10:30 - 11:20	Registration, coffee and posters.	
11:20 - 11:40	**Talk:** "Binocular summation: a meta analysis of 65 studies"	Dr Dan Baker
11:40 - 12:00	**Talk:** "Ipsilateral sensitivity to visual motion is restricted to V5/MT+ in the right cerebral hemisphere"	Dr Sam Strong
12:00 - 13:00	**The Geoffrey J Burton Memorial Lecture** - "Of mantids and men: Stereoscopic (3D) vision in humans and insects"	Prof Jenny Read
13:00 - 13:45	Lunch and posters	
13:45 - 14:20	AGM	
14:20 - 14:40	**Talk:** "Real metameric illuminants with maximum melanopsin contrast"	Dr Manuel Spitschan
14:40 - 15:00	**Talk:** "Effects of language on speeded colour discrimination are specific to the hue-defined, but not lightness-defined basic colour categories"	Dr Jasna Martinovic
15:00 - 15:30	Coffee and posters	
15:30 - 16:30	**CRS Lecture** - "Distorted insights: from perceptual anomalies to neural processing in red-green chromatic pathways"	Prof Andrew Stockman
16:30 - 17:30	Posters and drinks - prizes awarded	
18:00 - 19:00	Visit to *wonderlab* at the National Science and Media Museum	
19:30 - 21:00	Dinner	

Talk 11:20 -11:40

Daniel Baker, Freya Lygo, Tim Meese and Mark Georgeson

"Binocular summation: a meta analysis of 65 studies"

Abstract: Binocular summation is the advantage in contrast sensitivity when using two eyes versus one. It has been widely studied owing to its clinical importance as a measure of binocular function, and because the precise level of summation is determined by the magnitude of nonlinearities in the early visual system, before binocular combination. However, most studies have involved small sample sizes, making exact estimation problematic. We conducted a meta-analysis of 65 studies reporting psychophysical estimates of binocular summation in 716 observers. The lower bound of the 95% confidence interval on the mean summation ratio was consistently above the canonical value of 2, regardless of how studies were weighted. We further explored how methodological factors affect summation estimates, both by using subsets of the meta-analysis data and also confirming with stand- alone studies. These analyses show that stimulus factors such as spatiotemporal frequency affect summation, and that the imbalance in sensitivity across the eyes can moderate summation estimates. We suggest that there is no single canonical value for binocular summation, but that instead it takes on a range of values between approximately 2 and 2, depending on stimulus properties. In addition, when the two eyes are not balanced, summation estimates are reduced when calculated relative to the threshold of the more sensitive eye, but can be slightly elevated when the mean monocular threshold is used. Future studies can obtain accurate summation estimates by normalizing monocular contrasts to account for sensitivity differences, or by modelling results using a simple two-parameter model of binocular combination.

Talk 11:40 – 12:00

Samantha Strong, Edward Silson, André Gouws, Antony Morland and Declan McKeefry

"Ipsilateral sensitivity to visual motion is restricted to V5/MT+ in the right cerebral hemisphere"

Abstract: Previous experiments have demonstrated that transcranial magnetic stimulation (TMS) of human V5/MT+ in the right cerebral hemisphere can induce deficits in visual motion perception in both the contra- and ipsi-lateral visual hemi-fields. However, when TMS is applied to left V5/MT+, motion deficits are restricted to the contra-lateral hemi-field (Thakral and Slotnick, 2011).

One possible explanation for this may lie in differential stimulation of sub-divisions within V5/MT+ across the two hemispheres. V5/MT+ has two major sub-divisions; MT/TO-1 and MST/TO-2, and the latter sub-division contains neurons with large receptive fields (RFs) that extend much further into the ipsi-lateral hemi-field (up to 15 degrees) than MT/TO-1.

We wanted to re-examine this functional asymmetry between V5/MT+ across both hemispheres by using TMS. MT/TO-1 and MST/TO-2 were identified in six subjects using specialised fMRI localisers and centre-of-mass co-ordinates were used as target points for the TMS experiment (70% strength; 25Hz; 200ms). Subjects identified the translational direction (up/down) of coherently moving dots presented in either the left or right visual field whilst TMS pulses were applied synchronously with stimulus onset.

Application of TMS to MT/TO-1 and MST/TO-2 in the right hemisphere affected ability to perceive direction of translational dots in both the contra-lateral and ipsi-lateral visual fields, whereas detrimental effects following application of TMS to MT/TO-1 and MST/TO-2 in the left hemisphere were restricted to the contra-lateral visual field.

This result suggests an enhanced role for the right hemisphere in processing full-field translational motion, but contrary to our hypothesis, effects differ across hemispheres rather than within sub-divisions of V5/MT+.

Talk 14:20 – 14:40

Manuel Spitschan, Joshua Harvey, Takuma Morimoto and Hannah Smithson

"Real metameric illuminants with maximum melanopsin contrast"

Abstract: Human daylight vision is based on the excitation of the three different spectral classes of cones (L, M and S cones). In addition to these classical photoreceptors, the photopigment melanopsin is involved in entraining our behaviour and physiology to the light-dark cycle, modulating the secretion of neuroendocrine outputs such as melatonin, and controlling the diameter of the pupil. Any given illuminant in real scenes will activate all photoreceptors, but to different extents. What are the practical bounds on generating metamers that are matched in cone excitations but differ in melanopsin activation? Using a commercially available LED-based spectrally tuneable light source with 14 independently and continuously controllable spectral channels (eleven narrow-band, three broadband), we generated pairs of equiluminant spectra that differed in their melanopsin excitation by 200% and that were matched in chromaticity to five "neutral" illuminants corresponding to CIE daylight at colour temperatures 4000K, 5000K, 6500K, 10000K, and 25000K. Chromaticity calculations were performed using the physiologically relevant 10° XYZ CMFs based on the CIE 2006 cone fundamentals. We analysed these pairs of spectra at a fixed chromaticity using the following analyses: 1) By calculating the shift in tristimulus coordinates for a large sample (>50,000) of surface reflectance functions seen under the two different illuminants, 2) by rendering an indoor scene using the physically based rendering engine Mitsuba, 3) by measuring light-adapted pupil size whilst viewing a spatially unarticulated viewing box (painted with ~40% reflectance N7 Munsell paint) under the different spectra to determine if the two metamers in each pair have measurably different physiological effects.

Talk 14:40 – 15:00

Jasna Martinovic, Galina V. Paramei and W. Joseph MacInnes

"Effects of language on speeded colour discrimination are specific to the hue-defined, but not lightness-defined basic colour categories"

Abstract: Chromatic stimuli across a boundary of basic colour categories (BCCs; e.g. blue and green) are discriminated faster than colorimetrically equidistant colours within a given category. Likewise, language-specific colour categories are considered to have a speed-of-processing advantage at the novel category boundary. Russian has two BCCs for blue, sinij 'dark blue' and goluboj 'light blue'; native Russian speakers were reported to discriminate cross-boundary light and dark blues faster than English speakers (Winawer et al., 2007, PNAS, 104, 7780-7785). We attempted to replicate this effect in two experiments that employed identical categorisation and discrimination tasks. In Experiment 1, Russian speakers categorised a set of blue colours as sinij/goluboj while English speakers as light/dark blue; this task was followed by a colour discrimination task. In Experiment 2, Russian speakers initially performed the discrimination task on sinij/goluboj and goluboj/zelënyj 'green' sets. They then categorised these colours in three frequency contexts: with each stimulus presented an equal number of times (unbiased), or with either more frequent sinij or goluboj; or goluboj or 'green'. We did observe a classic boundary effect for goluboj/'green'; however, in neither of the two experiments was the boundary response-speed advantage observed for sinij/goluboj. The frequency bias affected only the sinij/goluboj boundary: in a lighter context, the boundary shifted towards lighter shades and vice versa. Contrary to the previous report, our results imply that in Russian, lightness-defined blue BCCs differ behaviourally from hue-based BCCs: for the former, the boundary is context-sensitive, less stable, and does not manifest speeded discrimination.

Poster board: 1

Abbie Millett, Gustav Kuhn, Antonia D'Souza, Ieva Vacaityte and Geoff Cole

“Mental states modulate gaze following, but not automatically.”

Abstract: Previous authors have argued that the computation of another’s visual perspective can occur ‘spontaneously’. In the current work we examined whether such perspective taking is indeed rapid and efficient or is due to conscious control. In two experiments, participants were asked to view everyday scenes that included a model who either gazed towards or away from a target object. Additionally, the view of the object was either unobstructed or occluded by a physical barrier, i.e., the model could either see the object or could not. In Experiment 1, observers freely viewed the scenes for five seconds whilst in Experiment 2 they were required to rapidly detect a target that appeared at various locations in the scene. Results showed that during free viewing participants were significantly faster to fixate the target object if the model gazed towards it, but only when the object was unobstructed. In other words, the model’s perspective appeared to be computed since saccades were influenced by what she could see.

However, no such effect of the model’s perspective occurred when participants performed the target detection task. Overall, these data suggest that although observers do take into account another person’s perspective but this is not spontaneous; it is due to mechanisms associated with conscious control.

Poster board: 2

David Souto, Lily Smith and Marina Bloj

"Where the rubber meets the road: visual cues to inferring friction"

Abstract: The movement of an object can be disambiguated by combining prior knowledge of Newtonian physics with sensory information. Friction puts a strong constraint on an object's dynamics, but its role in motion perception has been little investigated. We tested whether inferred friction with the ground determines the perception of an ambiguously rotating pattern. We rendered naturalistic 3D scenes representing a beach ball rolling on the grass and tracked observers' eye movements. We found that the ball was perceived as rotating congruently with the direction of friction, but only so when observers were looking at the point of contact with the ground. Shadows that specified no contact of the ball with the ground did not influence rotation judgements, indicating that dynamic cues alone were used to disambiguate rotation. Even though the rotation and translation of an object can be specified by global motion cues, foveal vision appears necessary to resolve friction between two surfaces.

Poster board: 3

Michelle To and David J. Tolhurst

"Minkowski integration of monochromatic and isoluminant planes in natural scenes"

Abstract: We have previously used magnitude estimation ratings to study the perception of feature changes in full colour natural images, e.g. changes in blur, object number, location or colour (To et al, 2010, JoV, 10(4):12, 1 22). When an image pair differed in two ways, the rating could be modelled using Minkowski summation of the ratings for the individual differences with m=2.5-3.0 (To et al, 2008, Proc.Roy.Soc. B, 275, 2299-2308). Here, we examine how the feature changes in the luminance and isoluminant planes are integrated to generate a coherent perception of the full coloured natural scene.

We ran four suprathreshold discrimination experiments where observers were presented with pairs of images and were asked to rate the differences. In two experiments, 1800 stimuli were monochrome versions of the images previously used in To et al. (2010), representing feature changes only in luminance. In the other experiments, 1800 stimuli were isoluminant versions of those same stimuli from To et al. (2010). The ratings for the present monochromatic and isoluminant stimuli can be weighted and combined following the same Minkowski summation function (with m=3.13) to predict (r=0.84) the original observers' ratings for the equivalent full colour stimuli in To et al.'s (2010) natural image study.

Poster board: 5

John Maguire, Declan McKeefry, Neil Parry, Ian Murray and Jan Kremers

"Human S-cone electroretinograms obtained by silent substitution stimulation"

Abstract: The purpose of this study was to characterise the response properties of the human S-cone ERG in normal trichromats in both time and frequency domains. We also examined how the S-cone response was affected in Blue Cone Monochromatism (BCM) and Enhanced S-cone Syndrome (ESCS). We recorded S-cone mediated ERGs using steady-state (sinusoidal) and transient (square-wave) silent substitution stimuli. Responses were obtained from n=16 normal trichromatic observers as well as two subjects with BCM and one with ESCS.

Temporal response functions were obtained using steady-state sinusoidal, S-cone isolating stimuli (1000 Td, cone contrast = 0.25) which varied in temporal frequency between 5Hz to 75Hz. The functions obtained were approximately low-pass in nature and response amplitudes fell below threshold criterion above 30Hz. The S-cone ERGs elicited by transient stimuli were characterised by components with implicit times longer than those measured for the corresponding components in the L- and M-cone ERGs. In normal trichromats the S-cone response lacked a prominent positive offset d-wave which was observed in the L- and M-cone responses. The S-cone ERGs obtained from the BCM and ESCS patients did exhibit a more prominent offset response.

The results demonstrate that silent substitution stimuli can be used to generate ERGs that selectively reflect S-cone mediated vision in humans. S-cone ERGs have response properties that are different to those mediated by L- and M-cones. Furthermore, the results raise the possibility that differences in the ERG waveforms observed in retinal pathologies that affect the S-cone system may reflect a re-organisation of S-cone signal processing in these conditions.

Poster board: 6

James Stone

“Accuracy and Shannon Information”

Abstract: As the accuracy of responses increase, response speed decreases. This speed-accuracy trade- off suggests that observer performance cannot be measured properly from reaction times or accuracy alone. However, even though both mean reaction times (MRT) and the corresponding proportion (P) of binary responses (e.g. yes/no) are recorded as a pair, MRTs are usually discarded. Here, it is shown how any speed-accuracy model can be fitted to observer (MRT, P) response pairs by finding model parameter values that maximise the mutual information between stimulus strengths (e.g. brightness) and observer response pairs; which is achieved by maximising the goodness of fit between observer and model response pairs. The model used here is the extended proportional rate diffusion (EPRD) model (Palmer et al, 2005; Stone, 2014). The proposed method provides the information implicit in each response pair, and in each component (i.e. MRT and P) thereof. Using a visual psychophysics experiment, it was found that the average information implicit in an observer's response pair is 3.38 bits, and that MRTs contain substantial information (1.21 bits) that is independent of the information (2.29 bits) in binary responses. The extra information gained by combining observer MRT and P values yields dramatic improvements in the precision of psychophysical parameters (e.g. thresholds). Consequently, the method can also be used to reduce the number of trials in an experiment, without loss of precision in estimated parameter values. In essence, this method discounts the effects of the speed-accuracy trade-off to provide a proper estimate of observer performance.

Poster board: 7

Andrew Logan, Gael Gordon and Gunter Loffler

"The Effect of Age-Related Macular Degeneration on Features of Face Perception"

Abstract: Age-related macular degeneration (AMD) significantly impairs face identification ability. This impairment has a negative impact on quality of life and has been highlighted by patients as a priority for improvement. We aimed to quantify the impact of AMD on different aspects of face perception.

Synthetic face discrimination thresholds were measured using a memory-free "odd-one-out" task. Sensitivity was measured for full faces (in which all features changed), external features (head-shape and hairline) and internal features (nose, mouth, eyes and eyebrows). Participants were ten adults with bilateral, non-exudative AMD, and ten age-matched controls with healthy vision. Mean LogMAR visual acuity (± SD) was +0.38 (0.18) and -0.02 (0.06) in the AMD and control groups respectively.

Full face discrimination thresholds were, on average, 2.11 times higher in AMD patients, relative to controls. This indicates that two faces that can easily be discriminated by individuals with healthy vision are indistinguishable to patients with AMD. Although AMD patients were also poorer than controls when presented with either external or internal features, the effect was not uniform: in AMD performance was 1.62 times poorer for the external features, but 3.13 times poorer for internal features.

AMD significantly reduces sensitivity to full faces and their component parts. Sensitivity to the internal face features is disproportionately impaired. This suggests that impaired spatial resolution in AMD is particularly disruptive to the processing of differences in the shapes and positions of the internal features (e.g. eyes, mouth). This information is not just important for identification, but also for other aspects of communication (e.g. facial expressions).

Poster board: 8

Niall Hynes, Matthew Cufflin, Karen Hampson and Edward Mallen

"Cognitive Demand and Accommodative Microfluctuations"

Abstract: When viewing a static target, the accommodation response fluctuates. These variations in response are termed microfluctuations. Microfluctuations can be divided into two categories, the Low Frequency Component (LFC) measuring below 0.6 Hz and the High Frequency Component (HFC) measuring between 1.0 and 2.3 Hz. This experiment aims to investigate the effect that mental cognition has on the nature of accommodative microfluctuations.

The study consisted of 22 participants, (mean age 25.96, ±4.99, range 20-35 years) comprising of 11 emmetropes and 11 myopes. Accommodation was monitored continuously using a modified Shin Nippon SRW-5000 autorefractor whilst participants completed 3 tasks of varying cognitive demand. Participants completed these tasks in a randomized order:

(i) Reading numbers aloud (Num).

(ii) Simple arithmetic (SA).

(iii) Complex arithmetic (CA).

Data was analysed using Fast Fourier Transform functions in Matlab. A repeated measures ANOVA highlighted a significant main effect in the mean power of the HFC ($F(2,42)=10.03$, $p < 0.01$). Pairwise analyses revealed that these differences exist between SA and CA ($p < 0.01$), and the Num and CA ($p < 0.01$) conditions with the HFC power being highest for the CA condition. No significant differences were found in power of the LFC across conditions.

Whilst cognitive demand has no effect on the overall accommodative response or the LFC in accommodative microfluctuations, it does appear to increase the power of the HFC during complex arithmetic. As the HFC has been shown to be associated with arterial pulse, this may correspond with other physiological finding related to cognitive demand.

Poster board: 9

Gunnar Schmidtmann

“The McGill Face Database: A Novel Database of Facial Expressions of Mental States”

Abstract: Current databases of facial expressions of mental states typically represent only a small subset of expressions, usually covering the basic emotions (fear, disgust, surprise, happiness, sadness, anger). To overcome these limitations, we introduce a large new database of pictures of facial expressions reflecting the richness of mental states. 93 expressions of mental states were interpreted by two professional actors and high-quality pictures were taken under controlled conditions in front and side view. The database was validated with two different experiments (N=65). Firstly, a 4-alternative forced choice paradigm was employed to test the ability of participants to correctly select a term associated with each picture. Secondly, the observers' task was to indicate the point within an emotional space ranging from pleasant to unpleasant in one dimension and arousal high to arousal low in the other.

Results from both experiments demonstrate that subjects can reliably recognize such a huge diversity of emotional states from facial expressions. The McGill Face Database provides a wide range of facial expressions that can be linked to mental state terms and can be accurately characterized in terms of arousal and valence independent of terms. The database is also available in French and German and is freely available for scientific, non-commercial purposes.

Poster board: 10

William McIlhagga

“Convolutional Classification Images of Edge Detectors in Human Vision”

Abstract: Observers had to detect a horizontal step edge in a stimulus by clicking on the edge position with a mouse. The horizontal edge could appear anywhere within a 5 degree tall central region inside a 10 degree tall stimulus. Horizontal brown noise was added to the stimulus to estimate classification images. The edge contrast was controlled with a one up two down staircase. Three observers participated in the study.

Responses were fitted with a convolutional model. I assumed that the observer convolved an edge detection filter across the entire stimulus, and clicked where the output of the filter was highest. The filter outputs are converted into a probability-of-click at each location by passing them through a softmax function. The edge detection filter was estimated by maximizing the likelihood of the observer’s actual click locations. A small smoothness constraint was imposed on the filter. The model was fitted with Python and is available as a Jupyter Notebook (https://python-william-mc.notebooks.azure.com/nb/notebooks/ AVA_templates.ipynb)

The estimated filter (a classification image, Ahumada, Jr. A. J. (1996). Perception, 25) is similar to a derivative of Gaussian filter, with a peak-to-trough width of around 0.1 to 0.15 degrees (somewhat wider than Shapley, R. M., and Tolhurst D. J. (1973) J. Physiol. 229: 165-183). When the analysis is restricted only to those trials where the observer was incorrect (and clicked far from the true edge), a similar filter is found. These filters are wider than the optimal filter, probably because observers were imprecise with their mouse clicks.

Poster board: 12

James Heron, Corinne Fulcher, Neil Roach and David Whitaker

“The role of second-order vision in human duration processing”

Abstract: Despite progress in elucidating the defining characteristics of duration perception, its neural underpinnings remain elusive. In one scenario, duration encoding could be a ‘by-product’ of neurons whose primary function has thus far been considered to lie outside the realm of duration processing. For example, in the visual domain we have recently shown [1] that bi-directional, repulsive duration aftereffects (DA) spread across a region of space that is proportional to the size of the adapting stimulus, potentially implicating second-order neurons in extrastriate cortices which integrate across proportionally smaller striate input neurons [2]. We tested this hypothesis by examining DA selectivity for features that invoke visual spatial mechanisms associated with first- vs second-order processing. We found extensive DA transfer across adapt-test changes in luminance-defined orientation and stimulus size. Conversely, DA showed little or no transfer when second-order contrast detecting mechanisms were required to extract the size or visibility of adapting and testing durations. Taken together, these results provide evidence for duration encoding linked to neurons that also subserve the processing of higher-order image statistics such as texture and contrast.

[1] Fulcher C, McGraw PV, Roach NW, Whitaker D & Heron J. (2016) Object size determines the spatial spread of visual time. Proceedings of the Royal Society B-Biological Sciences 283: 20161024.(pdf)

[2] Graham, NV. (2011) Beyond multiple pattern analyzers modeled as linear filters (as classical V1 simple cells): Useful additions of the last 25 years. Vision Research. 51, 1397-1430.

Poster board: 13

Eilidh Fenner, Alexandra Levine, Charlotte Codina, David Buckley and Heidi Baseler

"The effects of long-term visual experience on peripheral motion sensitivity"

Abstract: Catching a ball, deflecting an opponent and being aware of potential threats in one's surroundings all depend on peripheral visual sensitivity. Sports, video gaming and deafness have the potential to shape long-term visual experience by placing particular demands on peripheral vision. The purpose of the current study was to compare the effects of visual experience across sports, video gamer, early deaf and control groups using the same motion detection task. Participants indicated which of two clusters of dots presented on either side of fixation contained motion. Threshold (minimum speed required to detect motion) and reaction time (RT) were recorded for dot cluster pairs centred at various eccentricities between 5 and 40 degrees along the horizontal meridian. Both threshold and RT increased with eccentricity across groups. Thresholds varied significantly between groups at 20 and 40 degrees, but not at more central eccentricities. Threshold and RT were affected differently across groups, e.g. peripheral thresholds were lowest in the deaf group, while RTs were lowest in the sports group. Higher self-reported stress levels also correlated with lower thresholds in all groups. Our results suggest that differences in long-term visual experience, through deafness or practicing certain hobbies, modify visual motion sensitivity in different ways.

Poster board: 14

Rebecca J Hirst, Jemaine Stacey, Lucy Cragg, Paula C Stacey and Harriet A Allen

"The threshold for visually induced illusions (the McGurk effect) decreases with development"

Abstract: The McGurk effect is a visually induced illusion in which a seen mouth movement changes the sound perceived. The influence of vision over audition is proposed to increase across development such that vision plays an increasingly important role in in perception (Nava & Pavani, 2013). In this study we assessed the impact of auditory and visual noise on the McGurk effect in 32 adults (aged 20-35 years) and 90 children (aged 3-12 years). We predicted that susceptibility to the McGurk effect would increase with age in children, and also that adults will be more susceptible to the McGurk effect. Furthermore, we predicted the threshold for the McGurk effect (i.e. the level of auditory noise required to induce the effect and visual noise required to abolish it) would be lower in adults compared with children. In line with our predictions, we found that susceptibility to the McGurk effect increased with development and was higher in adults than children. Auditory noise increased the likelihood of vision changing auditory perception, and visual noise reduced the likelihood of vision changing auditory perception. Children also required more auditory noise than adults to induce McGurk responses and less visual noise compared with adults to reduce McGurk responses (i.e. adults and older children were more easily influenced by vision). Reduced susceptibility to visually induced illusions in childhood supports the theory that sensory dominance shifts across development.

Poster board: 15

Eugenie Golubova and Sandra Starke

"Evaluation of a wearable sight aid for people diagnosed with sight impairment"

Abstract: Moderate sight loss and blindness now affect around 700,000 people in the UK alone. Many conditions such as macular degeneration cannot be treated or corrected through spectacles. However many patients still have functional residual vision, the image is just very blurred and/or hazy. Patients therefore rely on sight aids to use their remaining sight. The limitation of current sight aids is their often small field of view and single-purpose character, most commonly designed for near-distance tasks. This pilot study evaluates a prototype wearable sight aid designed around a smartphone and virtual reality (VR) headset to overcome these limitations. The aim of the study was to examine whether such a sight aid would improve near- and distance vision during everyday activities. 194 people, most commonly experiencing central vision loss, participated in a 1:1 demo session, after which they could elect to take the prototype home for two weeks. 92 participants chose to do so, followed by a structured de-brief. 71% reported an improvement in ability to see for their preferred activity; 82% of these improved to a self-rated 7 out of 10 or better. Use cases included reading, hobbies, watching TV and attending events. Those who wanted to keep the prototype long term were contacted again after several months for a follow-up. Out of 34 long-term testers, 41% reported still using the device at least once per day and 67% at least weekly. 68% reported increased confidence and 59% increased independence. We conclude that wearable sight aids have great potential for those living with sight impairment.

Poster board: 17

David Coggan, Watson David, Tom Hartley, Daniel Baker and Tim Andrews

"A data-driven approach to stimulus selection reveals an image-based representation of objects in high-level visual areas"

Abstract: The topographic pattern of neural response in high-level visual areas is thought to be linked to categorical or semantic properties of objects. However, previous brain imaging studies have been limited by choices involved in the experimental design. In typical studies, the experimenter chooses the experimental conditions. These distinctions are then reflected in subsequent analyses and imposed on the interpretation of the data, potentially obscuring simpler alternative explanations. To address this problem, we developed a novel data-driven approach to stimulus selection in which a large database of objects was described in terms of image features. A clustering algorithm was then used to select images from distinct regions of this feature space. The image clusters did not correspond to typical object categories. However, they elicited distinct patterns of response across visual cortex. The patterns of neural response to image clusters in high-level regions was predicted by the perceptual similarity of the images. That is, image clusters that were perceived to be similar had more similar patterns of neural response. Interestingly, the representation of objects in high-level visual areas was different to that found in low-level visual areas. These findings provide an image-based explanation for the emergence of neural representations that are selective for objects in high-level visual areas.

Poster board: 18

Alexander Swystun, James Heron and Andrew Logan

“Quantifying the effect of viewpoint changes on sensitivity to face identity”

Abstract: Faces can be recognised across different viewpoints. Previous reports, however, suggest that changes in viewpoint reduce face identification accuracy. We aimed to quantify the effect of variations in viewpoint on the ability to discriminate between face identities.

Discrimination thresholds were measured for three observers for synthetic faces shown from the same frontal view (baseline). These baseline thresholds were compared to those for the same synthetic faces presented with a change in viewpoint (5°, 10° or 20°). Three different types of viewpoint change were tested: (i) front-side (frontal face matched to 20° side-view), (ii) symmetrical (10° right to 10° left) and (iii) asymmetrical (5° left to 15° right).

Relative to baseline, viewpoint changes significantly increased discrimination thresholds. The magnitude of this reduction in sensitivity increased monotonically with the size of viewpoint change (front-side: 5° = 1.22X, 10° = 1.87X, 20° = 2.21X). Importantly, the effect of the three types of viewpoint change was not equivalent: while a symmetrical 10° change did not significantly reduce sensitivity (1.11X), asymmetrical changes in viewpoint, of the same magnitude, increased face discrimination thresholds by a factor of 1.93X.

Changes in viewpoint significantly reduce discrimination sensitivity for face identity. The magnitude of this reduction in sensitivity is related to both the size and type of viewpoint change. These results suggest that the neural mechanisms which encode face identity are also tuned to viewpoint.

Poster board: 19

Tim Andrews, Philip Ulrich and Andre Gouws

"Neural correlates of group bias during natural viewing"

Abstract: To what extent do brains of different individuals operate in a similar manner? Previous studies have explored this issue by comparing the time-course of brain responses during natural viewing and have found a high level of correspondence in the brain responses across individuals. However, a variety of evidence has shown that individuals from different social groups can vary markedly in the way that they interpret the world. A key question in this regard is whether group differences in neural processing occur at early stages of processing when sensory information is encoded or whether they are evident at later stages of processing, which are more involved in interpreting the input. To explore the neural basis of these differences, we measured brain responses using fMRI from two groups of football supporters, while they watched a video of matches between their teams (Chelsea and Manchester United). First, we measured the time-course of responses in visual cortex. We found high correlations across individuals in the time-course of neural response across visual cortex. However, these visual regions did not show any group differences. Regions that showed higher correlations for individuals from the same group were found in a network of frontal and subcortical brain regions that are involved in motor control, social cognition and reward. Together, these results suggest that group differences in processing visual input are not found in sensory regions of the brain, but are evident in regions that are involved in the evaluation and interpretation of the sensory signals.

Poster board: 23

Ryan Horsfall, Sophie Wuerger and Georg Meyer

"Perceived simultaneity of audio-visual events is intensity-dependent"

Abstract: Simultaneity judgements (SJ) and temporal order judgements (TOJ) are used to characterise audio-visual integration mechanisms. The resulting points of subjective simultaneity (PSS) have been shown to be uncorrelated, suggesting different underlying mechanisms for the tasks. The multisensory correlation detector (MCD) model (Parise & Ernst, 2016) accounts for this lack of correlation by assuming identical early processing mechanisms but different task-specific weightings.

34 observers (20-69 Y/A) performed both SJ and TOJ tasks with identical flash/bleep stimuli (100ms) with varying stimulus onset asynchronies (-200ms AV to +200 VA) and two flash intensities (1.1cd/m2 or 366cd/m2). In the TOJ task, participants judged whether the audio or the visual stimulus came first; in the SJ task, whether the stimuli occurred simultaneously or separately.

The PSS was defined as the SOA corresponding to maximum of the SJ curve, and the 50% point of the TOJ curve. No correlation was found between the PSSs of the tasks but flash intensity had an effect: the PSS shifts from 20.9ms (dim) to 7.6ms (bright) in the SJ task, and from 17.2ms (dim) to -7.4ms (bright) in the TOJ task. The effect of intensity is asymmetric around the PSS and more pronounced for visual leading stimuli.

When an early non-linearity is added to the MCD model to account for the known effect of stimulus intensity on processing latency (e.g. Gilliatt et al., 1965), the intensity-dependent PSS shift is predicted, but the asymmetry is not captured. Our findings constrain possible models of intensity-dependent audio-visual integration mechanisms by ruling out low-level mechanisms as the sole explanation.