

**38th European Conference on
Visual Perception (ECVP)
2015
Liverpool**

momentum is independent of stimulus size. We replicated a significant effect of speed, but found no effect of stimulus size. This pattern of results supports an influence of representational momentum on the perceptual dynamics of the Lissajous figure. Using a Bayesian modelling approach, we will also address the question of how increased rotational speed leads to higher estimates of stimulus stability and how this might act on the occurrence of perceptual transitions.

[3P1M015] Estimates of eye velocity are tuned for speed

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Estimating eye velocity helps convert retinal motion into movement with respect to the head and other coordinate frames. Models of these coordinate transforms assume that eye-velocity estimates encode speed – yet direct evidence is scant. We therefore measured the orientation of discrimination contours in the distance-duration plane for pursued stimuli. If speed dominates, stimuli moving over different distances and durations should be more difficult to discriminate when their speed is the same. Discrimination contours (ellipses) will therefore be oriented obliquely along iso-speed lines. Because extra-retinal signals and retinal flow may both contribute to eye velocity estimation, we measured discrimination with and without visible backgrounds. In Experiment 1, a horizontally-moving pursuit target was shown in the dark (no flow), with horizontal lines (reduced flow) or vertical lines (high flow). Resulting ellipses were oriented along the iso-speed line, suggesting speed was dominant in all conditions. But ellipses were less elongated in the presence of flow, suggesting backgrounds enhanced distance cues not speed. In Experiment 2, distance cues were downgraded using short-lifetime dots. Discrimination ellipses were now more stretched along the iso-speed line. The results suggest: (1) eye-velocity estimates are tuned for speed; (2) both extra-retinal and retinal-flow cues contribute.

[3P1M017] Spatial integration in dynamic random-dot patterns depicting either first-order or second-order global motion

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Previous studies have investigated the spatial integration limits for first-order (luminance-defined), but not second-order (contrast-defined), global motion in human vision. In the present study, we compared coherence thresholds for random-dot-kinematograms (RDKs) containing either luminance-defined (modulation depth 0.3) or contrast-defined dots (modulation depth 0.8) depicting translational, rotational or radial motion. The diameter of the circular aperture in which the dots were displayed was varied (in equal logarithmic steps) from 2 to 16 degrees. Regardless of the type of dots used and trajectory depicted, participants' (N=7) thresholds decreased as image size increased. However sensitivity was greatest for rotational motion and least for radial motion, especially with the smallest RDKs tested. The minimum image size for which the direction of global motion was still reliably discernable was larger for RDKs composed of second-order dots than first-order dots. Nonetheless when differences in absolute sensitivity were taken into account, thresholds for first-order and second-order global motion fell at the same rate as RDK diameter increased. These findings reinforce the notion that if first-order and second-order local motions are detected separately, they are subsequently combined across space by a cue-invariant global motion mechanism, consistent with the properties of some neurons in extra-striate areas MT and MSTd.

[3P1M019] Electrophysiological correlates of motion extrapolation

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Motion extrapolation (ME), the ability to predict the future states of moving objects that are hidden by an occluder, is critical to interact with a dynamic environment. In a classical paradigm, participants are required to estimate time to contact (TTC) by pressing a button when the occluded moving target reaches a certain cue. Research using this paradigm showed that adapting the specific regions in which the target will be occluded produces a shift in the TTC estimate: adaptation in the same direction increases TTC, whereas adaptation in the opposite direction shortens it (Gilden et al., 1995). In this study, we asked whether the modulation of TTC by motion adaptation is reflected in the Contingent Negative Variation (CNV), a frontal electrophysiological component related to timing processing. Results showed a larger CNV amplitude after adaptation in the same direction of the target, possibly suggesting that visual and frontal areas interact during ME. Furthermore, we asked whether motion extrapolation could elicit an N2 component, which is normally elicited at the onset of visible motion at the posterior sites. Results showed a negative component peaking at 190ms post-occlusion at posterior sites ipsilateral to the direction of ME, potentially indexing the “start” of the actual ME.

[3P1M021] Psychophysical approbation of an algorithm for coherent motion perception

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Moving dot stimuli are used to study mechanisms of motion perception. Unfortunately independent researches yields diverse threshold values e.g. 5.6 ± 0.39 (%) (Ridder, Borsting, Banton, 2001); 15.34 ± 4.71 (%) (Milne et al, 2002); 25% (Slaghuis, Ryan, 1998). Dissonance among results may rise because lack of joint conception of motion perception stimuli design as well as from individual experience of test participants. We have studied how threshold values are influenced by differences in stimuli design (shape of the test field, moving dot density) as well as type of protocol of psychophysical testing. Lowest thresholds values were obtained by test field with elliptical shape ($r=6.2$ deg at 50cm) having dot velocity vectors constant (2deg/s) with limited fluctuations in dot density over the time. In case of constant stimuli coherent motion perception threshold was (5.0%, 0.4SD) and with adaptive staircase 4AFC psychophysical protocol it was (6.5%, 1.7SD). Preliminary results suggest that perceptual learning do affect repeatability of test results as well as fatigue of participant (Lee, Lu, 2010).

[This work has been supported by Nr.2013/0021/IDP/1.1.1.2.0/13/APIA/VIAA/001]

[3P1M023] Inter-scale suppression and facilitation in motion-discrimination are unaffected by dichoptic presentation

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The discrimination of motion direction of a fine-scale pattern is impaired when a static coarse-scale pattern is added to it. The strength of the impairment is unaffected by dichoptic presentation (Derrington et al, 1993), so it suggests that the interaction between different motion sensors tuned to high and low spatial frequencies is happening after binocular combination. Interestingly, discrimination of motion direction improves when a static fine-scale pattern is added to a moving coarse-scale pattern. In this work we tested whether this facilitation is also unaffected by dichoptic presentation. Using a mirror stereoscope, we measured duration thresholds of Gabor patches moving horizontally at 2deg/sec. We tested four conditions, two dichoptic presentations: a) 1c/deg moving in one eye and a static 3c/deg in the other eye; b) 3c/deg moving in one eye and 1c/deg static, and two monocular presentations, both stimuli (the static and the moving pattern) presented in the same eye. Results of 4 subjects showed that impairment and facilitation effects in motion discrimination were present with the same strength in both monocular and dichoptic presentations. We suggest that facilitation in motion discrimination is caused, after binocular combination, by the interaction between two motion mechanisms tuned to coarse and fine scales.

[3P1M025] Comparing the effects of contrast on perceived speed for linear and radial gratings

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At low speeds, lower contrast linear gratings appear to move more slowly than higher contrast gratings. This effect is reduced and even reversed at higher speeds. Are similar effects observed for ring-like radial gratings? Although drifting linear and radial gratings can be matched for local spatio-temporal properties, radial gratings have more complex global structure, approximating optic flow associated with either self-movement or object-movement in depth. Using a standard 2IFC method we assessed perceived speed of a low contrast (8%) reference grating moving at 1, 4, 8 deg/s (Exp 1, N = 19) and 2, 6, 12 deg/s (Exp 2, N = 18) relative to a higher contrast (64%) comparison. Linear stimuli were gabor patches ($SF = 1$ cpd, $\sigma = 3.33$ deg) and radial stimuli had matched spatial parameters. Consistent with previous studies, participants judged lower contrast linear gratings as markedly slower than higher contrast gratings, except at the highest speeds tested. This was also true for radial gratings, however, biases in perceived speed for these stimuli were even more pronounced at low reference speeds (1-6 deg/s). Contrast-dependent effects on speed perception appear to vary depending on the global structure of the stimulus.

[3P1M027] Perceived speed of mixed-contrast random-dot kinematograms

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Perceived speed and subsequent driving behaviour are thought to be altered in conditions of low contrast, e.g. when driving in fog (Thompson, 1982; Snowden, Stimpson & Ruddle, 1998). Here, we investigate perceived speed in scenes containing both high- and low-contrast components (e.g. street lights/fog lights visible through the fog). We varied the proportions of high- and low-contrast dots in random-dot kinematograms (RDK) and investigated the effect on perceived stimulus speed. We manipulated the proportion of high-contrast dots (20%, 50%, 80%, 100%) and the speed (4deg/s and 8deg/s) of the mixed-contrast RDK. Perceived speed was measured using a 2AFC design in which participants (N=15) reported the faster

Image segregation into foreground and background requires information relative to which border in the image is likely to belong to which surface. Receptive field structures of cortical neurons likely to deliver the border ownership code have been identified. To clarify how the human perceptual system resolves ambiguous border ownership, configurations with contours bridging gaps between edge inducers with varying contrast polarity were presented in random order to human observers. The contours could be interpreted as belonging to the surface in the center of the configuration, or the surface surrounding the center. Control configurations consisted of surfaces (dark-on-light surround and light-on-dark surround) with unambiguous border ownership. Observers had to judge whether they perceived the central surface in front, behind, or in the same place with the surrounding one. Results show that response probabilities are determined by the theoretically predicted direction of filling-in in the ambiguous configurations, irrespective of the contrast polarity of the inducing elements. In the control configurations where border ownership is unambiguous, the polarity of contrast is found to predict the perceived relative depth of the two surfaces.

CNRS "Actions Interdisciplinaires 2015"

[3P1M119] Conscious perception of local elements enforces their global integration and vice versa

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The primary task for the visual system is to organize the disparate retinal input into integrated perceptual representations. The extent to which conscious perception is required for visual organization to persist, and vice versa is yet unclear. We addressed this question using a continuous flash suppression (CFS) paradigm. In experiment 1, we tested whether a visible and invisible global context differentially modulates the perceived motion direction of a visible aperture stimulus (i.e., a stimulus that appears to move behind an aperture.) We found that the global context influenced perceived motion direction only when the context was visible. In experiment 2, a variant of the bistable diamond was used, consisting of four drifting gratings, which can be perceived as drifting independently, or as a global diamond shape moving behind occluders. The drifting gratings were presented in one eye in a square arrangement around fixation, while masks presented in the contralateral eye perceptually suppressed two of the gratings. We observed that a global perceptual interpretation of the visible gratings boosted the suppressed gratings into awareness faster, relative to when the gratings were perceived to drift independently. These results emphasize the mutual reciprocal reinforcement between conscious perception and global visual integration.

[3P1M121] Seeing the forest or seeing the trees: The role of urbanisation in the development of perceptual bias

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Global perceptual bias has been reported to emerge around 6 yr in Western populations (e.g. Poirel, Mellet, Houdé, & Pineau, 2008) and is thought to be a universal characteristic of perception in adulthood. In contrast, a remote Namibian population called the Himba demonstrate a strikingly local bias even in adulthood. This local bias diminishes with limited urban exposure in adulthood: Himba raised traditionally but relocated to town in adulthood are substantially more global than Himba remaining in the villages (Caparos, Ahmed, Bremner, de Fockert, Linnell, & Davidoff, 2012). Here we show that from as early as 6 yr urbanised Himba children already show a greater global bias than Himba adults raised traditionally but relocated to town in early adulthood. Furthermore we show that, within adults, both exposure to the urban environment earlier in life and exposure over a longer period of time are associated with a global perceptual bias comparable to that of Western adult populations. We conclude that global bias is not a universal characteristic of adult perception but requires urban exposure, or factors associated with such exposure, to be expressed.

Economic and Social Research Council UK and British Academy

[3P1M123] Colour induced enhancement of perception of global versus local movement

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Local and global perception of moving objects was studied psychophysically and neurologically (Anstis, Kim, 2011, *J Vision* 11(3);1–12; Zaretskaya et al., 2013, *J Neuroscience* 33,523–531). Authors hypothesise prevalence principles of perceptual “local” vs. “global” grouping that depends on stimuli geometry, lightness polarity, complexity. Previously elementary elements were gray-scaled and arranged in groups in various manners. We introduced: a) colour contrast between stimuli groups and between stimuli and background, b) viewing eccentricity of scene. We used spot doublets that can be perceived rotating around their symmetry centre (“local” motion) – organized at vertices of two squares that can be perceived sliding over each other along circular paths (“global” motion). Doublets were shown as red and green spots on yellowish background, further the colour saturation was minimized during trials. During onset of scene the local motion prevailed that

further turned to global sliding of two squares. We measured with 2-AFC paradigm the time course of the first switching event to global motion in dependence of spot colour distances ΔK in $L^*a^*b^*$ space both for chromatic and achromatic scene and contribution of chromaticity into facilitation of switching. Facilitation of switching was observed increasing eccentricity of viewing continuously moving the fixation point from the doublet centre to centre of scene.

[Support: ESF-2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001, Latvia.]

[3P1M125] Unconscious priming effect in visual scene with multiscale objects.

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Biederman and Cooper (2001) showed that priming effect in naming task remains the same regardless the differences in size of primer and target. However in this and similar works the size difference was small, or the used sizes were from the same diapason of sizes. There are two differently perceived diapasons of object sizes. Perception of objects larger than 1-1.5 deg (depending on objects class) is scale invariant, while objects, which size is smaller than 1.5 deg, are perceived poorer with stimulus diminution. In this work we investigated whether primer of a large size can prime the target, which size is smaller than 0.5 deg in match-to-sample task.

Object-sample appeared for 200 msec, SOA between sample object and test-event was 1200 msec. It was four-alternative forced choice task. Object-sample size was 0.1 or 0.2 degree, and noise level was 0 or 40%; SOA between primer and test-event was 300 msec. Object-prime appeared for 150 msec. Primer was masked and mask renewed every 150 msec.

Presentation of the congruent primer caused reduction of the reaction times in the most uncertain conditions (stimuli size 0.1 deg and noise level 40%) comparing to conditions without primer or with incongruent primer.

[3P1M127] The Role of the Magnocellular Visual Pathway in Object Recognition

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Visual categorization plays an important role in the fast and efficient processing of information surrounding us, still the neuronal basis of fast categorization has not been established. Two main hypotheses are known, both agree that the primary impressions are based on information acquired through the magnocellular pathway. It is unclear whether this information is due to the magnocellular pathway running parallel to the ventral pathway or to top-down mechanisms executed through the connections of the dorsal pathway and the frontal cortex. A categorization task was performed by 39 subjects, who decided about the size of objects based on the first impression. Stimuli used for the magno- and parvocellular pathways were discriminated by their spatial frequency content. Transcranial direct-current anodal, cathodal and sham stimulation were used to assess the role of frontal areas. Stimulation did not bias the accuracy of decision for stimuli optimized for the parvocellular pathway. In case of stimuli optimized for the magnocellular pathway, cathodal stimulation decreased the subjects' performance, whereas the anodal stimulation increased the performance. Our results support the hypothesis that top-down mechanisms, which promote fast predictions through coarse information carried to the orbitofrontal cortex by the magnocellular pathway, is crucial in fast categorization processes.

The study was supported by an OTKA K83671 grant.

[3P1M129] An Experimentally Constrained Theory For Levelt's Propositions and The Scalar Property Of Multistable Perception

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Reversal time distributions in multistable perception exhibit a characteristic gamma-like shape, which remains largely invariant across displays, observers, and stimulation levels, whereas distributions mean span over two orders of magnitude and feature a somewhat paradoxical input-dependences known as Levelt's propositions (Levelt, 1967; Pastukhov and Braun, 2007; Blake et al., 1971; Murata et al., 2003; Walker, 1975). This implies deterministic and stochastic contributions to the dynamical process underlying the alternation statistics must satisfy a peculiar balance (Kim, Grabowecky, Suzuki, 2007; Van Ee, 2009; Brascamp, Van Ee, Noest, Jacobs, Van den Berg, 2008; Pastukhov et al., 2013). Our hierarchical model of stimulus integration by ensembles of stochastic bistable nodes, fully constrained from experimental observations, can account for the shape and scalar property of reversal time distributions at all orders (Cao et al. 2015, in preparation) as well as numerous other properties. We show that successive truncations of the higher-order dynamics can provide with important insights; in particular, the reduction to a second-order diffusion process reveals that the scalar property relies on adequate

V1, feedback from V5 does not overwrite the feedforward processing of orientation. If orientation is not present, feedback from V5 completes the motion field, extinguishing target representation in V1. We confirmed that Gabors function as MIB targets at 7.1° and 5.8° eccentricity, but not 4.2°. We retinotopically mapped the target region in V1 and, using multivariate classifiers, decoded orientation when target was either visible or perceptually invisible (MIB). We provide evidence for both feedforward processing of target orientation and feedback processing of motion.

Work was supported by ESRC PhD AQM Studentship Funding and ERC-grant (ERC StG 2012_311751).

[3P2M036] Relationship between vection and body sway

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When observers view a large visual stimulus that moves uniformly, they often perceive illusory self-motion (vection). A vection-inducing stimulus is also known to induce postural responses and many studies have used visually evoked postural responses (VEPRs) as objective measures of vection. In the present study, to investigate the relationship between vection and VEPRs, we measured vection and center of foot pressure (COP). In an experiment, participants were asked to stand still with their arms at their sides while viewing a vertically or horizontally moving random-dot pattern. They were also asked to rate vection magnitude (from 0 to 100) after each trial. The results showed stronger vection to vertically moving stimuli than horizontally moving stimuli. Vection was also stronger for upward motion than for downward motion. COP started to move in the inducing stimulus direction immediately after the onset of the inducing stimulus, and its magnitude (difference from the baseline, i.e., COP data before the stimulus presentation) gradually became larger during the stimulus presentation. The mean COP during 1-s intervals before and after vection onset showed larger COP after the onset than before it. This suggests that, at least to some degree, mechanisms underlying vection and VEPRs are related.

[3P2M038] Perception of biological motion in central and peripheral visual field

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Studies analyzing motion perception in peripheral visual field demonstrate that central retina is more specialized for motion perception (Finlay, 1982). In the current research we used biological motion stimuli (consistent with and extending the paradigm by Johansson, 1973) with a two-fold aim: first, to explore the perception of biological motion when limited information of object's movement is given; second, to analyze whether a stimulus magnification can compensate for reduced motion perception in the peripheral visual field (Gurnsey et. al., 2010; Ikeda et. al., 2005). Participants were instructed to determine whether the presented stimulus is a biological object (walking in any of five different directions) or a scrambled version of it. The number of dots representing the motion varied from 1 to 13 according to psychophysical staircase method. The results indicate that perception of biological motion in the central visual field is highly individual (average thresholds range from 3.8-7.1 points). Stimulus magnification can compensate for the performance of the task only for smaller eccentricities (up to 8 degrees), but cannot compensate for larger eccentricities (16 degrees), thus demonstrating that the central retina is also specialized for biological motion perception additionally to e.g. detection of just noticeable object displacement.

Study is supported by ESF project No.2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001

[3P2M040] Motion-induced position shifts smaller across the vertical and horizontal meridians

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When a Gabor patch drifts across the screen while its internal pattern drifts in the orthogonal direction, the perceived direction of motion is the combination of the two motion vectors (Infinite Regress Illusion, Tse and Hsieh, 2006; Lisi and Cavanagh, 2014). If the Gabor patch oscillates sinusoidally back and forth on a linear path while the speed of the internal pattern is modulated sinusoidally 90° out of phase with the path motion, the path is perceived as elliptical. In the present study we measure the strength of this motion-induced illusion by asking subjects to add a physical shift orthogonal to the path (adding to the illusion) until the perceived path appeared circular. The initial physical path was centered 10° in the periphery and oriented in one of four directions (-45°, 0°, 45°, 90° where 0° is vertical) at one of the eight possible locations around the fixation point. The results show that for the vertically oriented stimuli the illusion is significantly weaker when presented at the vertical meridian, while for the horizontally oriented stimuli the illusion weakens at the horizontal meridian. These results suggest that the integration of the motion vectors is disrupted in the vicinity of the meridians.

This project was funded by ERC grant to P.C.

which neurons are binocular, selective for orientation and their activity is strongly modulated by attention (e.g., V3A and V4).

[3P2M118] The Leuven Embedded Figures Test (L-EFT): Measuring perception or cognition?

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Our visual system prioritizes global structures above local elements (Navon, 1977). A myriad of tasks claim to dissociate global from local perception, but the constructs underlying these tasks remain unclear. One paradigm commonly used in this field is the Embedded Figures Test (EFT; Witkin, Ottman, Raskin & Karp, 1971) but its results have been prone to a wide variety of interpretations. In the current study, testing over 130 participants, we aimed at a better understanding of what is measured by the EFT. Therefore, a new EFT was designed where local features at the target level (e.g., symmetry or closure), and global features at the pattern level (e.g., number of lines continuing from target into context) were independently manipulated in order to dissociate local from global processing. Secondly, the association between EFT performance, non-verbal intelligence and several executive functions was assessed to evaluate the impact of both perceptual and cognitive aspects on EFT performance. These data could clarify the construct validity of this paradigmatic task of global/local processing. In addition, our newly designed EFT may offer a more controlled measure, which is better able to differentiate between genuine perceptual, as opposed to executive contributions to EFT performance.

FWO and Methusalem program of the Flemish Government (METH/08/02)

[3P2M120] Effects of stimulus ambiguity on task-related ERP components

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During observation of an ambiguous figure (e.g. the Necker cube) our perception is unstable and alternates spontaneously between two interpretations. Tiny low-level changes can disambiguate the ambiguous stimulus and evoke two large ERP positivities (“ambiguity effect”). These components show larger amplitudes in the go compared to the nogo trials of a go-nogo paradigm, indicating an involvement of attentional processes. In the current study we compared the ambiguity effects between the go-nogo and a forced choice paradigm variants.

Methods: Ambiguous and disambiguated lattice variants were presented discontinuously in separate experimental blocks. In Experiment 1 (forced choice) participants reported both perceptual reversals and perceptual stability, in Experiment 2 they only reported perceptual reversals (go-nogo) between successively presented stimuli (go-nogo experiment). EEG data were selectively averaged for stimulus and response type.

Results: We found the ERP ambiguity effect in both experiments. In Experiment 1 we found an additional fronto-central positivity around 400 ms after onset (“P400fc”) of disambiguated but not of ambiguous stimuli.

Discussion: The novel P400fc is strongly determined by both stimulus ambiguity and task. It may represent a time stamp of task-related decision processes and show their dependence on stimulus ambiguity. Interestingly, reaction times cannot explain the ERP effects.

Financial support from Deutsche Forschungsgemeinschaft (KO 4764/1-1, TE 280/8-1) is gratefully acknowledged

[3P2M122] Representational similarity analysis of contour shape processing in the visual cortex

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Psychophysical studies suggest that human visual system analyses the shape of a closed contour on the basis of radial frequency (RF) components, consisting of sinusoidal modulations of the circle radius. We studied contour shape representations in the visual cortex using functional magnetic resonance imaging (fMRI). We used event-related design and measured activity patterns for 65 different shapes. We varied RF (3-6 cycles/perimeter), orientation (polar phase 0-270 deg) and amplitude (0-0.5 in proportion to radius) of the shapes. We used a searchlight-based representational similarity analysis together with a probabilistic atlas of the visual areas. First we calculated representational dissimilarity matrices (RDMs) for RF, orientation, local curvature, contrast energy and spatial frequency (SF) spectrum. Then these model RDMs were compared to the measured RDMs. The resulting correlation maps revealed RF specific activity patterns in areas V2d, V3d, V3AB, and IPS0, but not in areas hV4 and LOC. Orientation and local curvature did not show such specificity. Positive correlation maps were also found for SF-spectrum and contrast energy, but these showed no selectivity across areas. The results provide further support for the RF analysis of contour shapes and suggest that RF is represented in a subset of the mid-level visual areas.

[3P2M124] Impacts of fatigue on mental rotation

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According to Shepard & Metzler (1971) and Cooper (1975, 1976) reaction time (RT) for recognizing the identity of an object increases corresponding to the increase of rotational angle of this three- and two-dimensional objects. The purpose of our study is to explore possible impacts of the fatigue on mental rotation. Therefore, our study has a two-fold aim: to estimate a possible correlation between the time of being awake and RT; to explore the impact of fatigue on the RT in mental rotation task. To analyze the RT for recognizing rotated objects we have constructed a digitized test consisting of 256 object pairs (128 two- and 128 three-dimensional). According to our results RT is longer for mental rotation of mirrored objects in both 2D and 3D stimuli. The error rate is higher in 3D (18.3%) than in 2D objects (10.7%) but it does not depend on the time when the test is conducted. The average RT of the 2D and 3D objects' rotation is faster in the period 5-10 hours after awakening. Although we can observe that fatigued subjects have fewer errors, there is no the impact of fatigue on the RT in mental rotation.

Supported by ESF project No.2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001.

[3P2M126] A new principle of figure-ground segregation and object formation: The accentuation

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In this work we explored phenomenologically a new principle of figure-ground segregation and object formation: The accentuation. This principle, first suggested in previous works (Pinna 2010; Pinna & Sirigu, under revision), is now extended systematically to new visual domains going from the figure-ground segregation to the part-whole organization. The effectiveness of the principle of accentuation has been studied in the same spirit of Gestalt psychologists and demonstrated through new phenomena. It was also demonstrated that this principle is independent and autonomous and that it can be pitted against or in favor of other Gestalt principles of grouping and figure-ground segregation. Moreover, the accentuation has been extended from simple drawings to biological conditions, where the appearance and the evolutionary success of a living organism depend on the accentuation of single parts of the body aimed to hide, show, deceive, attract, repel other organisms. Our results suggest that the accentuation can be considered as one of the biological key elements aimed to improve more strongly the biological adaptive fitness.

[3P2M128] Using Visual Search to assess cues for Object shape.

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The visual system determines the shape of closed contours and can find a target among a set of distractors very rapidly if it contains a unique cue. Search speed and asymmetries in performance that can arise when target- and distractor-element roles are reversed were used to determine elements of the visual system's code for globally-integrated shape. Kristjansson and Tse (2001) argued curvature discontinuities (CDs) are critical local cues to shape, supporting rapid visual search with minimal distractor interference when present in the target but absent in the distractors. However, studies using Radial Frequency contours have suggested the internal polar angle between adjacent corners plays an elementary role. Two search experiments will be presented in which performance within-observers (n=5) is contrasted for patterns differing in curvature, CD, corner numerosity and internal polar angle. The results show that efficient search does not depend on the presence or absence of CDs, nor on differences in corner curvature or numerosity but that the angle separating corners was a primary feature driving both 'pop-out' and search asymmetry. The results support the conclusion that polar angles are labelled cues to shape in human vision and therefore a critical element in the code for object shape.

Australian Research Council grants DP0666206, DP1097003 and DP110104553

[3P2M130] The interference effect of color in amodal completion

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We investigated possible influences of surface color in amodal completion using a sequential matching task. During this task, participants had to judge whether a test shape could be a previously shown partly occluded shape. Similar to De Wit et

After training subjects of both groups developed a PRL. Furthermore, induced group subjects placed a target in the left visual field, as intended by the inducing procedure. Thus, this study demonstrates that PRLs can be induced at a specific position.

[4P1M033] Evidence for attenuated predictive signalling in schizophrenia

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Positive symptoms of schizophrenia such as delusions and hallucinations are thought to arise from an alteration in predictive coding mechanisms that underlie perceptual inference. Here, we aimed to empirically test the hypothesized link between schizophrenia and perceptual inference. 20 patients with schizophrenia and 27 healthy controls matched for age and gender took part in a functional magnetic resonance imaging (fMRI) experiment that assessed the influence of beliefs on perception of an ambiguous structure-from-motion stimulus. Schizophrenia patients compared to healthy controls reported perception of the ambiguous stimulus to be less biased by beliefs. This effect was paralleled by weaker belief-related activity in orbitofrontal cortex, a region that has been previously been involved in the generation and maintenance of beliefs. Our results indicate that in schizophrenia the influence of higher-level predictions such as beliefs in perceptual inference might be weakened. We suggest that attenuated predictive signaling during perceptual inference may provide the starting point for the formation of positive symptoms in schizophrenia.

This work was supported by the German Research Foundation (STE-1430/2-1 and STE-1430/7-1). Katharina Schmack is participant in the Charité Clinical Scientist Program funded by the Charité – Universitätsmedizin Berlin and the Berlin Institute of Health.

[4P1M035] Orientation discrimination is superior in individuals with autism spectrum conditions (ASC)

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Atypical perception, such hyper-sensitivity to some types of visual stimuli (Tavassoli et al., 2013), is commonly reported in individuals with autism spectrum conditions (ASC). In addition, several studies have found sensory discrimination to be altered in ASC. For instance, somatosensory discrimination (Blakemore et al., 2006) and pitch discrimination (Bonnell et al., 2003) have both been found to be enhanced in ASC. Here, we investigated whether orientation discrimination is also enhanced in ASC. We measured oblique orientation discrimination in 48 individuals with ASC, and 48 control participants matched on age, gender, and non-verbal reasoning ability. Orientation discrimination thresholds were significantly lower in adults with ASC ($M=5.81$, $SD=2.26$) than those without ($M=6.88$, $SD=2.37$; $t(94)=-2.267$, $p=.026$). This study demonstrates that oblique orientation discrimination is superior in individuals with ASC. Determining the cause of atypical perception in ASC may help cast light on the neural underpinnings of the condition. As neural inhibition is closely implicated in the tuning of orientation selective neurons, our future work will address whether neural inhibition may also be atypical in individuals with ASC.

[4P1M037] The effect of visual fatigue on clinical evaluation of vergence

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The number of complaints and visual fatigue increases after prolonged near work. It can be related to significant changes in coordinated work of accommodation and vergence system such as decreased accommodation and vergence range (Gur et al., 1994, Murata et al., 1996). The purpose of the study was to evaluate the effect of prolonged near work (computer and paper work >4 hours a day) on the clinical measurements of vergence response. Associated heterophoria (vergence state as a result of accommodation and vergence interaction), negative and positive fusional vergence (vergence amplitude), and vergence facility (dynamics of vergence response) were tested in 15 students (20-22 y., 11 with emmetropia and 4 with corrected myopia) using specially designed computerized tests. Dichoptic images were presented to each eye using red-cyan filters. The measurements were performed on five working days (in the morning and at the evening). Analysing the whole sample group, we observed no statistically significant changes of heterophoria, positive fusional vergence, and vergence facility at the end of the working day. Only negative fusional vergence demonstrated statistically, but not clinically significant decrease of values at the end of the working day. The results indicate that vergence response is rather stable over the day.

Supported by ESF project No. 2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001

[4P1M039] Perceptual compensation of pursuit-induced retinal motion in infantile nystagmus

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Visual crowding is the difficulty in identifying a target in the presence of nearby flankers. Most neurophysiological studies of crowding employed functional neuroimaging, but because of its low temporal resolution, no definitive answer can be given to the question: is crowding arising at the earliest (e.g., V1-V2) or at later stages of visual processing (e.g. V4)? Here, we used a classic crowding paradigm in combination with electroencephalography (EEG). We manipulated the critical space between peripheral target and flankers, while ensuring a proper control of basic stimulus characteristics. Analyses were focused on event-related potentials (ERPs) and oscillatory activity in the beta (15-30 Hz) and gamma (30-80 Hz) bands. We found that the first sign of a crowding-induced modulation of EEG activity was a suppression of the N1 component (~240ms post-stimulus), in agreement with a recent study by Chicherov et al. (2014). Oscillatory analysis revealed an early stimulus-evoked gamma enhancement (~100-200ms) that, however, was not influenced by the amount of crowding. Contrarily, a subsequent reduction in the beta band (~250-500ms) was observed for strong relative to mid crowding condition, and correlated with individual behavioral performance. Collectively, these findings show that crowding emerges at higher levels of the visual processing hierarchy.

[4P1M133] Object substitution masking, stimulus noise, and perceptual fidelity

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In Object Substitution Masking (OSM) a mask surrounding, simultaneously onsetting with, and trailing a target leads to a reduction in target perceptibility (Di Lollo et al., 2000). It has been questioned whether this process is due to target substitution or the addition of noise to the percept (Pödor, 2012). Two experiments examined this issue using an adjustment task in which a test Landolt C is presented and participants rotate it to match the target Landolt C shown during the trial (typical OSM paradigms use 2-4 alternative forced choice); the dependent measure was the angle of error. In Experiment 1 the effect of a trailing OSM mask (80ms-320ms) is compared against that of adding stimulus noise of varying densities (25%-75%) to the target location. Both manipulations (OSM, stimulus noise) produced a similar change in the distribution of errors compared against a baseline (0ms trailing mask, 0%-noise). The pattern is consistent with both mask manipulations reducing the fidelity of the target percept. In Experiment 2 the OSM and stimulus noise manipulations were varied factorially. Here the two manipulations had combinatorial effects on the error distribution. Implications are discussed regarding the mechanisms of OSM and the consequences of OSM for target perception.

[4P1M135] Peripheral vision effects central task performance under visual fatigue

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Visual load and difficult visual conditions can reduce performance (Richter, 2014). Nevertheless, open space offices are becoming more popular as well as GPS navigation while driving. What is more, we use our peripheral vision all the time, though a lot of tests are made to examine central vision and few of them involve periphery. For this reason, we investigated the role of peripheral vision on central task performance due to visual fatigue. The central task was performed at 60 cm. It was a computer-based visual search task consisting of a matrix (19.7deg horizontally and vertically) of black Landolt squares in size of 1.1deg each. This task was demonstrated on white background, with 5%, and 15% noise in periphery. Each participant had to memorize the target and find all the ones looking alike by clicking on them with a computer mouse. In addition, we measured near point of convergence, positive and negative relative accommodation and phorias at near. From the results, peripheral visual noise decreases central task performance under visual fatigue. Visual search task with 15% visual noise in periphery differs significantly between the performance with and without visual fatigue ($p < 0.05$, One-Way Anova).

This work has been supported by 2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001.

[4P1M137] Discrimination of blur in peripherally-viewed natural scenes

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All optical systems display some degree of blur. Although this may ultimately limit spatial resolution, blur also provides important signals for ocular accommodation, depth perception and motion perception. Predicting blur detection and discrimination of natural scenes, however, has been problematic and led to rather complex and varied models. Here we ask whether a recent blur discrimination model (Watson & Ahumada, 2011), operating on visible contrast energy differences between simple stimuli, can also capture performance with natural scene stimuli. We measured human blur discrimination performance using natural scene stimuli presented at three different eccentricities (0, 11, 22.5°) and blurred by seven different Gaussian kernels of varied scale (reference blurs). Images blurred by reference and test amounts were presented in

processing of fine visual details (Hyvärinen, 2013; Trauzettel-Klosinski, 2002). This study aims to explore how children with reading difficulties (3rd – to 5th grade) face reading demands and to assess their visual preconditions for reading. The focus is to examine whether they show specific strategies, which relate to their distinct visual conditions and the properties of the presented reading task. The collection of data covers three dimensions combining quantitative and qualitative measures: vision, reading and strategy use. The analysis of data focuses on exploring intrapersonal as well as interpersonal differences in reading with regard to the assessed visual functions and the specific reading texts. The collected data shows that the visual preconditions of children have to be taken into account when reading difficulties occur. Vision is commonly taken for granted and the influence of visual functioning on reading is underestimated.

[4P2M042] Changes in amplitude of accommodation for school-age children during the day

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School-aged children spend a lot of time doing near work. Long hours of reading could influence some visual functions, for example, accommodation system and can lead to asthenopia and fatigue. Other studies showed that reading distance is shorter for younger than older children (Wang, Bao et al, 2013). It means that younger children accommodate more than older children when reading. Taking in account these data we could expect that during the day amplitude of accommodation is reduced more for younger than older children. We wanted to test this hypothesis. Amplitude of accommodation was measured for 7- 15 years old children using subjective push-up technique. For measurements RAF Near Point Rule - a rod with movable target - was used. Measurements were done before and after lessons. Distance visual acuity also was measured in both sessions. Results showed that visual acuity does not change significantly during the day. However amplitude of accommodation reduced during the day, in average by 0.8D. Changes were larger for younger than older children. We can conclude that most of children have significant visual fatigue during the day and it is important to control that they take regular visual breaks to rest their eyes.

Supported by ESF project No.2013/0021/IDP/1.1.1.2.0/13/APIA/VIAA/001

[4P2M044] A Mixed-Method Analysis Assessing the Effects of Wearing organic light emitting diode (OLED) sleep mask on Sleep and Psychological Wellbeing

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Organic light emitting diode (OLED) sleep masks are of potential use for slowing the progress of diabetic retinopathy (Czanner et al., 2015) but little is known about their effect on sleep quality and psychological wellbeing. The purpose of this study was to use mixed-methods, using sleep diaries and standardised questionnaires (CESD, GHQ, PSQI) to examine these effects. We ask two questions. 1. What are the similarities and differences between data collected in diaries on sleep quality and quantity, with questionnaire data on sleep, and with automatically recorded mask wearing hours? 2. Does mask wear influence psychological wellbeing and sleep quality recorded in the diaries? We find broad similarities between diary, self-report and mask data. Our preliminary analysis shows: 1. Mask use was not associated with changes in wellbeing as assessed with questionnaires. 2. The sleep diary showed that mask comfort rather than light was the most important factor in sleep quality. 3. Sleep quality, as recorded in the diaries is affected by mask use in a small number of participants. Our study demonstrates the value of combining sleep diaries with objective and self-report measures of wellbeing, sleep quality and mask usage in evaluating sleep mask acceptability by complementing sleep questionnaires.

Small Business Research Initiative, Health Enterprise East, NHS Midlands and East on behalf of the Technology Strategy Board, United Kingdom

[4P2M046] The Iterative Amsler Grid (IAG): A procedure to measure image distortions in Age-Related Macular Degeneration (AMD)

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Age-related macular degeneration is a major cause of severe visual dysfunction in the elderly. Early detection of the symptoms can be crucial for intervention. One manifestation of the AMD is metamorphopsia - a condition where straight lines are perceived as curvy and wavy. Assessment is usually made with a printed Amsler grid of straight horizontal and

Visual-span size imposes a bottom-up sensory limitation on reading speed (Legge, 2007). The supporting evidence was mainly obtained by varying stimulus properties and making within-subject comparisons. Here we investigate whether individual differences in reading speed for text with fixed stimulus properties can be attributed to sensory differences, and whether experience-dependent changes in visual-span size can account for corresponding changes in reading speed. Six groups of subjects participated (a no-training group and five groups trained on letter recognition with different procedures at 10° in the lower field). Reading speed and visual-span size were measured in a pre- and a post-test at 10° in both lower and upper fields. We found a significant correlation between pre-test visual-span size and reading speed for both locations ($r \geq 0.45$, $p \leq 0.003$). Recognizing one extra letter per fixation is associated with a 29% faster reading speed. There is also a significant relationship between post-pre changes of visual-span size and changes of reading speed ($r \geq 0.37$, $p \leq 0.02$). Reading speed increases by an extra 25% for each additional letter improvement in visual-span size. These results indicate that both individual differences and experience-dependent changes in reading speed can be partially accounted for by the differences or changes in sensory limitations.

[4P2M136] Perceptual cancellation of stimulus saliency under dichoptic viewing conditions

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When different stimuli are presented to each eye the resulting percept is typically an unstable mix of different parts from each stimulus. Normally, the composition of the percept mutually exclusive between stimuli. One of the notable exceptions to this rule of mutual exclusivity is abnormal fusion (Wolfe, 1983), as observed with briefly presented stimuli. We use such abnormal fusion to hide target shapes in plain sight. Stimuli were composed from Gabor micropatterns, geometric singletons (square/circle), or coloured discs. Target stimuli contained a highly salient object shape, defined by feature contrast against homogeneous backgrounds. Feature contrast was, however, reversed between eyes. When presented dichoptically, perceptual fusion of both stimuli would therefore attenuate target saliency up until complete invisibility, whereas normal rivalry would leave the target shape visible. We find marked anisotropies in target salience for different between-eyes configurations of target definition. Anisotropies did not depend on presentation time (150ms/850ms). Target detection performance dropped to chance in many conditions even when each eye was presented with a perfectly visible target object. Our results can neither be explained by abnormal fusion nor by normal rivalry alone and point to higher-level influences on stimulus saliency under dichoptic viewing conditions.

[4P2M138] Blur adaptation, blur sensitivity and visual load

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Blur is an important dimension of the image quality. It is important to increase the knowledge about the perception of blur because of its relevance to visual acuity, control of accommodation and other visual functions. The aim of our study was to find out how the blur adaptation influences the blur sensitivity and to evaluate the effect of visual load on the blur sensitivity because of its connection to accommodative functions. We evaluated different blur perception thresholds (just noticeable blur, target recognition, clear image perception) as blur level was gradually changed before and after additional adaptation to optical defocus. Gaussian blur filter was used to simulate different blur levels. We compared the blur sensitivity before and after at least 5 hour long visual load at near distance (reading) to evaluate the effect of visual load to blur sensitivity in our study. The results showed that adaptation to optical blur (1.0 D simulated myopia) increased blur sensitivity. Thus it decreased blur thresholds by 10 - 48 % according to specific threshold and refractive group. We did not observe statistically significant change in the blur sensitivity after near distance visual load.

Supported by ESF project No.2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001

Symposium - Machine vision

[4S1A001] General-Purpose Models in Biological and Computer Vision

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The early days of computer vision were fired with an ambition to build impressive general-purpose vision systems. In these times there was a keen interest in understanding how biological systems operate so gracefully over a wide range of tasks and diverse conditions. As the full complexity of visual inference became apparent, the field of computer vision matured and became channelled into relatively narrow sub-problems. While leading to algorithms that actually work for some important applications, this has been at the expense of broader thinking about general-purpose vision systems. In this talk, I