye's Mind team on the platform)**

16.00 **Tea and farewells**

Poster presentations

Subir Che Selia - The (blind) eye's mind - Indeterminate image in the blind's visual imagery process

Privation of sight doesn't deprive the blind of visual imagination. It rather reorganizes other sensorial modalities to compensate the lack of visual information through sight. The blind's visual imagery process mixes sensorial experiences with imagination, memory and knowledge to allow the object to 'appear' outside of its optical externalities. It seeks out the particularities of the indeterminate visual information of an object to determine its meanings and appearance. It is the blind's own 'visuality'. This paper analyses ways in which this visuality relates to Pepperell's concept of 'indeterminate image' (2006) as observed by the sighted. It draws on the author's own study of blind protagonists as well as the photography works of the blind artist, Evgen Bavcar. It is hoped that the paper will contribute to a better understanding of the blind's visual imagery process through the appreciation of its generated image.

Nick d'Aloisio-Montilla - We 'see' more than we report

The distinction between phenomenal consciousness (what an experience is like) and accessconsciousness (what is reported or 'globally broadcast') remains an enduring controversy in philosophy. This work draws on the condition of aphantasia to propose a new argument in favour of the claim that phenomenal consciousness 'overflows' cognitive access. In other words, we see more than we report. Support for overflow lies in the rich capacity of visual iconic memory, and this is most commonly illustrated with the 'partial report paradigm'. In this work, I put forward a consciousness claim that any sound account of the partial report paradigm must satisfy, viz. that subjects 'see' reported items. I argue that the "no overflow" account relies on topdown modulation of the mind's eye in order to satisfy this claim. Importantly, aphantasia constitutes the absence of a functioning mind's eye. Thus, evidence suggests that those with aphantasia perform equally well in the partial report task, yet according to "no overflow", never 'see' the items that they report. This renders the "no overflow" account unsound.

Xiaoyan Hu - Painting as the image of mind

For Chinese artists, painting is the image of mind. Not merely nature, but mind is also the wellhead of painting. This idea originated in the Han scholar Yang Xiong (53BC–18AD) who thought of word as the sound of mind and calligraphy as the painting of mind, and who thus suggested that people can identify a person to be a gentleman or a petty man according to his print of mind. The Tang master Zhang Zao (active in the late 8th century) located the secrets of art in mind and nature by claiming that 'externally all creation is my master' and 'internally I have found the mind's sources' (Zhang Yanyuan, 847). Numerous later art critics and painters in Chinese art history advocated this claim of painting as the print of mind. To represent appears to be to express for Chinese painters, since painting as the print of mind, originates from both nature and mind, being 'perfected in the imagination', taking form in the surface of silk or paper as the trace of mind, indicating the loftiness or baseness of 'Qi Yun' (spirit consonance) beyond formal likeness (Guo Ruoxu, 1080). To release the image of mind, spontaneity has been especially emphasized in creative progress by Chinese artists. Although Michael Sullivan (1979: 6/8) interprets the expression of ideas and emotions in Western expressionistic art as very close to that of Chinese art, there is a marked difference between the expressionism of Chinese art and Western expressionist art, due to the unique features of Chinese art and the influence of ancient Chinese philosophy (Daoism, Chan Buddhism and Confucianism) on Chinese art.

Lynn Imperatore - See for yourself: drawing as application of perception

The process of drawing requires adaptation in the disposition of perception—an alteration that can reveal and recount aspects from the visual field beyond ostensible subject. Thus drawing is a tangible, tactile demonstration of diverse possibility within our enactments of sight. Drawing adjusts—even slows—the sensory process of seeing, allowing contemplation and expression of other trace visual data, hence reflecting both exterior and interior experiences of vision. As acquired expressive skill, drawing traditionally coalesces around specified rules which urge discrete and circumscribed projects in looking—aids for creating a record of resemblance or 'representation'. Regardless of subject or degree of realism, such shifts within the exercise of sight permit subtler perceptual ingredients to become discernable—enabled by these views toward drawing. It is likely that transcriptional processes like drawing evolved from perceptual promptings discerned along other subtle pathways of the sensory. Transient emanations unfold beside dominant inputs of waking visual life; emanations not solely confined to access through visual art practices. Dreams, imagination, reverie and other fluctuations within our nervous system are all manifestations of embodied perception. There is always more available than can be extracted from each fleeting temporal moment—remaining unnoted unless another understanding of *vision* is brought to bear. My research uses drawing practice to explore its capacity to document the unexpected edges of the visual field and perceptual world. In tracking and recording glimpses of such ephemera, the observational and notational practice of drawing can disclose a fuller accounting of vision incarnate.

Fabio Parente - Mental imagery during spatial language comprehension

Human beings have the remarkable ability to convey the content of their mental space through language, and to build mental representations of described situations in the absence of relevant sensory input. This research explored the top-down effect of high-level mental imagery on the attentional aspects of reading during the processing and comprehension of spatial descriptions. Participants were presented with simple route directions written using egocentric ("left" and "right") or cardinal ("north", "south", "east" and "west") relational terms, and prompted to assume one of two imagined perspectives during encoding (first-person vs bird's-eye). Language encoding measures were obtained via the use of eye tracking during reading. We further explored how differences in encoding of spatial linguistic information correlate with its recall, measured via performance in a map verification task, also with concurrent eye tracking. Results revealed differences in the allocation of attention (measured as the sum of all fixation durations) to landmark words in spatial descriptions and to landmark regions of sketch maps as a function of linguistic reference frame and imagined spatial perspective. Implications for models of language comprehension, eye movements, and mental imagery are discussed.

Binglei Zhao - A loss of imagery case study: no modulation of rotation-related negativity in mirror letter rotation

Patient MX reported a sudden loss of visual imagery, yet performed normally on a wide range of mental imagery tasks except for mental rotation. He was accurate, but showed a non-linear pattern of reaction times with increasing rotation angle. This suggested that he may have used an atypical strategy to perform the task (Zeman et al., 2010). To further investigate this account, MX and ten age and IQ matched controls were assessed in an event-related brain potentials (ERP) experiment while performing a normal-mirror image discrimination of letters in different rotation angles. MX performed as the controls in the normal condition, but showed reduced difference across angles for mirrored letters. A difference between MX and controls

was revealed by the corresponding ERP analysis of angular disparity effect, a parietal negativity which becomes more pronounced with increasing angular disparity (Heil, 2002). The controls showed the expected response of the rotation-related negativity (RRN) in both normal and mirror conditions. Little modulation of the RRN by angular disparity was observed in MX in mirrored condition, suggesting that he used some other cognitive source/process in addressing this task rather than mental rotation.

Binglei Zhao - Delayed mental rotation process in ageing: an ERP study

Behavioural studies have shown a significant age-related slowing in mental rotation tasks (Hertzog & Rypma, 1991). However, it is unclear whether this slower performance reflects a specific cognitive decline in spatial information processing in ageing or a more general slowing of perceptual and/or motor processes (Salthouse & Ferrer-Caja, 2003). To investigate this, event-related brain potentials (ERPs) were recorded while younger (n=10) and older participants (n=10) performed a letter rotation task involving mirror-normal letter discriminations. Behavioural results confirmed slower responses in the older compared to the younger participants. Furthermore, there was an interaction between rotation angle and group with lower mental rotation rate in older participants. The ERP analysis of the rotation-related effect, a parietal negativity which becomes more pronounced with increasing angular disparity (Heil, 2002), revealed systematic differences between old and young adults. Younger adults showed the angular disparity effect on the amplitude of the rotation-related negativity (RRN) starting from about 350 ms post-stimulus onset. This effect was reliably present for 200 ms (350-450ms and 450-550ms time windows) returning to baseline beyond 550ms post-stimulus. In contrast, reliable modulations of the RRN by angular disparity in older adults were observed between 450 and 650ms. These findings reveal that ageing selectively delays mental rotation processes, suggesting that the slower performance observed in the older participants is not simply caused by unspecific effects of aging on motor processes.

Binglei Zhao - The effect of representational complexity and element number on strategy selection in mental rotation task

The complexity effect on mental rotation rate has been considered a good indicator to distinguish between two views of visual imagery (Cooper & Podgorny, 1976): one positing that mental experience plays a functional role in cognition (e.g., Kosslyn), the other postulating that propositional knowledge is sufficient for supporting imagery (e.g. Pylyshyn). To reconcile these two views, it has been suggested that different strategies (e.g., holistic, piecemeal transformation) could be involved in performing mental rotation tasks (Logie et al., 2011; Zeman et al., 2010).

Three experiments tested possible strategies in performing mental rotation tasks. In a cube rotation experiment (Shepard & Metzler, 1971), participants did not show different mental rotation rate in processing 'standard' cube figures and 'non-standard' ones, designed by withdrawing cubes from the typical ones, suggesting they might fill in the missing cube automatically. In a second experiment, half of the stimuli ('non-standard') were decomposed so they did not retain the outline of the typical segments. Participants showed faster mental rotation rate in processing the 'non-standard' stimuli. The third experiment was set up by using the 'standard' polygons as in Cooper and Podgorny (1976) and 'non-standard' ones adapted from them. Results showed slower mental rotation rate in processing 'non-standard' polygons, suggesting that piecemeal transformation might be adopted. In sum, not only the number of elements affected mental rotation rate, but also the stimuli's representational complexity. These results refine Cooper and Podgorny's suggestion on complexity effect and provide some evidence that various strategies could be adopted in mental rotation processing.

BIOGRAPHIES

Susan Aldworth

Susan Aldworth lives and works in London. Her work explores the workings of the human mind. She is an experimental printmaker, (etching, monotype and lithography) and filmmaker, with a particular interest in expanding notions of contemporary portraiture. Susan Aldworth: The Portrait Anatomised was shown at the National Portrait Gallery, London in 2013. Aldworth curated and developed Reassembling the Self for the Hatton Gallery in Newcastle in 2012. Her most recent experiments into portraiture are The Entangled Self suite of etchings printed using human hair to make drawn marks. Aldworth is currently artist in residence at York University developing an exhibition The Dark Self about sleep. Her etchings printed directly from human brain tissue TRANSIENCE, can be seen at the Fitzwilliam Museum, Cambridge in September 2016 in Realisation.

Aldworth's practice has included exhibitions, residencies and commissions nationally and internationally. Her work is held in many public and private collections including the V&A, the British Museum, The Fitzwilliam Museum, The Wellcome Collection Library in the UK and Williams College Museum of Contemporary Art in USA. Working as an artist-in-residence in a medical or scientific setting is central to Aldworth's practice to explore the different narratives surrounding human identity. Aldworth is represented by GV Art Gallery, London.

Nanci Bell

Nanci Bell, M.A., is the co-founder and Director of Lindamood-Bell Learning Processes, an organization dedicated to helping children and adults learn to their potential. Lindamood-Bell was founded in 1986, and today there are over 63 Lindamood-Bell Learning Centers across the US, UK, Australia, and Canada. Under Nanci's direction, the organization is involved in research collaborations with MIT, UAB, and previously with Wake Forest, and Georgetown University. It has received recognition from the U.S. Department of Education, Newsweek, Time, US News and World Report, Neuron, NeuroImage, CNN, and PBS.

Nanci researched and developed key programs that have gained Lindamood-Bell its reputation as a source for real solutions for individuals of all ages with learning challenges. Her background is in the field of reading, with extensive experience in clinical instruction for language and literacy disorders.

After coursework at Harvard University, Nanci developed the theory that imaging the gestalt is a critical factor in language comprehension and analytical thinking. Primarily interested in solutions, Nanci developed specific steps to stimulate the dual coding of imagery and language. Hence, the book Visualizing and Verbalizing for Language Comprehension and Thinking® was written. Continuing to pursue a goal toward research and solutions, Nanci wrote another book and program to stimulate the dual coding of imagery and language for reading and spelling Seeing Stars® Symbol Imagery for Phonological and Orthographic Processing in Reading and Spelling.

Randomized controlled research shows that imagery can be stimulated, established, and applied to language comprehension resulting in both behavioral gains and significant neurological changes in brain structure.

Paul Broks

Paul Broks is a neuropsychologist-turned-writer. He pursued a career combining clinical and academic work and gained recognition as a writer with his first book *Into the Silent Land* (Atlantic Books, 2003), which mixed neurological case stories, fiction and memoir in an extended meditation on selfhood and the brain. Paul has written for theatre, radio and film, and his journalistic output includes columns for *The Times* and *Prospect* magazine. He wrote and presented several episodes in the major BBC Radio 4 series, *A History of Ideas* (2014/15) and has a new series, *Dr. Broks's Casebook*, scheduled for broadcast June 2016. Paul's next book, *The Rape of the Moon* (working title) is scheduled for publication by Penguin in 2017.

Renate Brosch

Renate Brosch holds the chair of English Literature at Universität Stuttgart. Areas of specialization are Visual Culture Studies, short story theory, and reader response studies. A long-standing area of research is cognitive narratology, in particular the question of the reading experience. Several recent handbook articles deal with the reader's capacity for visualizing.

Sandra Chapman

Sandra Chapman is primarily but not exclusively a plasma physicist working on problems in astrophysics and in the laboratory. She is currently Professor of Physics and directs the Centre for Fusion, Space and Astrophysics at the University of Warwick. Sandra's work is highly interdisciplinary, she has pioneered complex systems approaches to astrophysical and laboratory plasmas and more widely, to problems including climate and neuroscience. Sandra's research has been recognised with international research fellowships including from PPARC, the Royal Society and Japan Society for the Promotion of Science, the Nuffield Foundation, the Radcliffe Institute for Advanced Study (Harvard). She has held visiting Professorships at the Universities of Kyoto, Uppsala and Tromso and was a Senior Visiting Scientist at the Max-Planck-Institute for the Physics of Complex Systems, Dresden. Sandra is also a practising artist who works to bridge the 'arts- science divide' and has held a NESTA Dreamtime fellowship – working as an artist with the British Antarctic Survey in Antarctica.

Subir Che Selia

Subir Che Selia is a documentary filmmaker and a PhD student in Media Art at the

Bauhaus-Universität Weimar. His artistic research studies the nature and limitation of image, perception and imagination with a focus on the understanding of the shared relationship between the blind's visual imagery and visual media.

Accompanying the theoretical dissertation would be a documentary 'Sensing Berlin' in which the blind's perceptual experience while visually interpreting the city of Berlin is explored. Subir Che Selia holds an MFA in Media Art and a bachelor degree in Architecture.

Nick d'Aloisio-Montilla

Nick D'Aloisio is currently a student of Hertford College, Oxford where he reads Computer Science and Philosophy. D'Aloisio is also an internet entrepreneur and computer programmer. As Founder and CEO of Summly, D'Aloisio and his team developed a summarization algorithm with SRI (the Stanford Research Institute). Having received over one million downloads in the space of just 6 months, Summly was acquired by Yahoo in March 2013. D'Aloisio was awarded "Innovator of the Year" in New York City by the Wall Street Journal for his work on Summly. Until October 2015, D'Aloisio was Product Manager of Yahoo News Digest, which was critically acclaimed and received the 2014 Apple Design Award. During the summer of

2015, he took up the position of "Entrepreneur in Residence" at Airbnb. With an interest in the arts, D'Aloisio also worked on Yoko Ono's "To the Light" Serpentine exhibition in 2012. D'Aloisio has taken up a strong interest in the philosophy of mind since embarking on his studies at Oxford University.Fabio Parente – Bio

My research focuses on the construction of mental representations during linguistic processing, particularly of spatial information (e.g. environmental descriptions or route directions). Throughout my PhD I have attempted to relate behavioural measures and self-reported phenomenology to objective measures of attention during language encoding (i.e. eye-tracking) to inform models of spatial cognition. Additional research interests include the neural correlates of imagery and its phenomenology, as well as the development of imagery-based brain-computer interfaces and their application to various areas (e.g. accessibility for videogame users).

Juliana Dresvina

Dr Juliana (Julie) Dresvina studied History, Philology and Theology at Moscow State University and Oxford before receiving her PhD in English from Cambridge in 2007. Following this she worked at Cambridge and King's College, London, as a medievalist historian; taught English at QMUL, Reading, Oxford and Winchester; held art history postdocs with the Paul Mellon Centre in London and National Institute for Art History in Paris. She is currently a British Academy postdoctoral fellow with the Department of English at King's College London, and a member of Wolfson College, Oxford, and St Edmund's College, Cambridge.

Juliana is currently working on a study of psychohistory of late medieval Christian mysticism, based on the evidence from both Western and Eastern traditions. It explores the ways late-medieval people made sense of unusual or inexplicable experiences (recorded for posterity in contemplative, mystical and hagiographical texts) through the means available in their cultural idiom. The method employed for this study combines literary analysis with findings from the fields of neuroscience and clinical psychology

Gyöngyvér Horváth

Gyöngyvér Horváth is an art historian and an independent researcher. After completing her MA in art history at Eötvös Loránd University, Budapest, she obtained her doctorate in 2011 from the School of World Art Studies and Museology, University of East Anglia, Norwich, UK. Ms. Horváth served as an Assistant Professor of art history from 2008 to 2013 at the Institute for Theoretical Studies at Moholy-Nagy University of Art and Design, Budapest, and she also taught courses on the history and methodology of art at Eötvös Loránd University and Pázmány Péter Catholic University, Budapest. Her research concerns the historiography and methodology of art history, early modern painting and book illustration; it focuses especially on the phenomenon of visual narration. Currently she is working on a book Narrative Art History, which examines the historiography and methodology of the research on visual narration within art history, narratology and semiotics. This project was supported by the research grants of Dumbarton Oaks, Harvard University (2013), Collegium Hungaricum, Wien (2013) and Princeton University (2014).

Xiaoyan Hu

Xiaoyan Hu is a PhD candidate in the Department of Philosophy at the University of Liverpool. Her PhD research focuses on the notion of 'Qi Yun' (spirit resonance) in Chinese art (mainly classical painting) and the comparative analysis between Chinese aesthetics and Western aesthetics. She presented her paper at the 'Culture and the Creative Economy in Global Context' Conference in the University of Chester on 26th February 2016 and at the Third BSA Postgraduate Conference at the University of Southampton on 1st April 2016. Prior to her PhD study, she achieved her second MA degree with merit in Art Aesthetics and Cultural Institutions at the University of Liverpool in 2014 and her first MA degree in Chinese Ancient Literature in Qingdao University in China in 2010. She is a versatile person, trained in Chinese classic dance, Kun opera, and she plays the Chinese Zither (Gu Zheng). She has worked as an editor for a newspaper, journalist for magazine, and auditor for a Public Accountant Firm in China.

Lynn Imperatore

Dr Lynn Imperatore was awarded a PhD by the Department of Art and Design, University of the West of England (Bristol) in 2015. Her practice-led research is titled 'Out of the corner of the eye (the 'I'): Drawing as disposition of perception' and examines drawing's capacity to apprehend and articulate unexpected edges of the perceptual. She received a BA from New York University, an MFA from Vermont College of Fine Arts, and attended the School of the Museum of Fine Arts (Boston). She has taught university and postgraduate art, has exhibited widely and co-founded and co-edits HATCH/Drawing Research Project (http://www.hatch-drawing.org).

Maithilee Kunda

Maithilee Kunda is an assistant professor of computer science and computer engineering in the Department of Electrical Engineering and Computer Science at Vanderbilt University. Before coming to Vanderbilt, she worked as a research scientist in the School of Interactive Computing at Georgia Tech. Her work in artificial intelligence, specifically in computational cognitive systems, looks at how visual thinking contributes to learning and intelligent behavior, with a focus on interactive applications for individuals on the autism spectrum. She holds a B.S. in Mathematics with Computer Science from the Massachusetts Institute of Technology and a PhD. in Computer Science from the Georgia Institute of Technology.

Radu Leca

Radu Leca is an art historian specializing both in seventeenth century Japanese visual culture and in cartographic history, and interested in the role of images in social interaction. Leca's forthcoming book project concerns the relationship between reality and representation in the case of narratives of early modern Japanese portraits coming to life after having been painted on hanging scrolls.

Matthew MacKisack

I am a researcher working on connections between the history and philosophy of science, and the history and theory of art. My ongoing focus in this is the 'imagining subject': the ways in which the imagination is, and has been, modelled, theorised, and instrumentalised, through both aesthetic and scientific discourses. A graduate of the universities of Oxford and London, I was Associate Research Fellow on the Eye's Mind project at the University of Exeter Medical School.

Fiona Macpherson

Professor Fiona Macpherson is Professor of Philosophy, Director of Research in Philosophy, and Director of the Centre for the Study of Perceptual Experience at the University of Glasgow. She is Co-Director of CenSes: Centre for the Study of the Senses at the Institute of Philosophy, School of Advanced Study, University of London. She is a member of the Arts and Humanities Research Council, trustee of the Kennedy Memorial Trust, and President of the Scots Philosophical Association. She gained an MA from the University of Glasgow, an MLitt at the University of St Andrews, and a PhD from the University of Stirling. She was a Visiting Fellow at Harvard University, a teaching fellow at the University of St Andrews, and Rosamund Chambers Research Fellow at Girton College, Cambridge. While a faculty member at Glasgow, she has spent time as a Research Fellow at the Centre for Consciousness, RSSS, Australian National University, and as a Visiting Professor at Umea University, Sweden, the Institute of Philosophy, University of London, and the University of Trnava, Slovakia. Her research concerns the nature of consciousness, perception, perceptual experience, introspection, imagination, and the metaphysics of mind.

Shaun May

Dr. Shaun May is a Lecturer in Drama and Theatre at the University of Kent and the author of two books, *A Philosophy of Comedy on Stage and Screen* (Bloomsbury) and *Rethinking Practice as Research and the Cognitive Turn* (Palgrave). He is the Primary Investigator of the BA/Leverhulme funded project *Comedy on the Spectrum*, for which he is collaborating with colleagues in psychology and theatre to explore humour production in adolescents with autism. Prior to joining the faculty at the University of Kent he was a postdoc in Philosophy at the University of Liverpool and he taught at the Royal Central School of Speech and Drama and the Royal College of Art.

Bence Nanay

Bence Nanay is Professor of Philosophy and BOF Research Professor at the University of Antwerp, where he is also co-director of the Centre for Philosophical Psychology and Senior Research Associate at Peterhouse, Cambridge University. He is the author of Between Perception and Action (OUP, 2013) and Aesthetics as Philosophy of Perception (OUP, 2016) and the editor of Perceiving the World (OUP, 2010) and of Current Controversies in Philosophy of Perception (Routledge, 2016). He has published more than 90 articles on various topics mainly in philosophy of mind, aesthetics and philosophy of science.

John Onians

John Onians is Professor Emeritus in the Department of Art History and World Art Studies at the University of East Anglia. After writing a PhD supervised by E.H. Gombrich he became founder editor of the journal *Art History* and edited the first *Atlas of World Art*. He has spent twenty five years exploring ways of using neuroscience to solve art-historical problems and in 2007 published *Neuroarthistory. From Aristotle and Pliny to Baxandall and Zeki* which reviews forays in the same direction by earlier writers. His own attempt, which applies the latest neuroscience to the whole history of art on our continent, *European Art. A Neuroarthistory,* will appear from Yale later this year.

Alessia Pannese

Alessia Pannese is postdoctoral researcher in clinical experimental medicine in the Addictions Department at King's College London, and graduate student in history of art at Exeter College, Oxford.

Fabio Parente

My research focuses on the construction of mental representations during linguistic processing, particularly of spatial information (e.g. environmental descriptions or route directions). Throughout my PhD I have attempted to relate behavioural measures and self-reported phenomenology to objective measures of attention during language encoding (i.e. eye-tracking) to inform models of spatial cognition. Additional research interests include the neural correlates of imagery and its phenomenology, as well as the development of imagery-based brain-computer interfaces and their application to various areas (e.g. accessibility for videogame users).

Joel Pearson

Joel Pearson is a National Health and Medical Research Council fellow and Prof. of Cognitive Neuroscience at the University of New South Wales, Sydney Australia. He also leads the Pearson Lab, a multidisciplinary agile Cognitive Neuroscience research group that does both fundamental and clinical research, consults with companies, artists and designers on brain science.

Joel started his career studying art and filmmaking at one of Australia's top fine arts school, Collage of Fine Arts, University of New South Wales. However, he then decided to apply his creative discovery techniques to the scientific mysteries of human consciousness and the complexities of brain. He then completed his science PhD in 2 years, while fitting in several around the world trips and invited conference and university talks, alongside several publications.

After receiving his first research fellowship from the National Health and Medical Research Council he worked in two different psychology and neuroscience labs simultaneously at Vanderbilt University Nashville TN. In 2009 he was honored with the international William James prize for the greatest contribution to our scientific understanding of consciousness.

An internationally recognized leader in human consciousness research, Pearson's group takes an innovative, agile, from the ground-up approach to developing new methods to measure dimensions of human cognition, mental health and neuroscience, previously thought to be immeasurable. A few examples are the group's novel methods to measure the human imagination, intuition and hallucinations, using objective, reliable, neuroscientific methods. His work spans from fundamental science to helping individuals in the clinic – translational cognitive neuroscience.

Pearson takes a multidisciplinary agile approach to running his lab, bringing in staff and students from art, architecture, mathematics, computer science, psychology, neuroscience and medical imaging. The group studies many different exciting and cutting-edge topics, from new methods to map the human brain, treating mental illness, how to boost the human imagination and decision-making, to cognitive biases in financial risk assessment.

Jools Simner

Prof. Jools Simner is a neuropsychologist and expert in the field of synaesthesia research. Her career has taken her to the Universities of Oxford, Toronto, Edinburgh and Sussex, and she currently runs the Synesthesia and Sensory Integration lab at the University of Sussex. Her work focusses on the psychological and neuroscientific bases of synesthesia, and has been published high impact journals including 'Brain' and 'Nature', and in over 100 newspaper and media articles worldwide. She is the current Science Officer for the UK Synaesthesia Association, Director of the ERC-funded MULTISENSE project, and Director of the ESRC-funded Savant Network.

Michael Tye

Michael Tye encountered philosophy at Oxford, and taught at Temple University, St Andrews, and the University of London before coming to the University of Texas at Austin in 2003. He is the Dallas TACA Centennial Professor in Liberal Arts.

Nick Watkins

Nick Watkins trained as a theoretical physicist at UCL and Sussex. During his career at the Universities of Sussex and Warwick, and the British Antarctic Survey, his interests evolved from his PhD on the interface between the quantum and classical worlds, via experimental space physics to his current highly interdisciplinary work on complex systems including space plasmas, climate and animal foraging. Informed in part by his own experience, he has become very interested in the role that the diversity in human imagery and memory has played in shaping the history of science, and in particular, the life of Benoit Mandelbrot, the father of fractals. He has recently been a senior visiting scientist at the Max Planck Institute for the Physics of Complex Systems, and the University of Potsdam. He currently holds visiting professorships in the Centre for the Analysis of Time Series at the LSE and the Faculty of Mathematics, Computing and Technology of the Open University. He is also a visiting fellow at the Centre for Fusion, Space and Astrophysics at Warwick.

Nuala Watt

Dr Nuala Watt holds a PhD from the University of Glasgow on the role of partial sight in poetics. She is a member of the Clydebuilt poetry mentoring scheme. Her poems have appeared in *Magma* and *Gutter* as well as on BBC Radio 3 and in the webzine Jacket2. Poems also recently appeared in *Be The First To Like This* an anthology of new Scottish poetry.

Her pamphlet *Dialogue On The Dark* was published by Calder Wood Press in December 2015. She is currently working on a series of poems exploring mediaeval conceptions of blindness as preparation for a University of Glasgow conference on the history of the senses, which is due to take place in July 2016.

Poems are available at www.jacket2/content/nuala-watt

Crawford Winlowe

Dr Crawford Winlove was educated at the University of Bristol, completing his PhD under Prof. Alan Roberts, FRS. This work used a simple animal model, the *Xenopus* tadpole, to characterise the biophysical basis of patterns of electrical activity recorded in neurons that mediate behavioural responses.

Following his PhD, Crawford was appointed to a Lectureship at the Peninsula College of Medicine and Dentistry. He joined the University of Exeter in 2012.

Over this period his research has come to focus on human behaviour; techniques include neuroimaging, psychological testing and computational modelling. Crawford has particular interests in addiction – and imagination.

Paul Worthington

Paul Worthington has been the Director of Research and Development for Lindamood-Bell Learning Processes (LBLP) since 1990. Previously, he was the Director of the Chance Program for Learning Disabled college students at Graceland University, in Lamoni Iowa, and from 1972 he worked for the Department of the Air Force in Intelligence Operations. Lindamood-Bell Learning Processes' mandate is to comprehensively address the language and learning needs of individuals, developmentally or remedially, helping all to reach their potential.

Paul's current initiatives with Lindamood-Bell Learning Processes include on-going research in the areas of language and learning assessments/diagnosis, developmental and remedial language and learning program efficacy research, and professional development for teaching reading. His specific area of application in these areas is toward translational research between the neurobiological foundations of learning and the application(s) of that science to education. Current initiatives within this research model include collaborations with the Institute for Learning & Brain Sciences at the University of Washington and the National Science Foundation (Dyslexia), the Georgetown University Center for the Study of Learning and the National Institutes of Child, Health, and Human Development (Dyscalculia), the Cognition, Brain and Autism Laboratory at the University of Alabama in Birmingham (Autism), the University of California at Los Angeles (Executive Function), and finally the McGovern Institute for Brain Research at MIT (Dyslexia).

Paul's primary future research goal is toward approaches of neuro-biologically and behaviorally measuring individual differences of mental imagery abilities, especially as correlated with cognition.

David Zagoury

David Zagoury is a PhD student in art history at the University of Cambridge. His thesis, '*Fantasia' and Imagination in Art Theory from Leonardo to Lomazzo,* explores the conceptions of imagination developed by artists and critics in Northern Italy during the sixteenth century. David studied philosophy, art history and law at the University of Geneva (LL.B. 2011, B.A. 2013) and received his Masters in History of Art and Visual Culture from the University of Oxford in 2014, where he wrote a dissertation on Brion Gysin's *Dream Machine* (shortlisted for the AAH Dissertation Prize, 2015). In 2015, he was a scholar in residence at NIKI-Florence. He also worked for the Bodmer Library in Geneva and the Musée d'Art du Valais in Sion.

Adam Zeman

Adam Zeman is Professor of Cognitive and Behavioural Neurology at the University of Exeter Medical School. He works clinically with patients with cognitive and sleep disorders. His research focusses on the effects of epilepsy on memory, especially the syndrome of Transient Epileptic Amnesia - http://projects.exeter.ac.uk/time/ - and on visual imagery - http://medicine.exeter.ac.uk/research/neuroscience/theeyesmind/. He is the author of Consciousness – a user's guide (Yale University Press, 2002) and A Portrait of the Brain (Yale University Press, 2008). He led the Eye's Mind project with Professor John Onians.

Binglei Zhao

Binglei Zhao received the B.Sc. degree from Southeast University, Nanjing, China, and dual M.Sc. degree both in Science Education and in Cognitive Neuroscience from the University of York, U.K., in 2013 and 2014. She is currently working toward the PhD degree with the Human Cognitive Neuroscience, Department of Psychology, University of Southampton. Her research interests include visual imagination, visual spatial representation and educational neuroscience.