A Motor Bias Theory of Attention

ES/N018842/1

Cognitive and Motor Processes in Visual Attention Workshop

Durham University

Thursday 11th & Friday 12th July 2019

Thursday 11th

Time		Location
11.30 – 12.20	Registration Opens	L68
12.20 – 12.30	Opening remarks & Housekeeping	L48
12.30 – 13.30	Keynote **Dissociating Presaccadic attention from Covert attention** Marisa Carrasco	L48
13.30 – 15.00	Session 1: Oculomotor system **Selective processes for perceptual continuity in active vision** Martin Rolfs **Decision theoretic models of fixation control and target selection** Casimir Ludwig **What does Alzheimer's Disease reveal about the relationships of attention, working memory and the inhibitory control of saccadic eye movements?** Trevor J. Crawford	L48
15.00 – 15.30	Coffee Break	L68
15.30 – 17.00	Session 2 : Attention & Action **Visual attention at the edge of the oculomotor range** Nina Hanning **The reference frame of action-effect prediction** Thérèse Collins **Attentional template activation in preparation for search** Anna Grubert	L48
17.00 – 17.20	**Special session** on Attention and the Global Effect Stefan van der Stigchel	L48
17.20 – 19.00	**Poster Session** & drinks reception	L68
19.00 – 21.00	Social Dinner	St. Hilde & Bede

Friday 12th

Time		Location
9-10.30	Session 3: : Neuropsychology **Perception and action in parietal patients** Laure Pisella **Trans-saccadic memory after right parietal brain damage** Teuni ten Brink **Spared Action and Non-Invasive Brain Stimulation Training in Stroke Patients with Hemispatial Neglect** Monika Harvey	L48
10.30 – 11.00	Coffee Break	L68
11.00 – 12.00	Keynote **Visual Working Memory for Action** Christian Olivers	L48
12.00 – 12.45	Lunch	L68
12.45 – 14.15	Session 4: **A Motor Bias Theory of Attention** **OREO: An Oculomotor Readiness account of Exogenous Orienting** Soazig Casteau, Dan T. Smith **Gaze-contingent paradigm changes bias in spatial attention in healthy observers: an intervention with potential to treat patients with spatial neglect** Karin Ludwig, Thomas Schenk **TBA** Joris Elshout, Stefan van der Stigchel	L48
14.15 – 14.30	Summary & Closing Remarks	L48

Thursday 11th

Keynote Session

Dissociating Presaccadic attention from Covert attention

Marisa Carrasco
Psychology and Neural Science
New York University, U.S.A

Selective attention is essential for visual perception. Spatial attention allows us to grant priority and selectively process information at a given location. In this talk, I will compare and contrast two kinds of spatial attention: presaccadic (allocated to the location of the upcoming saccade's target) and covert (allocation to the target location while maintaining fixation).

First, I will highlight some research on endogenous (voluntary) and exogenous (involuntary) covert spatial attention, which has shown to alter performance and subjective appearance in many basic visual tasks mediated by contrast sensitivity and spatial resolution. Moreover, I will present a study revealing that covert attention modulates performance even at the center of gaze without any accompanying eye movements.

Second, I will present studies showing that while planning a saccadic eye movement, presaccadic attention: (a) improves performance and concurrently increases perceived contrast at the saccade target location; (b) alters the processing of feature information by narrowing orientation tuning and enhancing the gain of high spatial frequency information at the upcoming saccade landing location; (c) increases sensitivity for high spatial frequencies automatically, even when it is detrimental to the task at hand; (d) improves contrast sensitivity via response gain, regardless of the size of the presaccadic attention window. All these modulations are time-locked to saccade onset, peaking right before the eyes move. We propose that saccade preparation may support transaccadic integration by reshaping the representation of the saccade target to be more fovea-like just before saccade onset.

Finally, I will compare these studies on presaccadic attention with corresponding studies of endogenous (voluntary) or exogenous (involuntary) covert attention. I will discuss their similarities and dissociations with regard to their effects on performance, subjective appearance, gain and tuning properties, flexibility/automaticity, and temporal dynamics, which suggest different underlying mechanisms. Systematically investigating these common and differential characteristics furthers our understanding of the pervasive selective processing of information, which enables us to make sense of our complex visual world.

Friday 12th

Keynote Session

Visual Working Memory for Action

Christian Olivers
Institute for Brain and Behaviour Amsterdam
Section Cognitive Psychology
Vrije Universiteit Amsterdam, The Netherlands

Like attention, working memory eventually serves action. Yet, the bulk of visual working memory research focuses on sensory storage in service of single delayed match-to-sample tasks. I present work based on a more dynamic approach, where visual working memory flexibly adapts in response to changing task demands. I will show how oculomotor and EEG responses reveal which of multiple memory representations is currently active, and how switching between memory representations is controlled, when observers perform sequences of visual tasks. I will also present a study showing how the same stimulus is represented differently in working memory depending on the action required at test. Finally, time permitting, I will present a gated neural network model that uses action-based systems in combination with attention-driven reinforcement learning in order to acquire flexible control over working memory representations.

Thursday 11th **Talk Session 1 / 13.30 – 15.00**

Selective processes for perceptual continuity in active vision

Martin Rolfs
Department of Psychology
Humboldt-Universität zu Berlin, Germany

Saccadic eye movements rapidly shift our point of regard thousands of times every waking hour, allowing us to see every aspect of the visual scene at the highest resolution. Psychophysical studies suggest that vision undergoes turbulent changes every time the eyes shoot to a new location: we mislocalize flashed stimuli in space and time, visual sensitivity is notably hampered across the visual field, and visual sensory memory is wiped out as the saccade imposes drastic displacements of the image on the retina. I will present research showing how the active visual system tightly coordinates selective processes—eye movements, visual attention and visual short-term memory—to bridge the abrupt discontinuities accompanying saccades. I will argue that a prime function of this tight coordination is to shape a seamless perceptual experience of the visual world.

Decision theoretic models of fixation control and target selection

Casimir Ludwig
School of Psychological Science & Bristol Vision Institute
University of Bristol, UK

Limitations in the resolution of human vision mean that we have to be selective in our visual processing, and attend or fixate objects of interest sequentially. Selecting the next fixation location is typically thought of as a competition between multiple candidate targets in peripheral vision. One particularly popular instantiation of this idea is that motor programmes associated with fixating different candidate targets are engaged in a competitive "race to threshold". Whichever motor programme reaches a decision threshold first, is executed. This decision theoretic model provides an elegant, integrated account of *what* target is fixated and *when* that target is fixated. This model also has considerable neurophysiological support. I will evaluate the utility of this decision theoretic framework. Specifically, I will focus on the following questions. Is target selection controlled by a "race to threshold" between competing motor programmes in the presence of a foveal load? To what extent is fixation duration controlled by the foveal processing demands and the selection of the next target? Although target selection may be thought of as a dynamic competition between alternative motor programmes, the resolution of this competition does not determine fixation duration. Fixation duration is primarily determined by the foveal processing demands. The presence of even a simple foveal task seemingly alters the way target selection operates, and I will outline different possible models of the relation between foveal analysis and peripheral target selection.

What does Alzheimer's Disease reveal about the relationships of attention, working memory and the inhibitory control of saccadic eye movements?

Trevor Crawford
Department of Psychology
Faculty of Science and Technology
Lancaster University, UK

Several theories of visual search and inhibitory control have proposed a strong contingency between spatial attention, working memory and inhibitory control. For example, Vogel et al. stated, "Selection efficiency varies substantially across individuals and is strongly predicted by the particular memory capacity of each person" (Nature, 2005). Patients with early dementia due to Alzheimer's disease (AD and Mild Cognitive Impairment (MCI)) provide an ideal opportunity to evaluate the potential limitations of these theories, given their impairment of working memory. In this talk I will present a series of eye-tracking studies that we have conducted in my lab over the last 15 years on Alzheimer's disease. Large group studies have revealed that patients with AD have a reliable impairment of inhibitory control in the anti-saccade task (AST). Patients with AD (but not Parkinson's Disease) and patients with *amnesic* MCI (but not non-amnesic MCI) generate a high proportion of uncorrected errors in the AST. Trial-by-trial analyses reveal that the frequency of past errors increases the probability of future errors; conversely the frequency of past successes reduces the probability of future errors. These errors present early during the course of the disease, and correlate with the severity of the memory dementia. Detailed single case studies show that the impairments of inhibitory control can be clearly dissociated from the impairment of working memory, which presents a challenge for theories that have argued that the constructs of inhibitory control and working memory are one and the same. Curiously, using the recent distractor task (Crawford et al 2005; Wilcockson, 2019) that demands the spatial inhibition of a visual distractor, we have found no impairment in AD or MCI. The well-known "gap" effect is also well-preserved in dementia. Similarly, we find a clear preservation of bottom-up and top-down eye gaze control during a visual search task using TV video footage and during an every-day task, such as making a cup of tea. Together these findings reveal that a dysfunction of working memory can co-exist with the preservation of selective attention tasks in the laboratory and top-down control during more naturalistic every day behavior. In addition to the clinical relevance, these findings have implications for cognitive control theories of active vision.

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL DFG NWO

Visual attention at the edge of the oculomotor range

Nina Hanning
Department of Psychology
Ludwig-Maximilians-University, Germany

Neurophysiological studies demonstrated that attentional orienting is performed by fronto-parietal brain areas which also play an important role in oculomotor control (e.g. LIP and FEF). Accordingly, several studies claimed that exogenous attention can only be deployed to where we can potentially make an eye movement, i.e. within the oculomotor range (OR). This assertion was based on the finding that patients with eye movement disorders as well as participants whose oculomotor range had been experimentally reduced show no pronounced reaction time benefit at exogenously cued locations that were not reachable by their eyes. Deducing the allocation of visual attention from reaction times (stimuli appearing in the focus of attention are detected faster) is a popular approach in vision science, however, reaction times reflect the time for detecting the stimulus as well as decision- and response-dependent processes. Furthermore, a neurophysiological link between manual response times and oculomotor selection or activity is not established. In contrast, it is well known that spatial attention improves visual perception via oculomotor feedback projections converging onto earlier visual areas. We therefore tested the assumption that attention is limited to the oculomotor range by assessing visual sensitivity before saccadic eye movements and during fixation at locations within and beyond participants' oculomotor range. Participants rotated their heads to prevent them from performing large rightward saccades. In this posture, an attentional cue was presented inside or outside their oculomotor range. Participants either made a saccade to the cue or maintained fixation while they discriminated the orientation of a visual noise patch. In contrast to previous reports, we found that the cue attracted visual attention regardless of whether it was presented within or beyond participants' oculomotor range during both fixation and saccade preparation. Moreover, when participants aimed to look to a cue that they could not reach with their eyes, we observed no benefit at their actual saccade endpoint. Our results demonstrate that spatial attention is not coupled to the executed oculomotor program but instead can be deployed unrestrictedly also toward locations to which no saccade can be executed. This shows that the coupling of attention and eye movement control is not as tight as the prominent "Premotor Theory of Attention" suggests. Rather, attention can be shifted freely over the entire visual range, independent of pathological and physiological limitations of the eye movement system.

The reference frame of action-effect prediction

Thérèse Collins
Laboratoire Psychologie de la Perception - UMR 8242
Université Paris Descartes, France

An essential aspect of voluntary action control is the ability to predict the perceptual effects of our actions. The influence of action-effect prediction on behavior and perception has been shown in many studies. Participants generate an action and observe its consequences, usually the appearance of a particular visual stimulus on a computer screen. Following this acquisition phase, participants give a perceptual report about a stimulus that appeared as the result of their action. Studies have shown that sensitivity is greater when the effect is congruent with the previously learned association than when it is not. In the present experiment, we examined the spatial reference frame of action-effect prediction by changing either the spatiotopic or retinotopic location of the effect relative to the acquisition phase. Results show that action-effect predictions occur in both reference frames, arguing in favor of the involvement of multiple levels of visual brain processing.

Attentional template activation in preparation for search

Anna Grubert
Department of Psychology,
Durham University, UK

Attentional templates (mental representations of target defining features) are activated prior to search to guide spatial attention to target-matching events in the visual field. To investigate the temporal dynamics and organisational flexibility of preparatory template activation, we recently developed a new rapid serial probe presentation protocol (RSPP; Grubert & Eimer, 2018). In the basic version of this paradigm, circular search displays (presented every 1600ms) contained a colour-defined target among five differently coloured distractors. Brief circular probe displays that included a target- or distractor-colour singleton among grey items were flashed (50ms) in rapid succession (every 200ms) throughout each block, at a different eccentricity than the search displays. N2pc components, as electrophysiological markers of attentional capture, were measured in response to each successive probe in the interval between two search displays. Distractor-colour probes did not trigger any N2pc components, indicating that they were not systematically attended. However, target-colour probe N2pc amplitudes increased during the preparation period and were largest for probes directly preceding the next search display. This pattern of results indicates that attentional templates are activated (colour) selectively and transiently during the preparation for individual search episodes. In my talk, I will present a series of experiments in which we employed (variants of) this RSPP protocol and found that top-down controlled search preparation is modulated in line with temporal task parameters (during shorter versus longer and fixed versus variable inter-search intervals), that multiple preparatory target templates can be activated simultaneously (during multiple-colour search), but that such multiple template activation states are surprisingly inflexible and are not subject to strategic top-down adjustments (when the respective target colour is more versus less predictable).

[P1] Attention modulation at cued and non-cued locations for overt and covert attention shifts

Julie Ouerfelli-Ethier[1-2], Youngmin Song[3], Laure Pisella[2], & Aarlenne Z. Khan[1]

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[2] ImpAct team, INSERM UM1028, CNRS UMR 5292, University Claude Berneard Lyon 1, France
[3] Department of Biology, McGill University, Canada

We investigated with two experiments how attention is modulated at cued and non-cued locations or how this modulation differs between covert (fixation) and overt (saccade) attention shifts. In experiment 1, 12 participants (*M* = 26 y, *SD* = 6 y) discriminated the orientation of a single target Gabor-patch, according to a mostly valid cue across fixation and saccade conditions. While saccade planning increased performance during valid trials, there were no difference between fixation and saccade invalidity costs. In experiment 2, the target and the distractors were presented simultaneously. Preliminary data from four participants (*M* = 26 y, *SD* = 11 y) showed a facilitation effect at cued location regardless of condition, and a suppression effect for invalid trials, once more without an effect of condition. We speculated that suppression mechanisms may not be implicated unless objects are competing for selection.

[P2] Spread of attention towards stimuli grouped with a saccade target.

Olga Shurygina[1], Arezoo Pooresmaeili[2], Martin Rolfs[1]

[1] Department of Psychology, Humboldt-Universität zu Berlin, Germany
[2] European Neuroscience Institute Göttingen, Germany

Before the onset of a saccade, visual sensitivity increases at the saccade goal. In natural vision, movement targets are often part of extended objects, raising the question whether pre-saccadic attention is confined to the movement goal or instead selects entire target objects. We measured attention as performance in a visual discrimination task both at the target of a saccade and at locations of non-target items that were either perceptually grouped or not grouped with the saccade target. We observed a strong pre-saccadic attention shift: performance was highest at the saccade target and increased towards the movement onset. At the non-target locations, performance was higher during the middle stages of saccade preparation provided that these locations were perceptually grouped with the saccade target. The different dynamics of attentional allocation—towards the saccade target and the locations grouped with it—suggests that selection occurs at both object- and location-based levels of processing.

[P3] The influence of spatial priors and visual processing time on attentional selection and oculomotor control

Luca Wollenberg[1,2], Heiner Deubel[2]

[1] Allgemeine und Experimentelle Psychologie, Department Psychologie,Ludwig-Maximilians-Universität München, Germany

[2] Graduate School of Systemic Neurosciences, Ludwig-Maximilians-Universität München, Germany.

In a recent study (Wollenberg, Deubel, & Szinte, 2018, *PLoS biology*) we observed that visual attention is not deployed at the endpoint of averaging saccades but rather equally distributed across two competing saccade targets, suggesting that oculomotor averaging arises from unresolved saccade target selection. Here, we investigated how oculomotor competition is resolved when participants have prior knowledge about target or distractor locations. Participants had to saccade towards a target, presented together with a nearby distractor, and discriminate localized probes during saccade preparation. Importantly, we systematically varied the degree of preknowledge about target and distractor locations, and introduced delayed go-signals to differentially increase visual processing time. Data suggest that oculomotor competition is reflected in an initial attentional capture at the competing visual onsets and resolved only later via sustained and selective attentional facilitation of the target. Moreover, oculomotor averaging disappears roughly around the time of successful attentional target selection.

This work was supported by grants of the Deutsche Forschungsgemeinschaft to HD (DE336/5-1 and RTG 2175)

[P4] How primitive are pre-attentive primitives? Colour-constancy in a feature-based attention task.

Robert Kentridge, Liam Norman, Charlie Heywood, & Kathleen Akins

Department of Psychology, Durham University, UK

Pre-attentive vision is taken to operate on 'primitive' visual features. Colour can be represented in more than one way. We estimate colour as property of materials by discounting the effects of the colour of illumination on the light reaching our eyes from an object. These estimates differ from sensations of colours – we may judge two objects to be made of the same material when the sensations of those objects' colours differ. We test whether the representation of colour in pre-attentive vision is of material colour or is more closely allied to sensation. We conducted a feature-based attention task in which cue-colour predicted the location of a probe. We changed the illumination of stimuli between presentation of the cue and of a set of placeholders. A probe usually appeared in a placeholder in the same colour category as the cue. Half of those placeholders matched the cue in material colour, half reflected light with the same spectral composition as the cue under the initial illuminant. Probe orientation was discriminated more quickly in placeholders matching the cue's material colour than those matching in light spectrum. As placeholder colour determines the allocation of attention it must be represented pre-attentively, suggesting that material colour is available to pre-attentive vision.

[P5] Attentional inertia: Exploring the influence of a preceding task on visual attention

Catherine Thompson

School of Health Sciences, University of Salford, Salford, UK

When investigating the allocation of visual attention focus is generally given to the influence of top-down and bottom-up features within a given task. Yet findings show that features associated with a previous task can influence subsequent allocation of attention. This effect has been termed "attentional inertia" and it demonstrates the persistence of attentional settings from a task in which they are relevant to a task in which they are no longer relevant. Findings from a collection of experiments will be presented showing how top-down settings can persevere from one task to a second (sometimes very different) task and influence the allocation of attention, visual search, and performance in the second task. Limits to the attentional inertia effect will be outlined showing that the extent to which a preceding task can influence attention will depend upon the situational context and individual differences in attentional control. It is proposed that the effect should be considered within models of visual attention.

[P6] Temporal dynamics of attention shifts during arithmetic problem solving

Samuel Salvaggio, Nicolas Masson & Michael Andres

Université Catholique de Louvain, Belgium

Behavioural studies have suggested that number manipulation involves shifting attention along a left-to-right oriented continuum. We measured horizontal gaze patterns in two eye-tracker experiments that combined the free exploration of visual scenes with a verbal numerical task. The first experiment required participants to compare numbers (from 20 to 70) to a reference (45). A rightward shift was observed when the number was larger than the reference, starting after hearing the number decade and lasting until response production. The second experiment investigated the mental solving of addition (43+4) and subtraction problems (53-6). A first difference was observed just after hearing the operator: the plus sign shifted the eye rightward compared to the minus sign. A second difference between addition and subtraction was observed later, after problem offset, but only in problems requiring carrying or borrowing procedures. These findings evidence the effect of computational constraints on the time course of attention shifts.

[P7] Investigating the functional role of oculomotor programming in mental arithmetic with the abducted-eye paradigm

Nicolas Masson, Mauro Pesenti

Université Catholique de Louvain, Belgium

Space and numbers are intimately related, as evidenced by the fact that subtraction and addition solving is accompanied by leftward and rightward gaze shifts respectively. Those eye movements were considered as a spillover of mental associations between space and numbers. We tested whether this space-arithmetic association is mediated by the activation of oculomotor programs. We used the abducted-eye paradigm to disrupt oculomotor preparation in participants solving additions and subtractions presented visually while fixating a screen positioned either in front of them or at 40° to the left/right. Compared to the frontal condition, rightward abduction impaired additions with carry and leftward abduction impaired subtractions with borrow. This suggests that at least some arithmetic problems require processes dedicated to programming horizontal saccades. These problems might recruit oculomotor mechanisms operating on a visuo-spatial mental space built in working memory to represent one numerical magnitude (i.e., first operand) relatively to another (i.e., the result).

[P8] Time after time: support for memory accounts of temporal preparation.

Joe Butler, Samuel Ngabo, Marcus Missal

Psychology Department, University of Sunderland, UK

Complex biological systems build up temporal expectations to facilitate adaptive responses to environmental events. This is demonstrated in tasks which show faster response times when the period between warning (S1) and target stimulus (S2) on the previous trial was short and slower when it was long. The mechanisms driving these higher order effects are still under debate, with key theories proposing that either i) the foreperiod modulates the arousal system which subsequently influences responses on the following trial, or ii) that exposure to a foreperiod results in the creation of a memory trace which is used to guide responses on the subsequent trial. Here we provide data which extends the evidence base for memory models, by showing that previous foreperiod exposures are cumulative with reaction times shortening after repeated exposures; whilst also demonstrate that the higher order effects associated with a foreperiod remain active for several trials.

[P9] How are working memory resources re-distributed across saccades?

Robert Udale

Department of Experimental Psychology, University of Oxford, UK

Encoding the external environment requires integrating information from multiple fixations. How are memory resources re-distributed to the incoming perceptual information over these saccades? Some research has indicated that items which are currently being saccaded towards, but not yet fixated, are more precisely represented in memory than previously fixated items. This is consistent with the view that saccades are preceded by a shift in covert attention to the saccade target location with reallocation of memory resources to the saccade target's features. We tested the effect of fixation order on memory recall precision. Participants sequentially fixated items in a memoranda display (locations or orientations) at their own pace. Once they initiated a saccade towards the final item, the display disappeared. After a brief interval, they were cued to recall the feature of one of the items. We found greater precision for the final saccade target than for previously fixated items. This occurred irrespective of whether they were instructed to saccade towards a particular item last, or whether to fixate the items in any order they chose. However, when we ran an experiment in which the display would disappear unpredictably before participants had viewed all items, the final item benefit depended on how many items had already been fixated. These results indicate that mnemonic resources can be flexibly and strategically allocated depending upon task demands: to the upcoming saccade target in predictable conditions but confined to fixated items in more uncertain environments.

[P10] Investigating how prior knowledge influences perception and action in Developmental Coordination Disorder

Gavin Buckingham[1], Kate Allen[1], Sam Vine[1], Mark Wilson[1], David Harris[1], Greg Wood[2], and Krasimira Tsaneva-Atanasova[1]

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Developmental Coordination Disorder (DCD) is characterised by difficulties in the ability to perform different motor tasks. Recently, it's been suggested that a selective deficit in sensorimotor prediction and feed-forward planning might underpin these impairments. Here, in the context of a naturalistic object lifting paradigm, we present eye-movements, hand kinematics, and fingertip forces of a large sample of 8-12 year-old children with and without DCD. Findings related to hand-eye coordination and fingertip force application based on size cues are discussed in relation to current models of sensorimotor prediction.

[P11] Enhanced obstacle contrast as an intervention to promote visual scanning in fallers with parkinson's disease: role of executive function

Lisa Alcock [1,2], Brook Galna [1,2,3], Jeffrey M. Hausdorff [4,5,6], Sue Lord [7], & Lynn Rochester [1,2,8]

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[2] Clinical Ageing Research Unit, Campus for Ageing and Vitality, Newcastle upon Tyne, UK
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[5] Rush Alzheimer's Disease Center and Department of Orthopeadic Surgery, Rush University Medical Center, Chicago, U.S.A
[6] Sagol School of Neuroscience and Department of Physical Therapy, Sackler Faculty of Medicine, Tel Aviv University, Israël
[7] School of Clinical Sciences, Auckland University of Technology, New Zealand
[8] The Newcastle upon Tyne NHS Foundation Trust, Newcastle upon Tyne, UK

Introduction: The ability to perceive differences in environmental contrast is critical for navigating complex environments safely. People with Parkinson's disease (PD) report a multitude of visual and cognitive deficits which may impede safe obstacle negotiation and increase fall risk. Enhancing obstacle contrast may influence the content of visual information acquired within complex environments and thus target environmental fall risk factors. **Methods:** 17 PD with a history of falls and 18 controls walked over an obstacle covered in a high and low contrast material in separate trials whilst eye movements were recorded. Measures of visual function and cognition were obtained. Gaze location was extracted during the approach phase. **Results:** PD spent longer looking at the obstacle compared to controls regardless of contrast ($p<.05$), however group differences were largest for the low contrast obstacle. when accounting for group differences in approach time, PD spent longer looking at the obstacle and less time looking at the ground beyond the obstacle compared to controls ($p<.05$). The response to obstacle contrast in PD (high-low) was significantly associated with executive function. Better executive function was associated with spending longer looking at the low contrast obstacle and at the ground beyond the high contrast obstacle. **Conclusions:** Enhancing the contrast of ground-based trip hazards may improve visual processing of environmental cues in PD, particularly for individuals with better executive function. Manipulating contrast to attract visual attention is already in use in the public domain, however its utility for reducing fall risk in PD is yet to be formally tested in habitual settings.

[P12] Bias in space and time: the reliability and variability of pseudoneglect

Alexandra G. Mitchell, Sarah Benstock, Julie M. Harris & Justin M. Ales

School of Psychology & Neuroscience, The University of St Andrews, UK

Pseudoneglect is the presence of a left-ward asymmetry in spatial cognition in neurotypical individuals and current theories suggest that it is a consequence of hemispheric lateralisation in spatial attention (Bowers & Heilman, 1980). However only a few studies have investigated the reliability of pseudoneglect (Learmonth et al., *PLOSone,* 2015; Nicholls, Bradshaw & Mattingley, *Neuropsychologia*, 1999). Here we used three different tasks over four separate sessions; visuomotor manual line bisection (MLB), visual landmark and tactile rod bisection (TRB) to investigate both the reliability and variability of response bias. Biases for both the landmark (alpha = 0.80, $p < .001$) and TRB tasks (alpha = 0.61, $p = <.001$) were reliable across sessions, but not for MLB (alpha = 0.11 $p = .459$). However, no reliability across tasks was found (alpha = -0.12, $p = .606$). Differences highlighted between each pseudoneglect task questions possible underlying mechanisms of pseudoneglect.

[P13] Sensorimotor landscapes during body-directed actions. An EEG investigation.

Xavier Job[1,2], Silvia Chiesa[1], Laura Buck[1], Julia Mayas Arellano[3], Jose van Velzen[1]

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Behavioural and electrophysiological evidence has demonstrated that preparation of goal-directed actions modulates sensory processing at the goal location before the action is executed. The present study investigated tactile sensory processing during planned body-directed movements. A motor task cued the preparation of reaching movements toward a goal on the upper body or away from the body. Somatosensory evoked-potentials were recorded in response to task-irrelevant tactile stimuli delivered randomly at the central goal location on the body, or at adjacent lateral locations. Early stimulus-evoked activity was enhanced during movement preparation towards, compared to away from, the stimulated location. This enhancement of tactile processing was attenuated at lateral sites, particularly when the action space was occluded from vision. The results suggest that planned body-directed movements are accompanied by a topography of modulated sensory processing across the body which is more constrained around the goal of the movement when visual access of the action space is denied.

[P14] Motor imagery during action observation modulates automatic imitation in aging individuals

Matthew Scott, Jonathan Emerson, Adam Gilmartin, Daniel Eaves

School of Health and Social Care, Teesside University, UK

We assessed automatic imitation in older adults. On each trial participants (*n* = 11; mean age = 59.4 ± 5.5 years) viewed a target action: face-washing or paint-brushing in the horizontal or vertical plane. Before executing this rhythmical action, participants saw a rhythmical distractor video with a subtle speed manipulation across trials. Instructed and distractor actions either matched or differed in action type and plane. We quantified automatic imitation as an imitation bias in execution following distractor observation. Across five counterbalanced instruction conditions participants performed: distractor action observation (AO), observation while imagining a synchronised or static action (synchronised / static AO+MI), synchronised execution, or intentionally imitated the distractor speeds. While the imitation bias was significantly stronger for compatible synchronised AO+MI compared to AO and static AO+MI, this effect was absent for incompatible AO. Automatic imitation effects were therefore impaired in older adults, but can be enhanced via synchronised AO+MI instructions.

[P15] The Recent Distractor Effect: An assessment of ageing, cross-cultural and disease effects.

Megan Polden, Trevor Crawford

Department of Psychology, Faculty of Science and Technology, Lancaster University, UK

The Recent Distractor Effect (RDE) is when eye movements are faster to a location of a previous goal-directed target than a distractor target requiring inhibition (Crawford et al, 2005). The task involves two display screens; the first presents a goal-directed target and distractor targets. The second, a single target in the location of the previous target, the distractor or a new location. The WEIRD problem describes a frequently used sample of participants, creating issues for replicability, generalisability and interpretive power. The current study investigated the RDE with wider population samples such as healthy young (N=75) and older western adults (N=119), South Asian participants (N=83), Alzheimer's disease (N=65) and Mild cognitively impaired (N=91) patients, to ensure robustness. Participants were significantly slower on target to distractor trials compared to target to target trials. The RDE was present in all participant groups indicating the lack of susceptibility to ageing, disease and cross-cultural effects.

Friday 12th **Talk Session 3 / 9.00 – 10.30**

Perception and action in parietal patients

Laure Pisella
INSERM U1028; CNRS UMR5292
University Claude Berneard Lyon 1

We recently investigated whether attention and remapping deficits are possibly dissociated in patients with Balint syndrome following stroke or posterior cortical atrophy. We identified an impairment to deploy attention (shrinked attentional field) as a bilateral covert attention deficit. Disorganized ocular exploration appears to be independent and is hypothesized to result from processes maintaining a salience map over time (spatial working memory) and especially across saccades.

Trans-saccadic memory after right parietal brain damage

Teuni ten Brink
Department of Psychology
University of Bath

Spatial remapping, the process of updating information across eye movements, is an important mechanism for trans-saccadic perception. The right PPC is a region that has been associated most strongly with spatial remapping. We studied whether this right-hemispheric dominance translates into enhanced trans-saccadic memory for locations that are remapped into the right compared to the left hemisphere in healthy participants, and whether damage to the right PPC affects direction specific trans-saccadic memory.

Spared Action and Non-Invasive Brain Stimulation Training in Stroke Patients with Hemispatial Neglect

Monika Harvey
School of Psychology
University of Glasgow

A significant number of stroke patients with right hemisphere lesions show hemispatial neglect, a severe visuospatial impairment, where they fail to perceive/misperceive items presented in the contralesional part of space. I will present data showing that immediate on-line actions are relatively unimpaired in these patients, and further discuss two recent rehabilitation studies where we assessed whether these spared actions could be exploited for neglect rehabilitation a) via behavioural training and b) in a clinical trial using non-invasive brain stimulation.

Friday 12th **Talk Session 4 / 12.45 – 14.15**

Special Session: A Motor Bias Theory of Attention

OREO: An Oculomotor Readiness account of Exogenous Orienting

Soazig Casteau, Dan T. Smith

Psychology Department,
Durham University, UK

The idea that covert spatial attention is necessarily dependent on systems that control overt eye movements has had profound impact on models that propose to account for spatial attention. For example, the widely influential Premotor Theory of Attention (PMTA) (Rizzolatti, Riggio, Dascola, & Umilta, 1987) argues that covert orienting of attention is the result of an eye-movement being prepared but not carried out. One argument put forward by PMTA is the observation that attention could not be shifted to a location that cannot be reached with an eye-movement (e.g., Craighero, Nascimben, & Fadiga, 2004 However, using the same paradigm we observed a dissociation between saccade planning and endogenous covert attention (e.g., Smith et al., 2012). In the first part of my presentation, I will review some of our recent findings showing that (1) exogenous, covert orienting to peripheral cues was disrupted when stimuli are presented outside the range of eye-movement whereas covert endogenous orienting is not and (2) that 'pre attentive' search for feature singletons, which relies on the same cognitive processes as exogenous attention, is only possible within the range of eye-movement. Altogether, our findings showed that PMTA is inadequate to explain endogenous covert orienting, but may still be tenable as a theory of exogenous covert orienting. In the second part, I will propose a new theory to account for these results: OREO.

Gaze-contingent paradigm changes bias in spatial attention in healthy observers: an intervention with potential to treat patients with spatial neglect

Karin Ludwig, Thomas Schenk

Clinical Neuropsychology
Ludwig-Maximilians-Universität München, Germany

Spatial neglect is a debilitating disorder marked by reduced attention to contralesional stimuli. We developed a gaze-contingent intervention in which eye movements to one visual hemifield were reduced over the course of several hundreds of trials by removing the stimuli in this hemifield whenever participants made eye movements towards it. The aim of the study was to determine whether this intervention had an effect on the deployment of attention in healthy participants as a first step towards application in patients. Changes in overt and covert attentional allocation before and after the intervention were measured in a series of different tasks, showing effects on overt attentional allocation (visual search and change blindness tasks). The longevity of this influence was also tested: effects were found until the last follow-up (after 4 days). We conclude that the intervention shows promise for the successful application in neglect patients.

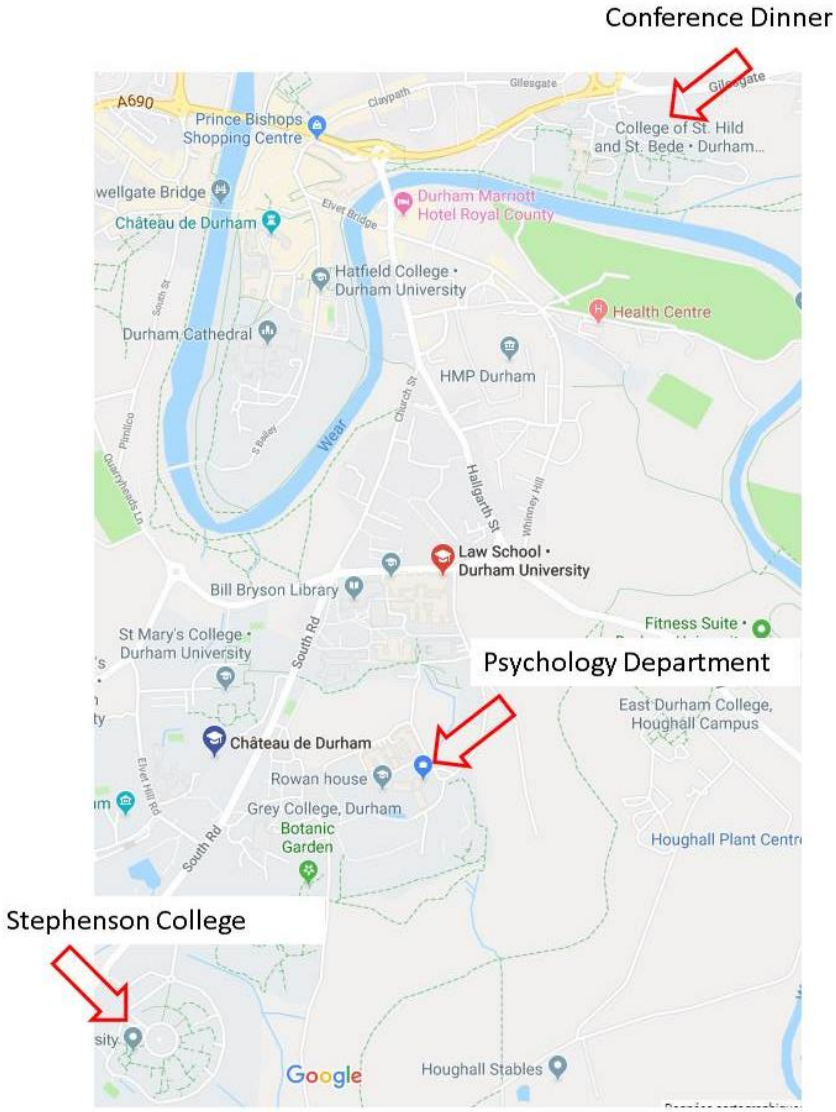
TBA: Joris Elshout, Utrecht University, The Netherlands

Useful Information

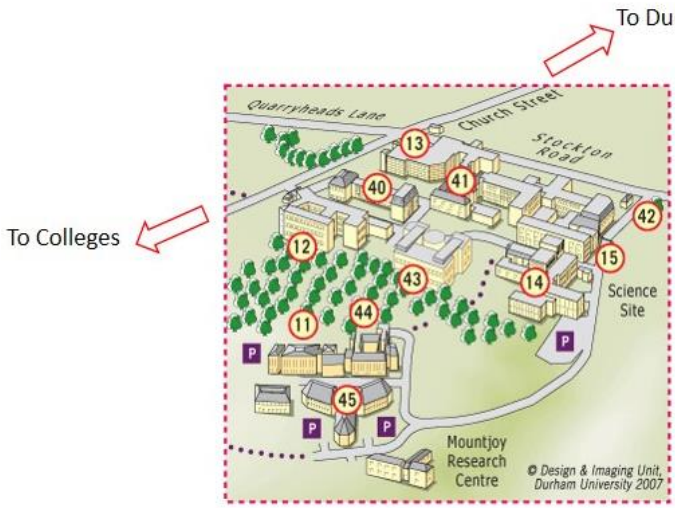
Posters

Posters may have a maximum size of A0 for portait orientation or A1 for landscape orientation. We will provide fixings for posters.

Venues



Psychology Department

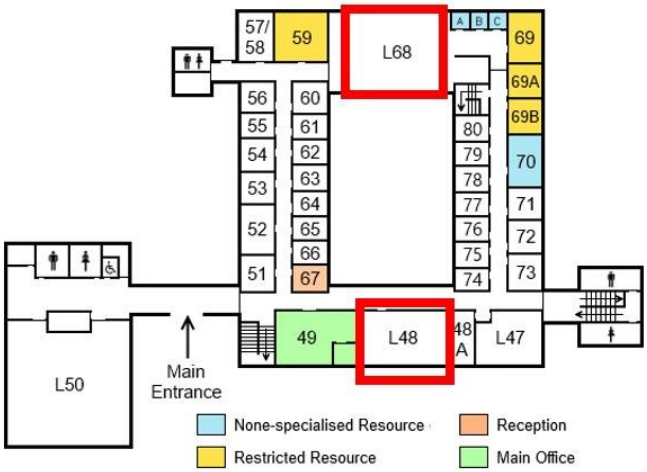


Main buildings:

13 – Bill Bryson Library
43 – Calman Learning Center
42 – Car entrance
44 – Psychology Building
45 – Montjoy Research Center

●●●●● Walking path to Psychology also known as « Cardiac Hill »

Psychology Building – Upper floor



Room L68
Registration
Poster session
Coffee Breaks
Lunch

Room L48
Talk sessions

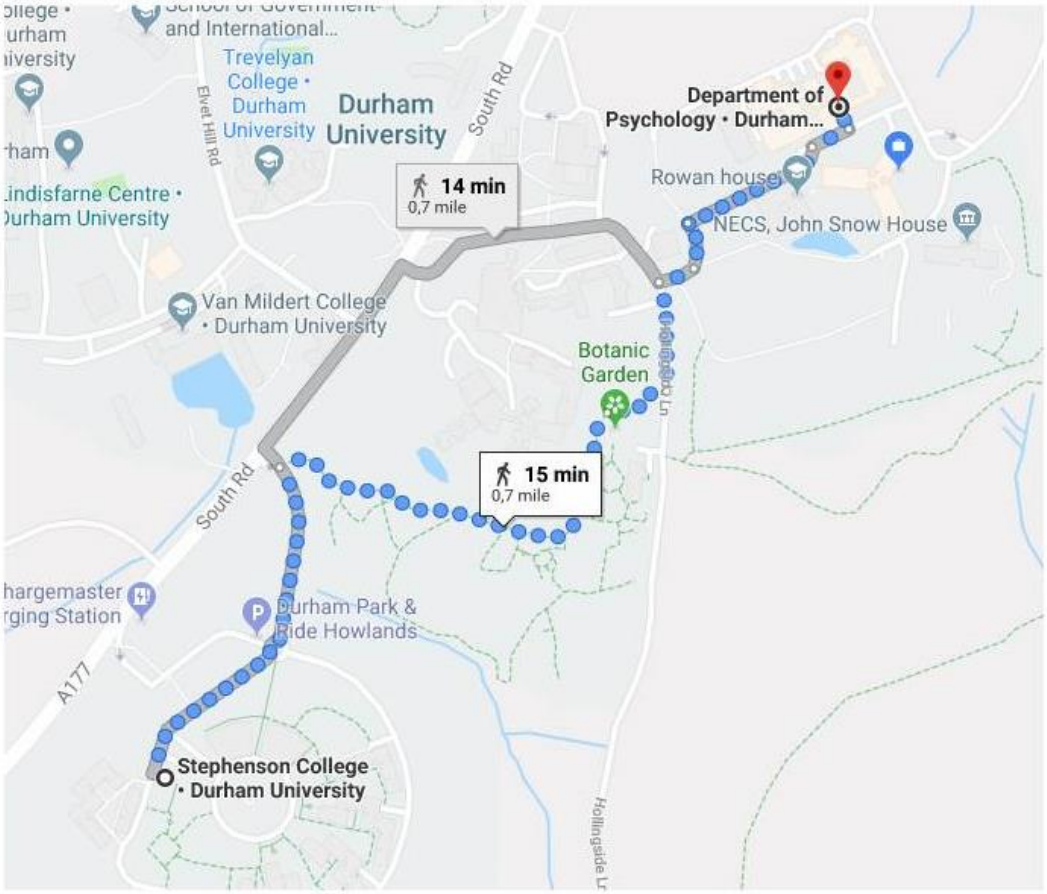
Conference Dinner

Joachim Room – St. Hild & Bede College

Durham, DH1 1SZ

Coach transfer provided from Psychology department – Return to Stephenson College

Stephenson College (accommodation)



Check-in: 14.00

Check-out: 10.00

Bus Stop: Mount Oswald (Bus 6 Sapphire of PR2)

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Travel

By Rail

60 InterCity trains from most major centres in the country call at Durham daily including 14 trains from London. The National Express high speed service takes under 3 hours from London King's Cross on the main London North Eastern Railway Line. First Transpennine Express offers frequent links to Manchester, Sheffield and Leeds, while Cross Country links Durham directly with Scotland, the Midlands and the South West.

Bus To/From Durham Bus Station (5 Minutes' walk from Train Station): 6 Sapphire (Stop' South Road'), PR2 (Stop 'New Inn - Church Street'), 56 (Stop Palatine Center).

Travel Planner: https://www.traveline.info/

By Road

Durham City Centre is only two miles from the A1(M). Leave the motorway at Junction 62 on the A690 Durham - Sunderland Road and follow signs to Durham City Centre.

By Air

Durham is 30 minutes' drive from Newcastle Airport and about 40 minutes from Durham Tees Valley. Both have regular domestic and international flights. Durham is linked to Newcastle Airport by rail and metro. Travellers into Durham Tees Valley can take the Arriva 12 bus service that links the airport to Darlington Railway Station, with regular connections to Durham.

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Internet Access

You can use either Eduroam or Visitors and non-accademic guests should use '**TheCloud@Durham**' to connect to the wireless service when visiting Durham University.

To connect to 'TheCloud@Durham' simply follow the steps below:

1. Switch on your smartphone, tablet or other Wi-Fi device and check that Wi-Fi is enabled.

2. Select 'TheCloud@Durham' from the available network list

3. Open your Internet browser - 'TheCloud' landing page below will appear. Click 'Get Online'.

If the web page does not appear refresh the page.

4. You will then see the service selection screen. Select 'The Cloud Wi-Fi'.

5. Once this is done you can either login with an existing 'TheCloud' account, or click on the 'Create Account' button to register for a free account.

6. Once you have logged in or registered you will be able to access the Internet using 'TheCloud@Durham'.

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Food & Drinks

Lunch will be provided on Friday along with tea and coffee during breaks. There are also several options for purchasing food and drinks near the meeting.

Calman Café - Starbucks

Situated in the Calman Learning Center (See map 43) the Calman Café offers a range of handmade and packaged sandwiches, paninis, soup, salads, muffins and snacks. Serving Starbucks coffee exclusively, come and join us for a Fairtrade Latte, with perfectly steamed milk, rich espresso and a delicate topping of foamed milk.

Opening Times: 08.00 to 14.30

Mountjoy Table

Situated inside the Mountjoy Centre(See map 45), the Table servery offers a range of packaged sandwiches, jacket potatoes, salads, soup of the day, fresh fruit salad and vegetable crudité deli pots, crisps, confectionary and cold drinks.

Opening Times: 10.30 – 14.30 (Thursday) 8.30 to 10.30 and 11.00 to 14.30 (Friday)

Botanic Garden

Café, Gift Shop and Visitor Centre - Located behind the Mountjoy Center

Opening Times: 10.30 – 17.00

Durham University

DREX

Durham Reading and Exploration Training

An app for those with partial visual loss

What is DREX?

DREX is the Durham Reading and Exploration training. Through regular training and assessment this app will teach you to compensate for your partial visual loss.

How does DREX work?

Training can be completed in your own home and at a time that suits you. You do not have to be supervised to complete this training. The app can be accessed by downloading it onto either a desktop computer, android tablet or Apple iPad.

DREX Training

The DREX training consists of 2 parts:

1. Reading Training

This training requires you to decide whether a word is a real word or a non-word.

2. Exploration Training

This type of training presents you with a number of targets and you must find the target that is different from the rest by size, shape or colour.

DREX training is self-adapting and increases in difficulty as you learn.

DREX Assessment

After undergoing the DREX training you will be assessed at regular intervals. 5 assessments are used:-

1. Visual Field
2. Visual Search
3. Reading
4. Short Term Memory
5. Quality of life

In this way we can learn whether the DREX training is an effective way of teaching you to compensate for your visual loss.

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