The University of Manchester
Neuroscience
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MANCHESTER 1824

AVA Annual Meeting 2008, in conjunction with The University of Manchester's Neuroscience Research Institute

VISUAL VARIATION AND BIAS

Tuesday April 1st

University of Manchester, Stopford Building, Oxford Road

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We would like to thank the following colleagues for serving as referees:

Marco Bertamini
Mark Georgeson
Emma Gowen
Tim Meese
Mark Scase
Andrew Schofield
Eugene McSorley
Tom Troscianko

We would like to thank Vicky Catterall (Manchester's Neuroscience Research Institute) for help with organising this meeting.

Sponsorship for the AVA Annual meeting 2008 was provided by:

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AVA Annual Meeting 2008, Tuesday April 1st 2008

VISUAL VARIATION AND BIAS

University of Manchester, Stopford Building, Oxford Road

10.00 Registration and morning coffee (Foyer outside lecture theatre)

11.00 Session 1 (lecture theatre 2) Chair person: Marco Bertamini
On the Role of Fourier Spectra in the Separation of Transparent Motion Components
Johannes M. Zanker & Andrew Meso (Royal Holloway University of London)

11.20
Subtracting Out Redundancy in 1-d and 2-d Image Signals: Illustrations from Tilt After-effects and Contrast Matching
Langley, K.[1] & Anderson, S.J[2] (1 University College London, 2 Aston University)

11.40
Detecting image symmetry using single linear filters
Lewis D Griffin (University College London)

12.00
Naso-temporal asymmetry for signals invisible to the retinotectal pathway
Sumner, Petroc[1,] Bompas, Aline[1,] Robert, Rafal[2] (1 Cardiff University, 2 University of Wales)

12.20
Eye Movement Prediction in Visual Interactive Environments Considering Physical Actions
Ali Borji (Institute for Studies in Theoretical Physics and Mathematics, Tehran, Iran)

12.40 Lunch and posters (Foyer outside lecture theatre 2)

13.20 Business meeting (lecture theatre 2)

13.40 Session 2 (lecture theatre 2) Chair person: Emma Gowen

The Geoffrey Burton Memorial Lecture sponsored by CRS:

Dr. Kate Plaisted (University of Cambridge)
Magnocellular processing in autism

Please note that this lecture will be available to watch again on the CRS website.

14.20
Implicit Memory of Visual Context is intact in Autism Spectrum Disorders
Anastasia Kourkoulou, John M Findlay, Susan R Leekam (University of Durham)

14.40
Is inhibition of return blind?
Geoff G. Cole[1], Paul A. Skarratt[2], & Gellatly, A. R. H[3] (1 University of Durham, 2 University of Hull, 3 Oxford Brookes University).

15.00
Inferring attentional capture by differences in search slopes.
Paul A. Skarratt, Geoff G. Cole, & Gellatly, A. R. H (University of Hull)

15.20 Coffee break and posters (Foyer outside lecture theatre 2)

15.40 Session 3 (lecture theatre 2) Chair person: Mark Scase
An ERP investigation of changes in facial expression.
Michael J Wright (Brunel University)

16.00
Contrasted pattern of brain activity in negative priming: a MEG study.
F. Boy, S. D. Muthukumaraswamy, K. D. Singh & P. Sumner (Cardiff University)

16.20
The role of convexity in the integration of ordinal and metric cues in depth
Marco Bertamini, Jasna Martinovic, Sophie Wuerger (University of Liverpool)

16.40
Perception of motion-in-depth using binocular cues: a fair comparison of changing disparity and inter-ocular velocity differences
Julie M. Harris, Harold T. Nefs and Catherine E. Grafton (University of St Andrews)

17.00 Wine and buffet reception and posters (Foyer outside lecture theatre 2)

Abstracts for oral presentations (in session order)

Note: The abstracts in this programme booklet may not correspond to the finally published abstracts in perception

Session 1

On the Role of Fourier Spectra in the Separation of Transparent Motion Components

Johannes M. Zanker & Andrew Meso (Department of Psychology, Royal Holloway University of London, Surrey TW20 0EX, England, j.zanker@rhul.ac.uk)

Humans are able to see two or more different motions within the same region of the visual field – motion transparency. The separation of transparent motion components offers an opportunity to study the integration of local motion signals. In an attempt to identify constraints for developing a computational model that can solve the problem of separating transparent motion components and that can explain psychophysical observations, we analysed such stimuli and their motion detector responses in space-time (Zanker & Meso, 2007, Perception, 36, 315-16). Here, we extend this work by investigating a range of motion channels tuned to different spatial frequencies and different stimulus patterns, including sinewaves, squarewaves, triangular profiles, and line gratings. These patterns were used to create two kinds of transparency configurations, in which the two components either move in opposite directions at the same speed, or in the same direction at different speeds. Whereas in the opposite-direction configuration local motion signals from pure sinewaves tend to blend into each other and under most conditions disappear, separate components become visible – and discriminable – in high-frequency channels for patterns that contain clear edges such as squarewaves. In the equal-direction configuration local motion components have even less distinct patterns that could reflect the different components, and signals from the transparent components can only be separated by combining the outputs from a set frequency channels to select velocity-related signals that are close to edges. This pattern of results corresponds to psychophysical observations that edges are crucial for the perception of transparency.

Subtracting Out Redundancy in 1-d and 2-d Image Signals: Illustrations from Tilt After-effects and Contrast Matching

Langley, K.[1] & Anderson, S.J[2] (1 Dept. Psychology, University College London, London WC1E 6BT, UK; 2 School of Life& Health Sciences, Aston University, Birmingham, UK)

Background: Subtractive and divisive processes have been used to explain a variety of adaptation effects in early visual processing. We argue that divisive adaptations are most likely to occur in the encoding of uncorrelated signals, or when the visual system's information transmission resources are limited (information bottlenecks), but that subtractive adaptations can occur when exploiting redundancies in 1-d and 2-d image signals. Methods: A multi-channel redundant Encoding-Transmission-Decoding (ETD) system is studied in which early adaptations (information losses) are justified by the transmission constraints imposed upon the propagation of information by the system. Results: The transmission system is shown to be capable of explaining subtractive isotropic losses in adapted contrast (Ross and Speed, *Vis. Res.*, 1996), subtractive orientation tuned losses in adapted contrast, and cross-orientation

suppression (Carandini et al., *Vis. Neurosci.*, 1998). The cross-orientation suppression arises from a subtraction of orthogonal filter responses which may be viewed as a coded energy signal. The system is thus able to account for biases in contrast and in spatial orientation (direct and indirect tilt after-effects). Conclusions: In assuming the visual system is optimized to process signals whose dimensionality is lower than the number of channels at its disposal, our model demonstrates that subtractions are to be preferred over divisive adaptations. The approach implies that early vision, which probably suffers an information bottleneck, is likely to exploit multiplicative adaptations while the later visual stages use subtractive ones.

Detecting image symmetry using single linear filters

Lewis D Griffin (Computer Science, University College London, London WC1E 6BT)

Obviously, multiple linear filters can test for image symmetry. For example checking for equal responses from a pair of identical isotropic filters located symmetrically either side of a candidate line of reflection tests for the presence of the reflectional symmetry. Less obviously, single filters can make such tests. For example, an anti-symmetric filter (e.g. a sine-phase Gabor function) placed so that its line of anti-symmetry coincides with a candidate line of reflection will give zero response whenever the reflectional symmetry is present: so a non-zero response reliably signals that the reflectional symmetry is *not* present. In general we can define a (non-zero) filter as sensitive to a symmetry if it gives the same response whenever the image has the symmetry.

Single linear filters can be sensitive to symmetries other than simple reflection. More general symmetries are characterized by a mathematical *group* of transformations that leave the image unchanged.

Let *G* be a group of isometries (i.e. rigid transformations of the image plane). It can be proved that a non-zero filter *K* is sensitive to whether the symmetries of the image include *G* if and only if $\sum_{s\in G} K(s \circ \_) \equiv 0$, which means: apply each of the isometries in the group to the filter, sum the results, and only if the copies completely cancel out is the filter is sensitive to the symmetry.

Let *H* be a group of image-isometries (i.e. ordered pairs $\langle s,i \rangle$, composed of a rigid transformation of the image and a rigid transformation of the intensity domain, that are applied to an image $I : ¡^{2} \to ¡$ as follows $\langle s,i \rangle \circ I(\_) = i \circ I(s \circ \_)$). It can be proved that a non-zero filter *L* is sensitive to whether the symmetries of the image include *H* if and only if $\sum_{\langle s,i\rangle \in H} |i| L(s \circ \_) \equiv 0$. Hence, the test for sensitivity to a group of image isometries is similar to the test for sensitivity to a group of isometries, except that each of the spatially transformed copies of the filter is weighted negatively if the intensity isometry is of the reflection type, before adding up the copies and checking for cancellation.

Naso-temporal asymmetry for signals invisible to the retinotectal pathway

Sumner, Petroc[1], Bompas,Aline[1], Robert, Rafal[2] (1 School of Psychology, Cardiff University, United Kingdom; 2 Wolfson Centre for Clinical and Cognitive Neuroscience, University of Wales, Bangor, United Kingdom)

Monocular viewing conditions reveal an asymmetry between stimuli presented in the temporal and nasal visual fields in their efficiency for automatically triggering eye

saccades and grasping attention. For instance, observers free to make a saccade to one of two stimuli presented together, orient preferentially to the temporal stimulus. Such naso-temporal asymmetries (NTA) have been assumed to reflect the asymmetry in the retinotectal pathway to the superior colliculus. We tested this hypothesis using S cone stimuli, which are invisible to the magnocellular and retinotectal pathways. The observed NTA in choice saccades to bilateral stimuli was no less present for S cone stimuli than for luminance stimuli. Additionally, the amplitude of the NTA can be enhanced when S cone signals are added to luminance signals. These results suggest that NTA in human is not restricted to retinotectal projections. Puzzlingly, asymmetries in saccade choice are generally not accompanied by asymmetries in latency, challenging models of saccade generation. Possible origins for behavioral NTA are discussed.

Eye Movement Prediction in Visual Interactive Environments Considering Physical Actions

Ali Borji (School of Cognitive Sciences, Institute for Studies in Theoretical Physics and Mathematics, Niavaran Bldg. P.O. Box 19395-5746, Tehran, Iran, borji@ipm.ir)

Human and machine vision systems are limited in terms of processing huge amounts of incoming visual information. Visual attention proposes a solution to such limitation by selecting those visual areas worth further higher cognitive processing. Eye movements convey much information about overt visual attention and are believed to be task dependent (Yarbus, 1967). Recent studies have been focused on prediction of eye movements in visual interactive environments rather than static synthetic search arrays (Peters et al, 2007, ACM trans,2, 1-21). In this study, we aim to investigate the role of previous eye movements and physical actions on future eye positions. Each frame and its associated physical action and eye position were recorded while subjects played video games (Nintendo, Need for speed). An augmented vector of fourier components representing each frame and its associated action were passed as input to a standard classifier (Multi-layer neural networks, Support-vector machines). The classifiers were trained to find associations of these vectors and their corresponding eye positions. Learned classifiers over 23 frames of each second of video a game was later tested over the remaining test frames. Our results show high classification rates for prediction of eye movements in visual interactive environments. They also suggest evidence toward usefulness of previous physical actions on prediction of future eye movements.

Session 2

Magnocellular processing in autism

Dr. Kate Plaisted (University of Cambridge)

Children and adults with autism show marked difficulties in processing social information. Many studies have revealed deficits in making inferences about other people's intentions and mental states, often characterised in the literature as deficits in social cognition. They attend less to faces and show abnormal face scanning, focussing on the mouth rather than the eye region, abnormalities that are referred to as deficits in social perception. In addition, general sensory and perceptual abnormalities have been observed in autism since the time the disorder was first described and abnormal sensory and perceptual interests provide important information for diagnosis. Despite the importance of this feature of autism, rather less research has

focussed on the possible underlying mechanisms compared to the social perceptual and social cognitive features. However, a recent interest of the possibility of a dorsal-stream processing deficit has raised a debate about the integrity of the magnocellular system in autism. In contrast to studies of dyslexia, very few studies assessing magnocellular functioning have yet been conducted in autism. Those that have suggest that functioning of the magnocellular system is equivalent to that of typical children. However, like studies in dyslexia, these previous studies conducted in autism did not employ the optimal stimulus. I will present two of our recent studies both of which suggest that magnocellular processing is impaired in autism. These findings highlight the need to consider the role of abnormal perceptual mechanisms in the aetiology of the disorder and to broaden current theories of autism beyond the constructs of deficits in social perception and social cognition. I will present some ideas about the impact of early magnocellular dysfunction on the achievement of early social developmental milestones, which might lead to the characteristic pattern of deficits in social perception and social cognition seen in autism.

Implicit Memory of Visual Context is intact in Autism Spectrum Disorders

Anastasia Kourkoulou, John M Findlay, Susan R Leekam (University of Durham Department of Psychology, Science Laboratories, South Road, Durham DH1 3LE)

Background: Individuals with ASD are characterised by a tendency for attention to details and a processing bias towards featural and local information (Happé & Frith, 2006, J. of Autism & Dev. Disorders, 36, 5-25) which leads to reduced global/contextual processing in visual tasks. However, this local bias is less apparent when individuals with ASD are explicitly required to attend to global information. Therefore, the question is whether the attention of individuals with ASD is also cued to global information when this global information is learned implicitly. Objectives: We aimed to investigate whether individuals with ASD show intact implicit learning and memory of visual context, in tasks that required focused visual attention. Methods: Participants were asked to search for a target which was embedded in a predictive or a non predictive context (Chun & Jiang, 1998, Cognitive Psychology, 36, 28–71) in a series of implicit learning experiments. The size of the predictive context was varied ranging from local to global and its colour composition was also varied. Results: Results showed that individuals with ASD were able to show implicit memory of the global and local visual context. Conclusions: Results will be discussed in terms of the enhanced perception of individual features hypothesis (Plaisted, Saksida, Alcántara & Weisblatt, 2003, Phil. Trans. R. Soc. Lond. B, 358, 375–386).

Is inhibition of return blind?

Geoff G. Cole[1], Paul A. Skarratt[2], & Gellatly, A. R. H[3] (1Department of Psychology, University of Durham, DH1 3LE; 2 Department of Psychology, University of Hull, HU6 7RX; 3 Department of Psychology, Oxford Brookes University, OX3 OBP

Inhibition of return (IOR) refers to the slowing of responses to stimuli that appear at previously attended locations. In a series of four experiments we examined whether IOR is 'blind' to the type of stimulus event that can occur at the inhibited location or whether certain stimuli attenuate, that is override, this form of inhibition. Specifically, we assessed whether biologically relevant stimuli such as object appearance, object motion or threatening faces can attenuate IOR. Observers performed target detection/discrimination tasks in a standard IOR cueing paradigm. Results showed that whereas IOR was found with neutral target stimuli, targets comprising threatening faces or looming objects attenuated the effect. However, the onset of a

target object was no more able to override IOR than an offset. These findings suggest that the visual system is indeed sensitive to the type of stimuli that occur at inhibited locations.

Inferring attentional capture by differences in search slopes

Paul A. Skarratt, Geoff G. Cole, & Gellatly, A. R. H (1 Department of Psychology, Applied Sciences 3, University of Hull, Cottingham Road, Hull, HU6 7RX, p.skarratt@hull.ac.uk; 2 Department of Psychology, University of Durham, DH1 3LE, 3 Department of Psychology, Oxford Brookes University, OX3 OBP0)

A stimulus event is said to capture attention automatically when it elicits similarly rapid responses irrespective of the number of distractors in the array. This shallow search function contrasts with the relatively steep functions yielded by stimuli that do not capture attention, and is understood to reflect the way in which certain stimuli can receive attentional priority. Recently, we reported that objects that loom or recede in visual space are equivalent in their ability to capture attention, but that looming objects elicit faster responses overall. We hypothesised that the reaction time (RT) advantage for looming objects is non-attentional in nature, and may reflect post-selection processes that prime the motor system to respond more rapidly. This claim was examined in three experiments using a variation of the singleton paradigm (e.g., Yantis & Johnson, 1990). Experiment 1 replicated the RT advantage for looming objects, whilst Experiments 2 and 3 employed measures of perceptual performance. Results will be discussed in relation to the dynamic events that capture attention, as well as the inferring of capture on the basis of differences in search functions.

Yantis, S., & Johnson, D. N. (1990). Mechanisms of attentional priority. *Journal of Experimental Psychology: Human Perception & Performance*, *16*, 812-825.

Session 3

An ERP investigation of changes in facial expression.

Michael J Wright (Centre for Cognition and Neuroimaging, Brunel University, Uxbridge, London, UB8 3PH, UK)

Emotional facial expressions are dynamic, but analysis of the neural basis for these facial changes by ERP techniques poses some challenges. A rough approximation to the natural dynamic change is an abrupt transition between two expressions of the same face. This is a visually compelling stimulus that gives a strong and consistent ERP. Whereas P1 to the first stimulus is always larger than P1' to the second (reflecting a larger physical stimulus change), N170' and P2' to the second face are often larger than N170 and P2 to the first face. Pairs of 0.5s successive stationary face images (prime and target) with different expressions were used to investigate dynamic effects. In experiment 1 (N=20) average ERPs to happy-neutral, neutral-happy, fearful-neutral and neutral-fearful pairs were obtained. Waveforms (N170', P2' P3') to the second happy and fearful expressions differed substantially from each other and from neutral, and the N170' to a neutral target differed significantly for the two prime conditions. In experiment 2 (N=23), average ERPs to angry-happy, happy-angry, angry-neutral and happy-neutral pairs were obtained. There was a similar effect of angry prime on happy and neutral target but the waveform for an angry target following a happy prime differed from that of a neutral target following a happy

prime. Overall there was evidence both for absolute and relative coding of facial expressions.

Contrasted pattern of brain activity in negative priming: a MEG study
F. Boy, S. D. Muthukumaraswamy, K. D. Singh & P. Sumner (SumnerLab, School of Psychology, Cardiff University)

When the identity of a visual stimulus requires rapid behavioral decisions in the context of competing activation from other sources, neurophysiological studies in monkeys and fMRI and patient investigations in humans suggest that crucial interactions between posterior parietal cortex and premotor frontal areas occur. In this experiment, we investigated dynamic of brain activity during a visual masked-prime paradigm in normal subjects using Magnetoencephalography (MEG) and a source reconstruction algorithm (Synthetic Aperture Magnetometry -SAM). The task used arrow stimuli pointing either right or left, and the use of a Stimulus Onset Asynchrony (SOA) of 150ms elicited a negative priming effect (shorter RTs for the condition in which prime and target are congruent, i.e., similar), allowing us to probe both motor-related activation and inhibition phases. We found contrasting patterns of brain activity around the premotor areas and the posterior parietal cortex between congruent and incongruent prime-target couples. Such result suggests that interaction between these cortical regions is involved in steering the fast selection of an adequate behavioral response to visual stimuli in the context of the automatic activation and inhibition phases produced by irrelevant stimuli

The role of convexity in the integration of ordinal and metric cues in depth
Marco Bertamini, Jasna Martinovic, Sophie Wuerger (University of Liverpool), m.bertamini@liv.ac.uk

Ordinal depth cues, i.e. familiarity and convexity, can influence perceived metric depth in stereograms with unambiguous depth order. Recent work has also found that convexity alone can influence perceived metric depth in this way (Burge, Fowlkes, & Banks, 2007, *Perception, 36*; Bertamini, Martinovic & Wuerger, 2008, *Journal of Vision,* 8, 2). Greater disparity must be present in a display in which the foreground is concave to match the perceived depth of a display in which the foreground is convex. We have tested an extreme case of convexity: a circular region presented as either foreground or background (hole). In terms of contour curvature a circular hole is strictly concave. However, we found no reliable difference in the point of subjective equality when a figure and a hole are compared. A possible explanation is that the effect depends on an attentional shift that is only present in bipartite displays. This was confirmed by the use of a display in which convexity was completely removed (straight line). A difference in size was sufficient to generate a change in the likelihood to select one of two stimuli, with the larger stimulus being chosen preferentially. This goes against the role of size in figure-ground organisation (smaller regions are more likely to gain figural status) and supports instead the hypothesis of an attentional shift.

Perception of motion-in-depth using binocular cues: a fair comparison of changing disparity and inter-ocular velocity differences

Julie M. Harris, Harold T. Nefs and Catherine E. Grafton (St. Andrews Vision Lab School of Psychology, University of St. Andrews, St. Mary's College, South St. St. Andrews, KY16 9JP)

There has been much debate in recent years over whether binocular motion-in-depth is perceived via changing disparity over time (CDOT) or inter-ocular velocity differences (IOVD), or both. Here we use a signal-in-noise paradigm to provide equivalent visual information from the two cues to make a fair test of their relative utility. Three types of random dot stimuli were designed, to respectively contain one or the other, or both of the two cues. We used several different tasks, including motion-in-depth detection, and direction discrimination, as well as comparing performance for a variety of manipulations of background information. For almost all observers, in almost all conditions, there was clear advantage of CDOT information over IOVD. In fact, some observers could not perform some tasks at all using IOVD information alone. Intriguingly, one observer, who was poor at using CDOT information, could use IOVD. The results suggest that mechanisms sensitive to CDOT dominate perception of motion-in-depth for most visual systems.

Posters (in alphabetical order)

Active adaptation of colour perception across the visual field.

Aline Bompas and Petroc Sumner (School of Psychology, Cardiff University, UK)

The density variation of macular pigment with eccentricity introduces major centre-periphery differences in the spectrum and intensity of light sampled by our photoreceptors. Though this difference affects colour perception in controlled laboratory conditions, objects seen in peripheral vision do not suddenly change colour when we look straight at them in everyday life. Our results show that the reason for this puzzle is not simply that we pay no attention to these meaningless variations, but rather, eye movements may actively participate in compensating for these predictable distortions.

To quantify the perceived colour difference, participants were asked to compare the colour of two purple stimuli, successively presented in the centre and in periphery (in both presentation orders), the colour of the latter being adjusted according to a staircase procedure until a perceptual match was reached. This fixation condition was compared to a condition where, the retinal sequence being exactly the same, a saccade was now performed during the interval between central and peripheral patches. We find that making an eye saccade reduced the colour difference between centre and periphery, presumably changing the perceived colour of peripheral and/or central stimuli. This result may indicate an oculomotor contribution to colour perception that could provide the basis of an active mechanism that learns, predicts and then compensates for colour distortions introduced by the retina.

How does the frontal eye field (FEF) affect early visual processing? Contrast discrimination in patients with FEF lesions

Ursula Budnik[1], Robert Rafal[2] and Petroc Sumner[1] (1 School of Psychology, Cardiff University, United Kingdom; 2 Wolfson Centre for Clinical and Cognitive Neuroscience, University of Wales, Bangor, United Kingdom)

Transcranial Magnetic Stimulation (TMS) of the FEF has been found to modulate visual perception, enhancing contrast sensitivity in periphery relative to fovea. Similarly, the BOLD response for early visual cortex (V1-V4) was relatively boosted in periphery (Ruff et al. 2006, Current Biology, 16, 1479–1488). If TMS acted as a "virtual lesion" of FEF, we might predict that patients with FEF lesions would show a similar pattern – relatively enhanced peripheral contrast perception. If the TMS effect was due to non-specific sub-threshold activation of FEF (as suggested by Ruff et al.), patients should show the opposite effect – relatively impaired peripheral contrast detection. We measured discrimination thresholds for fovea, left and right in four neurological patients with FEF lesions, ten healthy age matched participants and additionally in five patients with pulvinar lesions and two patients with discrete lesions in the vicinity of, but excluding, the FEF. We employed Gabor patches with vertical or horizontal orientation and a two-alternative forced-choice staircase method (three-down, one-up, contrast adjustment ratio of 1.2). The right FEF patients showed relative impairment for contrast discrimination in the periphery when compared to neurological and healthy controls. Contrast discrimination in fovea was higher in neurological controls then in elderly healthy controls but did not differ significantly on average among the neurological groups tested. Thus damage to FEF appears to impair relatively low level perception, consistent with the idea that activation of FEF (naturally or using TMS) leads to a relative boost of visual processing in the periphery.

The Physiological Basis Of rTMS-Induced Speed Bias: Facilitation or Suppression of Neural Processing?

Burton, M.P., McKeefry, D.J., Barrett, B.T. & Vakrou, C (Vision Science Research Group, School of Life Sciences, University of Bradford, Bradford. UK. BD7 1DP)

Although TMS has been shown to be capable of temporarily disrupting normal cognitive processes, its method of action is still poorly understood. We investigated the physiological effect of TMS by applying repetitive pulses (rTMS) to V5/MT+ after adaptation had taken place to either a fast (20deg/s) or a slow (4deg/s) moving sinusoidal grating which reversed direction every 2s. The effect of rTMS on the perceived speed of a subsequently presented test grating (10deg/s) was compared with the effect of rTMS on the perceived speed of the same grating without prior adaptation. Without rTMS, adaptation to the faster moving grating reduced the perceived speed of the subsequently presented test grating, whereas adaptation to the slower grating increased its perceived speed. We consider that adaptation effectively reduced the relative contribution of the un-adapted speed channel, distorting perceived speed. Application of rTMS to V5/MT+ coincident with the presentation of the test grating, during a delayed speed discrimination task, reduced its perceived speed by ~10% (n=4). After adaptation, delivery of rTMS to V5/MT+ consistently reduced the perceived speed of the test, irrespective of the adaptation speed. rTMS reduced the perceived speed by ~18% and ~17% for the faster and slower adaptation conditions, respectively. The enhanced effect of rTMS after adaptation and its ability

only to reduce speed, independent of the speed channel adapted, suggests that rTMS does not facilitate neural activity. Instead, the results imply that the deficits observed in speed perception are the consequence of rTMS-induced suppression of neural function.

Comparison of the estimates of receptive field centre sizes of retinal ganglion cells using the Hermann grid illusion and Westheimer functions.

Michael J.Cox and Jose B. Ares-Gomez (Department of Optometry, University of Bradford, Bradford, West Yorkshire, BD7 1DP, UK)

Introduction: Techniques such as Westheimer functions or the Hermann grid illusion (HGI) can investigate the retinal ganglion cells' (RGCs) spatial properties. Although these two techniques are believed to be dependent upon the RGC spatial profile, little information exists as to their level of correlation at measuring this profile.

Methods: A computer-based nulling psychophysical test and modelling procedure utilising the HGI was used to estimate the diameter of the RGC receptive field centre (Cox et al., 2001, Spatial Vision, 20:415-436). Westheimer functions were based upon finding a pedestal surround luminance to bring a 1.5 arcmin radius test stimulus to threshold detection as a function of the pedestal radius. The function minimum was used to estimate the RGC receptive field centre diameter (Enoch, 1978, IOVS, **17**:208-257). Test locations were at 1.5°, 3.0° and 6.0° from the point of fixation in either the inferior temporal or inferior nasal visual field. Data was collected from three visually normal observers.

Results: Measured RGC centre diameter increased from central to peripheral locations using both techniques. The measurements from the two techniques were significantly correlated although the HGI based technique appeared more likely to detect asymmetries across the retina than the Westheimer based technique, and the linear regression fit between the two techniques was different for each observer.

Conclusions: Either method of assessing the RGC receptive field centre size appears to work, although absolute values are not identical. Comparative measurements across the retina or across time within an individual should be valid. Comparing measurements between individuals or within a normative database would be more challenging.

The movement of motion-defined contours can bias perceived position

Szonya Durant and Johannes M. Zanker (Department of Psychology, Royal Holloway, University of London,Egham, Surrey, TW20 0EX)

Illusory position shifts induced by motion suggest that perceived position and luminance-defined motion interact in the human visual system. We used Gabor patterns to define the movement of randomly positioned black dots, which generated lobes of alternating motion directions. We then moved the carrier of the Gabor function that defined the pattern of dot motion within a static envelope, leading to movement of motion-defined boundaries within a blurred aperture. Could this "motion-defined motion" influence the perceived position of the static envelope? We presented two horizontally oriented motion patterns on either side horizontally of a central fixation target, moved the contours in opposite directions, and asked participants to judge the relative position of the envelopes. We found that at a low spatial frequency (0.2 cycles/deg), with only one or two moving contours present in

the pattern at any given time, there was a shift in perceived position consistent with the direction of the motion contours of up to 0.4°, much larger than has been seen in the luminance domain. The motion of contours formed by orthogonal (vertical) dot motion caused a larger shift than parallel (horizontal) direction. At a high spatial frequency (0.7 cycles/deg) nine moving contours are visible inside the envelope, and a smaller shift was observed for the orthogonal case, but no shift was observed for the parallel case. These results show that a higher-order mechanism that extracts the motion of motion contours is able to influence positional judgements.
This work is supported by EPSRC grant number EP/C015061/1.

Spatial frequency processing in the central visual field and Task-dependent effects on perception of natural scenes in hemianopes

Isabelle Gaudry [1, 2, 3], Olivier Coubard [1, 2], Céline Cavezian [1, 2], Carole Peyrin [1], Céline Perez [1, 2, 3], Mickaël Obadia [3], Olivier Gout [3], Sylvie Chokron [1, 2, 3]
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The central visual field is often used to compensate for difficulties encountered in the peripheral visual field of patients suffering from lateral homonymous visual field defects. Since vision quality in the central visual field has not been extensively studied in hemianopia, we wanted to assess if this capacity preserved in these patients. In addition, following the hypothesis of a hemispheric specialization for spatial frequency processing, we hypothesized that a specific deficit for either high or low spatial frequencies could be evidenced depending on the lateralization of the lesion.
Comparisons were made of accuracy scores and reaction times of patients with right (N=6) and left (N=6) lateral homonymous hemianopia, and healthy controls (N=25) in detection and categorization tasks of natural scenes presented in the central visual field. Images were filtered in high or low spatial frequencies, or non-filtered. Patients' contrast sensitivity measured using Pelli-Robson charts were within the normal range (M = 2.17, SD = 0.77).
No overall effects were found for accuracy. Significant effects for task, group and spatial frequency factors were observed for reaction time.
Reaction times during the detection task were faster than in the categorization task. Overall, left hemianopes (right brain-damaged) were significantly slower than controls. A significant task-group interaction revealed that right hemianopes (left brain-damaged) reaction times were normal for the detection task, but increased to that of left hemianopes in the categorization task.
Finally, the overall effect of spatial frequencies showed longer reaction times for high spatial frequencies. A spatial frequency-group interaction was not found.
Results are interpreted in terms of hemispheric specialization for visuo-spatial abilities, and top-down activations related to tasks specificities.

Multisensory processing in autism spectrum disorders

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It is reported that multisensory perception may be 'fragmented' in autism spectrum disorders (ASDs), but it remains debated at what level any abnormality in cross-modal integration may occur. To test whether ASD children and adolescents have compromised audio-visual integration at a perceptual level, we employed an audio-visual 'launch/pass' phenomenon (Sekuler, Sekuler & Lau, 1997, Nature, 385, 308.), in which a disk is made to appear to crash into and launch a second disk, rather than to pass over it, by presenting an auditory stimulus at the point of occlusion. Such phenomena putatively reflect early perceptual integration, and thus reduced integration should lead to fewer reported crashes. Participants with/without ASDs (n = 19 per group) were presented with ambiguous experimental trials, in which a disk passed over a second stationary disk of the same colour. An auditory signal was presented either as the moving disk occluded the stationary disk (0ms), or 250ms before or after occlusion. In control trials, unambiguous crashes and misses were presented using disks of different colours, with auditory signals at equivalent time points to ambiguous trials. ASD participants and controls reported similar patterns of crashes when matched for age, and either verbal or non-verbal IQ. This corroborates recent reports that have also failed to find multisensory deficits in ASD at the perceptual level.

A case of developmental prosopagnosia: the role of experience in face recognition

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Prosopagnosia or face blindness can be divided into two forms: acquired prosopagnosia where face recognition problems arise following head injury; and developmental prosopagnosia which is lifelong and evident from birth, possibly with a genetic component. We report the case of a female subject, MS, aged 46 with developmental prosopagnosia. MS had normal visual acuity, colour vision and stereo vision but reported she had always had difficulty recognising familiar faces. We tested MS on a battery of tests to investigate her face recognition ability. We found normal performance on the Benton Facial Recognition Test consistent with results reported by Duchaine and Nakayama (2004, Neurology, 62, 1219-1220) on other developmental prosopagnosic subjects. MS reported that she accomplished this test using feature by feature matching and distance between features. To assess whether some facial features were more important than others in identification we tested the ability of MS to identify images of faces with hair, nose, mouth and eyes removed. In addition we assessed recognition using 4 alternative forced choice grids of famous faces with features removed. Accuracy of performance and reaction times were recorded. We found performance was good overall but reaction times were longest when faces were presented with no hair. Some famous faces were consistently identified even with features removed. These faces were individuals most familiar to MS. We conclude that MS had acquired strategies to identify faces to counteract her prosopagnosia and these strategies worked best in the faces with which she had most experience.

Low-contrast classification images and early nonlinearities.

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Classification images (Ahumada, A. J., 1996, Perception, 26, 18) let us compute the template that approximates a perceptual decision. Classification images are formed by accumulating high-contrast noiseimages added to a detection or discrimination task. High-contrast noise is used to optimize statistical efficiency. However, high-contrast noise is unsuitable for a perceptual system which has an early nonlinearity prior to internal noise. In this case, added high contrast noise has the effect of linearising the system (from Birdsall's theorem) and the resultant template looks nothing like the template used when the added noise is absent. This problem with classification images can be solved by the simple expedient of sing low-contrast noise. If the added noise merely reduces a 75% correct rate down to about 60%, this causes tolerable reduction in statistical efficiency, but ensures that the noise has little effect on any early nonlinearities. I apply this technique to the contrast discrimination of sinusoids to show that at low spatial frequencies, contrast discrimination thresholds are affected by an early compressive nonlinearity, similar to that proposed by McIlhagga & Peterson (2006, Vis. Res., 46, 1934-45).

Involuntary inhibition of movement initiation alters oculomotor competition resolution

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Identifying a stimulus as the target for a goal-directed movement involves inhibiting other competing possible responses. Both target and distractor stimuli activate populations of neurons in topographic motor maps such as the superior colliculus. Separable inhibitory interconnections bias local competition to ensure only one target is selected and alter movement initiation. Behavioural evidence of these inhibitory processes comes from the effects of distractors on oculomotor landing positions and latencies. Their presence can shift saccade landing position away from the target when they are close to the saccade target or serve to increase saccade latency when they are far from the target. The extent of both of these perturbations is a direct measure of the underlying state of inhibition of distractors. Here we investigate the relationship between these two sources of inhibition. Targets were presented with, or without, distractors, and the deviation of saccade landing position due to their presence was measured. In separate experiments, the possible position and identity of the target and distractors were manipulated. In all cases saccade landing position was found to be less affected by the presence of the close distractor when accompanied by distractors in a remote position. The involuntary increase in the latency of saccade initiation caused by the presence of the remote distractors alters the state of competitive processes involved in selecting the saccade target thus changing its landing position.

Distinct position assignment mechanisms revealed by cross-order motion

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Motion perception influences perceived position. It has been shown that first-order (luminance defined) motion shifts perceived position across a wide range of spatial and temporal frequencies. On the other hand, second-order (contrast defined) motion shifts perceived position over a narrow range of temporal frequencies, regardless of spatial frequency (Bressler & Whitney, 2006, Vis Res, 46, 1120-1128). These results suggest the presence of distinct position assignment mechanisms for first- and second-order motion. We further investigated whether first- and second-order systems independently encode and assign the position of a moving stimulus. To this purpose we used first- and second-order Gabors consisting respectively of a sinusoidal luminance and contrast modulation of dynamic random-dot patterns, enveloped by a static Gaussian. We presented two horizontally offset Gabors placed above and below a central fixation point, with sine wave carriers drifting in opposite directions. Subjects judged the position of the top Gabor relative to the bottom one. Results show a position shift in the direction of the carrier motion for first- and second-order Gabors when presented separately. However, when first- and second-order Gabors were displayed within the same trial (cross-order motion), no position shift was observed. The absence of a position shift using cross-order motion supports the hypothesis that the two motion systems independently encode and assign the position of a moving object.

Measuring the impact of ocular aberrations on contrast sensitivity; the importance of orientation

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The human visual system displays an anisotropy for contrast sensitivity when measured at different grating orientations. This has been shown to be neural in origin with a diffraction-limited eye (Campbell et al 1966, J Physiol, 187, 427-436). Many studies ignore orientation even though the oblique effect is quite well known. While this maybe valid for diffraction-limited eyes, for larger pupils, the aberrations of the eye induce retinal blur and a point spread function that is non-circularly symmetric. The impact of aberrations on vision is particularly important in people who have undergone procedures such as refractive surgery as aberrations typically increase after surgery leading to visual problems especially in low light levels.

In order to assess the effect of ocular aberrations on visual performance, contrast sensitivity was determined at different orientations and spatial frequencies. Two different pupil sizes, 3mm and maximally dilated, were used. Normal observers (n=24) and those who had had refractive surgery (n=12) were recruited to the study. The theoretical effects of aberrations were simulated in a computer model. Aberrations were measured using a Tscherning type aberrometer. Contrast sensitivity was determined using a binary search method incorporated into customised software that presented stimuli using a Cambridge Research Systems VSG 2/5.

We report that one of the impacts of ocular aberrations is to cause losses in contrast sensitivity that are selective for different orientations. We show that using gratings at several orientations provides a better prediction of higher-order aberrations than when testing using only a single orientation

Ipsilesional attentional deficits in left hemianopia

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Most studies on homonymous hemianopia tend to concentrate on the blind visual field and rarely investigate possible deficits within the healthy visual field. We used a letter-detection task to test if damage to the right occipital lobe (thus, left homonymous hemianopia; LHH) presents visual attention deficits in the right, ipsilesional field compared to normal controls. Chokron, Brickman, Wei and Buchsbaum (Brain Res Cogn Brain Res, 9, 85-90; 2000) found a left hemisphere specialization for selective attention and a right hemisphere specialization for global visual detection. Therefore, patients with LHH are expected to show greater difficulty with global detection compared to selective attention.

Twenty-eight healthy, right-handed participants (14 men, 14 women) aged 24-73 (*M*=40.0; *SD* =13.6) and 8 male, LHH patients, aged 24-72 (*M*=51.3; *SD*=17.7) completed a letter-detection task where they either selectively detected a small letter surrounded by flankers (Surrounded) or globally detected one large letter (Alone). Patients' contrast sensitivity measured using Pelli-Robson charts were within the normal range (*M* = 2.19, *SD* = 0.10).

Regardless of task, there was no difference in reaction time between patients and controls. However, in accuracy, patients (Alone: M=82.8, SD=29.09; Surrounded: M=55.0, SD=18.23) were significantly less accurate than controls (Alone: M=96.8, SD=6.49; p=.02; Surrounded: M=79.4, SD=15.62; p<.00) on both tasks.

The results indicate that despite the two groups' comparable processing times for stimuli, the quality of the processing is not equivalent given patients' poorer accuracy rates compared to that of healthy peers. Although selective attention was expected to be conserved in LHH patients, deficits in performance exist. The current findings encourage a closer look at hemianopes' "healthy" visual field.

Model-free estimation of a threshold from a psychometric function

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The main interest in many psychophysical experiments is the estimation of a threshold from a psychometric function fitted to a set of data. Fitting a function is necessary to

allow for the natural variation in response at each stimulus level, and it usually proceeds by specifying a parametric model, such as the probit or the Weibull, and estimating its parameters by maximum likelihood. The threshold of the resulting estimate is then taken be the estimate of the threshold for the underlying function. The method is very efficient if the chosen model coincides with the true function, but the true model is rarely known. If the chosen model is incorrect, then the estimated thresholds may be seriously biased and very different from the true threshold. This problem is illustrated with synthetic data examples, which have the advantage that the model function is known and therefore one can assess how good (or how bad) the estimates really are. In the examples presented, the true threshold does not lie in the 95% confidence interval for the estimated thresholds. Thus the inferences drawn from statistical analysis are incorrect and could be seriously misleading. An alternative method is advocated here based on a non-parametric approach. The estimation process is performed locally and thus it does not rely on any specific model function. For the same synthetic data, the local method gives consistent estimates, and the confidence intervals always cover the true threshold.

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