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The 7th Asia-Pacific Conference on **Vision**

July 15-18, 2011
Hong Kong

THE UNIVERSITY OF HONG KONG
CENTENARY
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香港大學百周年

Abstracts

Meeting Schedule

Friday, July 15

8:30am – 6:00pm	Registration Open		Loke Yew Hall
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10:00am – 12:00pm	Talk Session 1	Action & Virtual Environment	Library Extension 4
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3:45pm – 4:00pm	Coffee Break		Loke Yew Hall Foyer
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Saturday, July 16

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10:30am – 12:00pm	Poster Session (odd presenters)	Faces & Objects Cognition Reading & Learning Perception & Action	Loke Yew Hall
12:00pm – 1:30pm	Lunch Break		
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3:45pm – 5:15pm	Poster Session (even presenters)	Faces & Objects Cognition Reading & Learning Perception & Action	Loke Yew Hall
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Sunday, July 17

8:30am – 5:00pm	Registration Open		Loke Yew Hall
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10:30am – 12:00pm	Poster Session (odd presenters)	Multisensory Physiology Development Attention Eye movements	Loke Yew Hall
12:00pm – 1:30pm	Lunch Break		
1:30pm – 3:30pm	Symposium 3	Predictive Coding	Rayson Huang Theatre
1:30pm – 3:30pm	Talk Session 5	Reading & Crowding	Library Extension 4
3:30pm – 3:45pm	Coffee Break		Loke Yew Hall Foyer
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Monday, July 18

8:30am – 6:00pm	Registration Open		Loke Yew Hall
9:00am – 11:00am	Symposium 4	Optic Flow, Perception & Action	Rayson Huang Theatre
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11:00am – 11:15am	Coffee Break		Rayson Huang Theatre
11:15am – 12:45pm	Poster Session (odd presenters)	Shape, Form & Texture Perception Color, Light and Contour Motion 3D Perception	Loke Yew Hall
12:00pm – 1:30pm	Lunch Break		
1:30pm – 3:30pm	Symposium 5	Perceptual Learning	Rayson Huang Theatre
1:30pm – 3:30pm	Talk Session 7	Motion	Library Extension 4
3:30pm – 3:45pm	Coffee Break		Loke Yew Hall Foyer
3:45pm – 5:15pm	Poster Session (even presenters)	Shape, Form & Texture Perception Color, Light and Contour Motion 3D Perception	Loke Yew Hall

Keynote Presentations

Friday 15th July, 4:15pm, Loke Yew Hall
Regeneration of optic nerve

Kwok-Fai So

Chair Professor and Head of Department
Jessie Ho Professor in Neuroscience
Li Ka Shing Faculty of Medicine
University of Hong Kong

The optic nerve is part of the central nervous system (CNS) and has a structure similar to other CNS tracts. The axons that form the optic nerve originate in the ganglion cell layer of the retina and extend through the optic tract. As a tissue, the optic nerve has the same organization as the white matter of the brain in regard to its glia. There are three types of glial cells: Oligodendrocytes, astrocytes and microglia.

Little structural and functional regeneration of the CNS takes place spontaneously following injury in adult mammals. In contrast, the ability of the mammalian peripheral nervous system (PNS) to regenerate axons after injury is well documented. A number of factors are involved in the lack of CNS regeneration, including: (i) the response of neuronal cell bodies against the damage, (ii) myelin-mediated inhibition by oligodendrocytes, (iii) glial scarring, by astrocytes, (iv) macrophage infiltration, and (v) insufficient trophic factor support.

The fundamental difference in the regenerative capacity between CNS and PNS neuronal cell bodies has been the subject of intensive research. In the CNS, the target normally conveys a retrograde trophic signal to the cell body. CNS neurons die because of trophic deprivation. Damage to the optic nerve disconnects the neuronal cell body from its target-derived trophic peptides, leading to the death of retinal ganglion cells (RGCs). Furthermore, the axontomized neurons become less responsive to the peptide trophic signals they do receive. On the other hand, adult PNS neurons are intrinsically responsive to neurotrophic factors and do not lose trophic responsiveness after axotomy.

In this talk, different strategies to promote optic nerve regeneration in adult mammals are reviewed. Much work are still needed to resolve many issues. This is a very important area of neuroregeneration and neuroprotection, as currently there is no cure after traumatic optic nerve injury or retinal disease such as glaucoma which affect retinal ganglion cells and optic nerve axons.

Saturday 16th July, 9:00am, Rayson Huang Theatre
Don't pack your iPod in honey: Lessons from the study of visual search

Jeremy M. Wolfe

Professor of Ophthalmology and Radiology
Brigham & Women's Hospital
Harvard Medical School

We are built to search. Our ancestors foraged for food. We search for pens, keys, and cars in parking lots. Even when the stimulus is visible, we must search because we cannot fully process all visual stimuli at once. I will discuss the limits on vision without attention and some of the mechanisms of visual search. I will then turn to real world tasks like the search for cancer in x-rays or security threats in luggage. I will show how our normal processes of search can lead to serious problems in socially important tasks.

The perceptual basis of some rules of thumb in photography

Martin S. Banks

Professor of Optometry and Vision Science
Affiliate Professor of Psychology and Bioengineering
School of Optometry
University of California, Berkeley

We communicate increasingly with visual imagery such as realistic pictures (e.g., photographs, computer graphic images, perspective drawings and paintings). People are readily able to interpret pictures, but the means by which they do so is poorly understood.

Photographers utilize many guidelines for creating natural-looking pictures. One guideline concerns the lens focal length required to produce pictures that are not spatially distorted. Photography texts recommend choosing a focal length of 50mm. There are two phenomena related to this guideline. One is perceived spatial distortions in wide-angle (short focal length) pictures. I will argue that the perceived distortions are caused by the perceptual mechanisms people employ to take into account oblique viewing positions. The second phenomenon is perceived depth in pictures taken with different focal lengths. The textbooks argue that pictures taken with short focal lengths expand perceived depth and those taken with long focal lengths compress it. I will argue that these effects are due to a combination of the viewing geometry and peoples' viewing.

Another guideline concerns the camera aperture and depth-of-field blur. Photography textbooks do not describe a quantitative rule and treat the magnitude of depth-of-field blur as arbitrary. I examine apertures, lenses, and image formation. From that examination, I argue that there is a natural relationship between depth-of-field blur and the 3D layout of the photographed scene. Human viewers are sensitive to this relationship. In particular, depicted scenes are perceived differently depending on the relationship between blur and 3D layout.

Understanding the perceptual basis of these guidelines provides insight into how to construct photographs, perspective paintings, and computer graphic images for more effective visual communication.

Symposia

Schedule Overview

Friday, July 15, 10:00 am - 12:00 pm
    S1 Attentional selection

Saturday, July 16, 1:30 pm - 3:30 pm
    S2 Perception of art

Sunday, July 17, 1:30 pm - 3:30 pm
    S3 Predictive coding

Monday, July 18, 9:00 am - 11:00 am
    S4 Optic flow, perception and action

Monday, July 18, 2:15 pm - 4:15 pm
    S5 Perceptual learning

S1
What are the units of attentional selection? Insights from the study of feature binding, perceptual priming, object integration and visual search

Friday, July 15, 10:00 am - 12:00 pm
Symposium Session, Rayson Huang Theatre
Chairs: Liqiang Huang & Arni Kristjansson

Symposium Summary

A long-standing issue of debate in the literature on visual attention is what are the units of visual selection. While there is little disagreement that certain entities of interest are selected for preferential processing, which aspects of the visual scene the selection is performed upon is less clear. Does the visual system base its' selection on features such as color, shape, or even location, or are whole integrated objects which have a spatial representation, selected? The aim with the symposium is to bring together research findings from a number of different vantage points that may bear upon this issue. The topics addressed in the symposium include the what are the units of conscious access in a matching task, the nature of repetition benefits in visual search, the integration of objects for selection, how the identity of selected objects is maintained in time, and the roles of top-down guidance and grouping in attentional selection. Attempts will be made to integrate insights from these different viewpoints upon the question of what the units of attentional processing and selection are under different conditions.

S1.1, *10:00am*

Characterizing the nature of visual conscious access: The distinction between features and locations

Liqiang Huang[1] (lqhuang@psy.cuhk.edu.hk); [1]Department of Psychology, Chinese University of Hong Kong

The difference between the roles of features and locations has been a central topic in the theoretical debates on visual attention. A recent theory proposed that momentary visual awareness is limited to one Boolean map, that is the linkage of one feature per dimension with a set of locations (Huang & Pashler, 2007). This theory predicts that: (a) access to the features of a set of objects is inefficient whereas access to their locations is efficient; (b) shuffling the locations of objects disrupts access to their features whereas shuffling the features of objects has little impact on access to their locations. Both of these predictions were confirmed in Experiments 1 and 2. Experiments 3 and 4 showed that this feature/location distinction remains when the task involves the detection of changes to old objects rather than the coding of new objects. Experiments 5 and 6 showed that, in a pre-specified set, one missing location can be readily detected, but detecting one missing color is difficult. Taken together, multiple locations seem to be accessed and represented together as a holistic pattern, but features have to be handled as separate labels, one at a time, and do not constitute a pattern in featural space.

S1.2, *10:24am*

A primitive memory system for attention deployments: Some recent challenges and their resolution.

Árni Kristjánsson[1] (ak@hi.is); [1]Laboratory for visual perception and visuomotor control, Faculty of Psychology, University of Iceland

In the past my colleagues and I have presented evidence for the existence of a primitive memory for attention deployments. This memory system orients attention to features and locations of recent behavioral importance. A large part of the proposal is that the memory system facilitates attentional selection of features in the environment such as color, orientation etc. I will review the findings behind these proposals. The bulk of this evidence comes from studies of history effects in vision, such as priming of visual search, and implicit learning in exogenously cued attention shifts. In addition recent challenges to this view will be discussed, in particular arguments that the facilitation from repetition in visual search tasks occurs at a relatively late stage of perceptual processing. Our recent investigations of these proposals suggest that there is indeed evidence for higher level priming effects in visual search under certain conditions, but those findings do not challenge the basic proposals regarding the primitive memory system, since the evidence for feature specific facilitation is robust.

Formation and maintenance of feature bundles in dynamic object files

Jun Saiki[1] (saiki@cv.jinkan.kyoto-u.ac.jp); [1]Graduate School of Human and Environmental Studies, Kyoto University

Object files play important roles in visual cognition, one of which is feature integration. However, their internal structure remains unknown. The current study investigated how multiple features of an object —color and shape— are integrated using a modified object-reviewing paradigm. In particular, we tested whether independent features or color-shape conjunction are bound to the file. A preview of two colored objects was followed by a linking display. Then, a target was presented to judge whether the target contains any feature of the previews, regardless of their locations. Conditions in which both color and shape are matched with different corresponding preview locations were compared. If features are independently bound, facilitation in response time (RT) will increase additively as the number of location-shared features. If features are bundled, the RT facilitation occurs only when both features share the location. A series of experiments different in stimuli, the number of placeholders, and object motion showed different patterns of mean RT, but RT distribution analysis indicated that estimated non-decision time is consistent with the feature bundle hypothesis. The conjunction-based object preview benefit suggests that in object file formation, color and shape form a perceptual unit, and the unit is kept through object motion.

Maintaining visual attention over time: Effects of object continuity

Katsumi Watanabe[1] (kw@fennel.rcast.u-tokyo.ac.jp); [1]Research Center for Advanced Science and Technology, The University of Tokyo

Maintaining visual attention in dynamic environments is an important function of the visual system. The visual system appears to modulate attentional state to identify a target embedded in a rapid sequence of nontargets; typically target identification gets better as the number of preceding items increases and is maintained at this increased level. We examined the temporal characteristics of the visual system that contribute to maintaining attentional state. Inserting one-second temporal gap in the sequence reset the elevated attentional state. However, the results also suggested that the attentional state was maintained as long as the sequence was interpreted as a single event (i.e., the object continuity was maintained). It has been proposed that 'object files' keep track of visual items and accumulate information as they move and change. It is also known that objects' features (shape and/or color) affect the distribution of attention within objects. In a separate set of experiments, we examined whether the change detection of feature-location binding in moving visual objects would affect the attentional distribution within objects by using a probe-detection paradigm. The results showed that the performance of irregularity detection did not influence the attentional distribution within objects. This finding implies that attentional distribution within objects occurs independent of object continuity.

Taking conjunction search to a higher dimension

Jeremy M. Wolfe[1] (wolfe@search.bwh.harvard.edu), Maria Nordfang[2] , Aina Martinez I Zurita[3] ; [1]Harvard Medical School & Brigham and Women's Hospital, [2]University of Copenhagen,Denmark, [3]Research Science Institute & Brigham and Women's Hospital

In visual search for conjunctions, targets are defined by combinations of features. Thus, targets might be RED VERTICAL items among RED horizontal and green VERTICAL distractors. Guided Search and similar models argue that features are only conjoined once an object is attended. However, efficient conjunction search is possible because observers can guide attention toward red and toward vertical. Real world objects may be defined by the conjunction of many features with no one feature defining the target. Can attention be guided to higher order conjunctions? We created 6D conjunction stimuli and varied the number of features shared between targets and distractors and the number of distractor types. RT x set size slopes range from 1.4 msec/item when 2 distractor types each share 3 features with the target to 66 msec/item when 6 distractor types each share 5 features with the target. Using different, 3D conjunctions, we held distributions of features constant (1/3 of each of 3 colors, shapes, and orientations). We varied the grouping of distractors in order to look for evidence of simultaneous guidance by multiple attributes versus sequential grouping of subsets (Find the odd orientation in this color subset). We find that guidance and grouping may both contribute to efficient conjunction search.

S2
Perception of Art and Art of Perception

Saturday, July 16, 1:30 pm - 3:30 pm
Symposium Session, Rayson Huang Theatre
Chair: Branka Spehar

Symposium Summary

What you see is what you see. (Frank Stella)

The beholder's eye, which moves like an animal grazing, follows paths prepared for it in the picture. (Paul Klee)

Visual art and vision science are intimately and inextricably linked. The principles of visual processing play a crucial role not only in appreciation of art but also in communicating an artistic idea through some form of visual representation. The papers in this symposium address this interrelationship by considering a rich and diverse set of artworks ranging from early Renaissance and Rembrandt's portraits to abstract expressionism and Op Art. They investigate how artists exploit stimulus properties and perceptual principles to create convincing visual effects that not only effectively control the guidance of visual attention but also influence aesthetic reinforcement.

Depicting occlusion in Early Renaissance art

Barbara Gillam[1] (b.gillam@unsw.edu.au); [1]University of New South Wales

The artist attempting to give the impression of three-dimensional relationships must convey somehow that one surface is in front of another. There is a large and venerable literature in Psychology on this subject, showing how figure-ground, border ownership and amodal completion and continuation are determined but there is almost no discussion of how artist's have recruited these and other principles to create convincing impressions of occlusion. Even Gombrich (Art & Illusion 1960) only considers the situation in which a figure has to be imagined from very partial cues, not how juxtaposed elements in art are parsed perceptually into occluding and occluded surfaces. In this paper I shall discuss approaches to occlusion present in early Renaissance art and the degree to which the principles now well-known to Psychologists were discovered and used, as artists increasingly depicted naturalistic scenes. Among the preoccupations of these artists, as indicated by their work, were whether and how much to occlude faces (and the related issue of the management of haloes), occlusion of and by architectural features, and the importance or otherwise of transitivity in occlusion relationships within the scene. They also clearly used the ground plane, high viewpoints and arrangements of contour terminations, as well as more conventional figural cues, to disambiguate perceived occlusion or to avoid the confusion of multiple surfaces.

S2.2, *1:54pm*

Following the eyes of the masters: Looking and liking are linked

James T. Enns[1] (jenns@psych.ubc.ca); [1]Department of Psychology, University of British Columbia, Canada

Portrait artists claim that their choices with regard to textural detail guide the viewing experience and hence the artistic appreciation of the finished work. We tested these claims in experiments where eye gaze was monitored while viewers considered the relative artistic merit of a series of portraits. The portraits included both famous masterpieces and new portraits rendered from photographs using a parameterized non-photorealistic technique to mimic Rembrandt (DiPaola, 2007). The findings have implications for understanding both human vision science and visual art. Portrait artists claim that their choices with regard to textural detail guide the viewing experience and hence the artistic appreciation of the finished work. We tested these claims in experiments where eye gaze was monitored while viewers considered the relative artistic merit of a series of portraits. The portraits included both famous masterpieces and new portraits rendered from photographs using a parameterized non-photorealistic technique to mimic Rembrandt (DiPaola, 2007). The findings have implications for understanding both human vision science and visual art.

S2.3, *2:18pm*

The Ethereal Veil of Visual Perception

Gert J. Van Tonder[1] (gvtonder@yahoo.co.uk); [1]Kyoto Institute of Technology, Japan

The rich palette of perceptual effects elicited from simple patterns of black and white lines - such as the paintings of op artists - underlines just how much science still needs to unravel before the complexity of visual perception is fully understood. In this presentation, I would like to show how a few of the more subtle and some of the most salient perceptual effects experienced in black and white line patterns can be interpreted as a concerted outcome of various very early stages of visual processing. Specifically, what seem to be complex effects can be simulated with relatively simple models. The effects bear witness to the intuitive skill with which the artists wield considerable visual impact on their canvas. Scientific scrutiny, of their art and of the possible visual processing involved, leads to new insight into the perceptual complexity experienced in these deceptively simple paintings. In a sense, their works present the construction of an ephemeral canvas within stripes of black and white paint.

S2.4, *2:42pm*

Physics, perception and physiological of Jackson Pollock's fractals

Richard P. Taylor[1] (rpt@uoregon.edu); [1]University of Oregon, Eugene, USA

Fractals have experienced considerable success in quantifying the visual complexity exhibited by many natural patterns, and have captured the imagination of scientists and artists alike. Our research has shown that the poured patterns of the American abstract painter Jackson Pollock are also fractal. This discovery raises an intriguing possibility – are the visual characteristics of fractals responsible for the long-term appeal of Pollock's work? To address this question, we have conducted ten years of scientific investigation of human response to fractals and here we present, for the first time, a review of this research that examines the inter-relationship between the various results. The investigations include eye-tracking, visual preference, skin conductance, EEG and preliminary fMRI measurement techniques. We discuss the artistic implications of the positive perceptual, physiological and neurological responses to fractal patterns.

S2.5, *3:06pm*

Beauty and the Beholder: A sensitive relationship

Branka Spehar[1] (b.spehar@unsw.edu.au); [1]School of Psychology, University of New South Wales, Sydney, NSW Australia

Despite a rich set of experimental findings suggesting that certain stimulus qualities, such as symmetry, proportion, or complexity, are related to aesthetic appeal, the exact functional relationship between aesthetic experience and any of these stimulus qualities remains unknown. Motivated by our previous findings that humans display a consistent preference for a certain range of fractal dimension across fractal images of various types we turn to scale-specific processing of visual information to understand this relationship. Our hypothesis is that the preference for certain spatial structures, including fractals, can be partially accounted for by the visual system's

general sensitivity for spatial variations at the spatial scales that most closely approximate given spatial structures. Although we do not offer a comprehensive model of aesthetic experience, we demonstrate a strong relationship between visual preference for simple visual patterns and visual sensitivity. Our results support assertions that there is a close relationship between aesthetic experience and the coding of natural stimuli.

S3
Predictive coding of vision

Sunday, July 17, 1:30 pm - 3:30 pm
Symposium Session, Rayson Huang Theatre
Chair: Lars Muckli

Symposium Summary

We are continuously anticipating what we will see, hear, or feel next. Without prediction, successful interaction with our environment would be inefficient and slow. Predicting incoming sensory information allows for the allocation of resources to novel or surprising information. Recent brain imaging evidence provides empirical support for the predictive coding framework. Models of predictive coding typically involve three elements: 1) top-down projections of predictions, 2) comparison of predictions and inputs, and 3) the bottom-up projection of the prediction error. In the simplest version of this concept, the top-down prediction explains away the predicted component of the incoming stimulus so that only the prediction error is projected forward. In the symposium, examples are presented for predictive coding in early vision, including binocular rivalry and apparent motion processing. An extension of the simple predictive coding framework is suggested, to incorporate synergetic effects of attention and prediction. Interestingly, the predictive coding framework also provides a new perspective on the origin of symptoms underlying sensory information processing in schizophrenia, whereby disturbances in forming adequate models of the environment lead to inappropriate sampling of visual scenes, potentially resulting in the uncorrected inferences observed in hallucinations and delusions.

S3.1, *1:30pm*
Contextual and predictive coding in V1

Lars Muckli[1] (Lars.Muckli@glasgow.ac.uk); [1]Centre for Cognitive Neuroimaging (CCNi), Institute of Neuroscience and Psychology, University of Glasgow

Primary visual cortex (V1) is often characterized by the receptive field properties of its feed-forward input (only up to 5%). We focussed our fMRI studies on non-stimulated retinotopic regions in V1 to gain a better understanding of contextual processing. We investigated activation along the non-stimulated long-range apparent motion path (1), occluded a visual quarterfield of a natural visual scene (2), or blindfolded our subjects and presented environmental sounds (3). We were able to demonstrate predictive activity along the illusory apparent motion path (1), use decoding to classify natural scenes from non-stimulated regions in V1 (2), and to decode environmental sounds from V1, V2 and V3 (3). Is this contextual processing useful to predict upcoming visual events?

To investigate predictability we used apparent motion as the prime stimuli and tested with a probe stimulus along the apparent motion path to find that predicted stimuli are processed more efficiently – leading to less fMRI signal and better detectability (1). In summary, we have found brain imaging evidence consistent with the hypothesis of predictive coding in early visual areas.

S3.2, *2:00pm*
Predictive coding and binocular rivalry

Jakob Hohwy[1] (Jakob.Hohwy@monash.edu); [1]Australian Research Council Future Fellow, Department of Philosophy, Monash University

The notion of unconscious perceptual inference, particularly in the shape of predictive coding, promises to address many of the problems of visual perception that has long preoccupied philosophy. The dichoptic viewing conditions during binocular rivalry presents an extreme example of the epistemic task confronting perceptual inference and rivalry is therefore an important test-case for the predictive coding framework. This talk explores what predictive coding can and cannot tell us about the mechanism behind rivalry. The guiding thought is that Bayesian inference and prediction error drive selection, dominance and alternation in rivalry, and a number of computational and empirical studies of rivalry are reviewed in this light. The talk also presents preliminary findings from interdisciplinary imaging and psychophysical studies of binocular rivalry, which test aspects of the predictive coding hypothesis.

S3.3, *2:30pm*
Attention reverses the effect of prediction in silencing sensory signals

Floris P. De Lange[1] (floris.delange@donders.ru.nl), Peter Kok[1], Dobromir Rahnev[2], Janneke F. Jehee[1], Hakwan C. Lau[2]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, Netherlands, [2]Department of Psychology, Columbia University, New York, USA

Predictive coding models of perception suggest that predicted sensory signals are attenuated (silencing of prediction error). These models, though influential, are challenged by the fact that prediction sometimes enhances, rather than reduces task-relevant sensory signals, as in the case of spatial cueing experiments. One possible explanation is that in these experiments, prediction (i.e. whether a stimulus is likely to be presented) is confounded with attention (i.e. whether a stimulus requires a behavioural response), which is known to boost rather than reduce sensory signal. However, recent theoretical work on predictive coding inspires an alternative hypothesis, and suggests that attention and prediction may operate synergistically to improve the precision of perceptual inference. This model posits that attention leads to heightened weighting of sensory evidence, thereby reversing the sensory silencing by prediction. We factorially manipulated attention and prediction in an fMRI study to test the validity of this model. Our results support a predictive coding model wherein attention reverses the sensory attenuation of predicted signals. This may explain the seemingly contradictory findings in the literature regarding the effects of prediction on neural responses.

Developing a diagnostic brain imaging protocol for recent onset psychosis which embodies principles of predictive coding and free energy

Michael Breakspear[1] (mjbreaks@gmail.com); [1]Division of Mental Health Research, Queensland Institute of Medical Research

Although schizophrenia is usually conceptualized of as a disorder of well formed hallucinations and delusions, its onset is more typically characterized by heightened arousal, a vague but pervasive feeling of unease and poorly formed misperceptions. This unstable constellation of symptoms challenges clinical diagnosis at a time when properly guided interventions are most likely to have the greatest long-term benefits. It is possible to frame this clinical picture as a disturbance in the capacity of the cortex to optimally form predictive models of the environment, to appropriately sample visual scenes in order to estimate the likelihood of such models and to hence minimize surprise in a dynamic social landscape. This approach suggests that manipulating the relationship between visual search strategies and natural scene statistics might be a sensitive means of quantifying core neurobiological deficits early in the course of emerging psychotic disorders. We are developing a diagnostic tool for the prodromal phase of these disorders which involves experimentally disturbing the relationship between visual saccades and the stream of natural images in well directed films. I will outline the conceptual and computational bases and early experimental results thus far obtained, including a canonical example of paranoia and theory of mind in a spaghetti western

S4
Optic flow, perception and action

Monday, July 18, 9:00 am - 11:00 am
Symposium Session, Rayson Huang Theatre
Chair: Li Li

Symposium Summary

Ever since Gibson (1950) postulated that humans use the image motion of theenvironment on the retina generated during locomotion (optic flow) to perceiveand control self-motion, much research in cognitive psychology and neurosciencehas investigated the specific cues from optic flow that people use to performcommonly experienced perception and action tasks. This symposium, whichincludes both brain-imaging (Wann) and psychophysical studies (Li, Lappe, andGray), aims to introduce new cutting-edge research as well as establishedtheories and techniques on this topic. The speakers will address key currentissues including (i) the brain areas involved in integrating task-relevantinformation for the control of locomotion, (ii) the role of optic flow invisual control of steering toward a goal, (iii) the information from optic flowfor the estimation of travel distance, and (iv) optical information forvisual-motor control in baseball batting. The symposium is intended tointerest a wide range of audiences.

Moving beyond heading. How does the brain reconcile where we are going with where we want to go?

John Wann[1] (j.p.wann@rhul.ac.uk); [1]Department of Psychology, Royal Holloway, University of London

Navigating successfully through the environment typically involves both detection of the current direction of travel (heading) and anticipation of changes in heading trajectory that will be required in the next few seconds. There is existing evidence that global flow patterns are encoded in visual areas MT+ and that heading may be extracted either at this level or potentially in higher areas such as VIP or CSv (e.g. Wall & Smith, 2008). In a series of studies, using fMRI, we have been exploring the neural systems engaged in integrating heading with dynamic spatial targets to enable effective steering. This talk will present evidence of increased activation in distinct regions of the superior parietal lobe (SPL) when participants are integrating future path information (upcoming bends) with current heading, when all low-level visual features are controlled for. Equivalent areas are also activated during active steering (route selection) through a slalom of obstacles as compared to steering in which participants were replayed their previous steering trials and had to mimic their virtual heading (tracking heading). Correlational analysis of fMRI data with respect to individual behavioural performance also revealed that there was increased activation of an anterior (and partially overlapping) region of the SPL in participants who exhibited smoother steering performance. These studies take the task of locomotor control beyond the simple extraction of heading from flow and elucidate the systems engaged in the spatial encoding and updating of future targets (or obstacles) with respect to current heading, which is essential for effective locomotion in any cluttered environment.

Using optic flow for the estimation of travel distance

Markus Lappe[1] (mlappe@uni-muenster.de); [1]Institute of Psychology, University Munster, Germany

Much research on optic flow has been concerned with the estimation of heading and the control of the direction of self-motion. In my presentation I will instead focus on a different use of optic flow, namely the estimation of the distance that one has traveled. Optic flow in itself does not provide travel distance, only the combination of distance and speed (time-to-contact) is directly available. However, when scaling information from the environment is present, such as the distance to the ground when standing or walking on flat terrain, an integration of the optical velocity can yield ego-speed and travel distance. I will present experiments that show that humans can use optic flow for the estimation of travel distance, but that they often under- and, in some conditions, overestimate a movement's extent. I will then present a model of travel distance estimation from optic flow that is based on leaky path integration.

S4.3, *10:00am*

Visual-motor control in baseball batting

Rob Gray[1] (r.gray.2@bham.ac.uk); [1]School of Sport & Exercise Sciences, University of Birmingham

With margins for error of a few milliseconds and fractions of an inch it is not surprising that hitting a baseball is considered to be one of the most difficult acts in all of sports. We have been investigating this challenging behavior using a virtual baseball batting setup in which simulations of an approaching ball, pitcher, and field are combined with real-time recording of bat and limb movements. I will present evidence that baseball batting involves variable pre-programmed control in which the swing direction and movement time (MT) are set prior to the initiation of the action but can take different values from swing-to-swing. This programming process utilizes both advance information (pitch history and count) and optical information picked-up very early in the ball's flight (ball time to contact TTC and rotation direction). The pre-programmed value of MT is used to determine a critical value of TTC for swing initiation. Finally, because a baseball swing is an action that is occasionally interrupted online (i.e., a "check swing"), I will discuss experiments that examine when this pre-programmed action can be stopped and the sources of optical information that trigger stopping.

S4.4, *10:30am*

The role of optic flow in visual control of steering toward a goal

Li Li[1] (lili@hku.hk); [1]Department of Psychology, The University of Hong Kong

The visual control strategies for steering toward a goal include aligning the instantaneous direction of travel (i.e., heading; Gibson, 1950) or future path (Wann & Swapp, 2000) specified by optic flow with the target, equating the time-to-closure of the target-heading angle with the time-to-passage of the target (tau-equalization, Fajen, 2001), and centering the target in the perceived straight ahead (Rushton et al., 1998). In this talk, I present experiments that systematically examined and differentiated the use of these different strategies to determine the role of optic flow in visual control of steering toward a goal. In Experiment 1, the displays were rendered such that the target egocentric direction was fixed and thus unavailable for steering. In Experiment 2, the target drifted naturally on the screen, and the heading specified by optic flow was displaced 10° away from the participant's straight ahead. When the target egocentric direction was fixed, participants steered to align their heading with the target. When the target drifted on the screen, participants steered to center the target in their perceived straight ahead, which was on average shifted 32% toward the displaced heading specified by optic flow. Centering the target also generated 44% (375 ms) faster responses than aligning heading with the target. We found no evidence to support the use of the path or the tau-equalization strategy. Our data demonstrate that when target egocentric direction is available for steering, heading specified by optic flow is no longer used for steering. Instead, it is used for the recalibration of the perceived straight ahead in egocentric space.

S5
Perceptual learning

Monday, July 18, 2:15 pm - 4:15 pm
Symposium Session, Rayson Huang Theatre
Chairs: Fang Fang & Cong Yu

Symposium Summary

Perceptual learning is the process of long lasting improvement in performing perceptual tasks as a function of experience. It has been observed in all sensory modalities and has been studied intensively in past decades because of its close links to cortical plasticity. In vision, the majority of perceptual learning studies focus on experience-dependent changes taking place at early processing stages in the visual system. It has been demonstrated that training can improve performance in discriminating many elementary visual features, including contrast, orientation spatial phase, stereoacuity, hyperacuity, motion direction, and texture. Perceptual learning also occurs with more complex visual stimuli such as shape, object and face, whose recognition and identification can be improved by practice. However, the mechanism of perceptual learning is still elusive. In this symposium, Fang Fang (Peking University), Shawn Green (University of Minnesota), Philip Kellman (UCLA) and Cong Yu (Beijing Normal University) will present their most recent works about the mechanisms of perceptual learning with methods of psychophysics, EEG, fMRI and theoretical analysis, especially focusing on the important characteristics of perceptual learning (e.g. specificity, transfer and unification) as well as its practical applications.

S5.1, *2:15pm*

Visual perceptual learning and its specificity and transfer: A new perspective

Cong Yu[1] (yucong@bnu.edu.cn); [1]Institute of Cognitive Neuroscience & Learning, Beijing Normal University

Visual perceptual learning is known to be location and orientation specific, and is thus assumed to reflect the neuronal plasticity in the early visual cortex. However, in recent studies we created "Double training" and "TPE" procedures to demonstrate that these "fundamental" specificities of perceptual learning are in some sense artifacts and that learning can completely transfer to a new location or orientation. We proposed a rule-based learning theory to reinterpret perceptual learning and its specificity and transfer: A high-level decision unit learns the rules of performing a visual task through training. However, the learned rules cannot be applied to a new location or orientation automatically because the decision unit cannot functionally connect to new visual inputs with sufficient strength because these inputs are unattended or even suppressed during training. It is double training and TPE training that reactivate these new inputs, so that the functional connections can be strengthened to enable rule application and learning transfer. Currently we are investigating the properties of perceptual learning free from the bogus specificities, and the results provide some preliminary but very interesting insights into how training reshapes the functional connections between the high-level decision units and sensory inputs in the brain.

Learning to discriminate face views

Fang Fang[1] (ffang@pku.edu.cn); [1]Department of Psychology, Peking University, P.R. China

Although visual feature leaning has been well studied, we still know little about the mechanisms of perceptual learning of complex object. Here, human perceptual learning in discrimination of in-depth orientation of face view was studied using psychophysics, EEG and fMRI. We trained subjects to discriminate face orientations around a face view (i.e. 30°) over eight daily sessions, which resulted in a significant improvement in sensitivity to the face view orientation. This improved sensitivity was highly specific to the trained orientation and persisted up to six months. Different from perceptual learning of simple visual features, this orientation-specific learning effect could completely transfer across changes in face size, visual field and face identity. A complete transfer also occurred between two partial face images that were mutually exclusive but constituted a complete face. However, the transfer of the learning effect between upright and inverted faces and between a face and a paperclip object was very weak. Before and after training, we measured EEG and fMRI BOLD signals responding to both the trained and the untrained face views. Analyses of ERPs and induced gamma activity showed that face view discrimination training led to a larger reduction of N170 latency at the left occipital-temporal area and a concurrent larger decrease of induced gamma activity at the left frontal area with the trained face view, compared with the untrained ones. BOLD signal amplitude and MVPA analyses showed that, in face-selective cortical areas, training did not lead to a significant amplitude change, but induced a more reliable spatial pattern of neural activity in the left FFA. These results suggest that the visual system had learned how to compute face orientation from face configural information more accurately and that a large amount of plastic changes took place at a level of higher visual processing where size-, location- and identity-invariant face views are represented. The learning might be implemented through neuronal tuning curve sharpening and internal noise removing.

Transfer and Learning to Learn in Perceptual Learning

C Shawn Green[1] (csgreen@umn.edu); [1]Department of Psychology, University of Minnesota

As there is considerable current interest in the training characteristics that produce non-specific perceptual learning, we propose that it may be useful to differentiate between "transfer" and "learning to learn." These two constructs emerge from learning at different levels of a hierarchical Bayesian model. At the lowest level of the hierarchy is the individual learning task, where the subject is typically asked to estimate the probability of a state given data (e.g. - the probability that the answer is "clockwise" given an oriented gabor). By Bayes' rule, improving this estimate requires learning the probability of the data given the states (i.e. the likelihood). Tasks to which learning at this level should "transfer" are those that utilize the same likelihood as that which is learned during training (and thus requires that the tasks share a common state representation). Consistent with this viewpoint we have shown transfer of learning across orientation that is dependent on the state representation inherent in the training task. "Learning to learn" on the other hand requires that learning occur at levels above the individual task. By being exposed to multiple individual learning tasks, subjects can learn the manner in which likelihoods across tasks are generated. While subjects who have learned at this level may show weak immediate transfer effects, they should learn individual tasks more quickly. We have recently suggested that learning at this level is responsible for the broad range of tasks in which enhancements are noted as a result of action video game play.

Unifying Perceptual Learning

Philip J. Kellman[1] (Kellman@cognet.ucla.edu); [1]Department of Psychology, University of California, Los Angeles

What is the relation between perceptual learning (PL) in basic sensory discriminations and in more complex tasks, including real-world learning tasks? Most recent PL work focuses on the former, using simple sensory dimensions and a few specific stimulus values. In contrast, other PL research and virtually all real-world tasks involve discovery of invariance amidst variation, and may also involve PL working synergistically with other cognitive abilities. In this talk I will suggest that, despite superficial differences, low- and high-level PL tasks draw upon -- and reveal -- a unified type of learning. I will consider several arguments that have been advanced in favor of confining perceptual learning to plasticity at the earliest cortical levels along with models of PL based on receptive field change vs. selection. These analyses do not support the idea of a separate low-level process but do support both the abstract character of PL and its dependence on unifying notions of discovery and selection. In the final part of the talk, I will relate this unified view of PL to direct practical applications. Learning technology based on PL -- Perceptual Learning Modules (PLMs) -- can address elusive aspects of learning, including pattern recognition, transfer, and fluency, even in high-level, symbolic domains, such as mathematics learning.

Friday Talks

Action and virtual environments

Friday, July 15, 10:00 am - 12:00 pm
Talk Session, Library Extension 4
Chair: Jeffrey A. Saunders

11.1, *10:00am*

Active control does not eliminate motion-induced illusory displacement

Ian M. Thornton[1] (i.m.thornton@swansea.ac.uk), Franck Caniard[2] , Pascal Mamassian[3] , Heinrich H. Bülthoff[2] ; [1]Department of Psychology, Swansea University, [2]Max Planck Institute for Biological Cybernetic, Tübingen, Germany, [3]Laboratoire Psychologie de la Perception, Université Paris Descartes, Paris, France

When the sine-wave grating of a Gabor patch drifts to the left or right, the perceived position of the entire object is shifted in the direction of local motion. In the current work, we explored whether active control of the physical position of the patch overcomes such motion induced illusory displacement. In Experiment 1, we created a simple computer game and asked participants to continuously guide a Gabor patch along a randomly curving path using a joystick. When the grating inside the Gabor patch was stationary, participants could perform this task without error. When the grating drifted to either left or right, we observed systematic errors consistent with previous reports of motion-induced illusory displacement. In Experiment 2, we created an iPad application where the built-in accelerometer tilt control was used to steer the patch through as series of "gates". Again, we observed systematic guidance errors that depended on the direction and speed of local motion. In conclusion, we found no evidence that participants could adapt or compensate for illusory displacement given active control of the target.

11.2, *10:15am*

Influence of optic flow information beyond the velocity field on the active control of heading

Li Li[1] (chenjingpku@gmail.com), Leland S. Stone[2] , Jing Chen[1] ; [1]Department of Psychology, The University of Hong Kong, Hong Kong SAR, [2]Human-Systems Integration Division, NASA Ames Research Center, CA, USA

We examined both the sufficiency of the optic-flow velocity field and the influence of optic-flow information beyond the velocity field on the active control of heading. The display simulated a vehicle traveling on a circular path through a random-dot 3D cloud under a static or a dynamic scene in which dots were periodically redrawn to remove information beyond a velocity field. Participants used a joystick, under either velocity and acceleration control dynamics, to steer and align the vehicle orientation with their perceived heading while experiencing random perturbations to the vehicle orientation.

Frequency response (Bode) plots show reasonably good performance under both display conditions with a decrease in gain and an increase in phase lag for the dynamic scene for both control dynamics. The performance data were then fit by a Crossover Model to identify reaction time and lead time constant to determine how much participants anticipated future heading to generate lead control. Reaction time was longer and lead time constant was smaller for the dynamic than the static scene for both control dynamics. We conclude that the velocity field alone is sufficient to support closed-loop heading control, but optic-flow information beyond the velocity field improves visuomotor performance in self-motion control.

11.3, *10:30am*

Can observers judge future circular path relative to a target from retinal flow?

Jeffrey A. Saunders[1] (jsaun@hku.hk), Ka-Yiu Ma[1] ; [1]Department of Psychology, Hong Kong University

We investigated the ability of observers to judge whether they will pass left or right of a visible target from simulated motion along a circular path. Strategies based on optic flow would generally require compensation for pursuit eye movements. Wann & Swapp (2000) proposed an alternative strategy that requires only retinal flow. The experiments compared three conditions that provide the same retinal flow but different observer-relative optic flow. In the heading-relative view condition, simulated view direction rotated with change in heading, as naturally occurs when driving a car. In target-relative view condition, simulated view direction rotated to keep the direction of the target constant. In world-relative view condition, the simulated view direction was fixed relative to the environment. If an observer fixates the target, these conditions produce the same retinal flow. The initial heading direction of simulated motion was varied across trials, and responses were used to compute PSEs representing perceptual bias. Judgments were most accurate in the heading-relative condition. In the target-relative and world-relative view conditions, PSEs indicated large biases consistent with underestimation of path curvature. The large biases suggest that retinal flow is not sufficient to judge future circular path relative to a target.

11.4, *10:45am*

the role of central and peripheral vision in perceiving collision impacts

Nam-Gyoon Kim[1] (nk70@kmu.ac.kr); [1]Department of Psychology, Keimyung University

I present the results of two experiments that investigated the role of central and peripheral vision in collision detection and control of braking. Displays simulated observer movement over a ground plane toward obstacles in the observer's path (Experiment 1) or toward a vertical 2-D plane (Experiment 2).

Optical expansion was depicted under the constraint that tau-dot remains constant throughout the approach. Furthermore, displays were masked centrally (peripheral vision) or peripherally (central vision) with mask size ranging from 10° to 30° in diameter in steps of 5°. Results demonstrated that the peripheral retina is more effective than the central retina in processing the optic flow pattern specifying tau-dot and thus collision detection. Previous research demonstrated either minimal difference or a slight advantage to central vision in the capacity to process the self-motion information about heading and postural control. Those results conflicted with clinical studies showing that patients with peripheral vision loss experience more problems maintaining safe mobility than those with central vision loss. The present results are more consistent with clinical findings. It appears then that the roles played by retinal center and periphery differ depending on the type of self-motion they subserve.

11.5, *11:00am*

Translational optic flow induces shifts in direction of active forward and backward self-motion

Kenzo Sakurai[1] (sakurai@mind.tohoku-gakuin.ac.jp), Philip M. Grove[2] ; [1]Department of Psychology, Tohoku Gakuin University, [2]School of Psychology, The University of Queensland

Previously, we reported that when observers passively experience real linear oscillatory somatic motion while viewing orthogonal visual optic flow patterns, their perceived motion direction is intermediate to those specified by visual and vestibular information individually (Sakurai et al., 2002, ACV; 2003, ECVP; Sakurai et al., 2010, VSS; Kubodera et al., 2010, APCV). Here, we extend those studies to active somatic motion, measuring the angular shift in body direction after active body motion while viewing synchronized orthogonal optic flow. Experimental visual stimuli consisted of 1 second of translating leftward (rightward) random-dots and 1 second of random noise. Control stimuli consisted of two 1-second intervals of random noise separated by a static interval. Observers viewed the stimulus for 30 seconds through a face-mounted display, while actively stepping forward and backward such that their forward body movement was synchronized with the random-dot translational motion. Observers' body direction was measured before and after each trial. Translational optic flow induced shifts in body direction that were opposite to shifts in perceived direction with passive viewing in our previous reports. Observers may have compensated their body motion in response to perceived direction shifts similar to those we reported for passive viewing.

11.6, *11:15am*

Distinct visual thresholds for egocentric and allocentric information pick up?

Matthieu De Wit[1] (dewitm@hku.hk), John Van Der Kamp[2] , Rich Masters[1] ; [1]Institute of Human Performance, University of Hong Kong, [2]Research Institute MOVE, Faculty of Human Movement Sciences, VU University Amsterdam

Unlike perceptual size judgments, actions - but not delayed actions - performed under full vision are relatively unaffected by the Müller-Lyer illusion. Controversy remains as to the source of these effects. We aimed to illuminate the problem by exploiting the possibility that vision for action and perception may have distinct thresholds. In Experiment 1, participants performed delayed pointing movements towards briefly presented (12 ms - masked) M-L targets of different sizes. While participants were unable to perceptually discriminate between targets, their movements were nevertheless a function of target size, but not of the illusion (de Wit, van der Kamp, & Masters, in press). This implies that 1) vision for action is functional even after a delay and/or 2) distinct thresholds exists for egocentric and allocentric information pick up, possibly irrespective of whether a task is perceptual or motoric in nature. Experiment 2, in which participants manually matched the size of perceptually indiscriminable M-L targets, supports the latter option. These findings are reviewed in relation to recent discussions of the two-visual-systems model. de Wit, M.M., van der Kamp, J., & Masters, R.S.W. (in press). Delayed pointing movements to masked Müller-Lyer figures are affected by target size but not the illusion. Neuropsychologia.

11.7, *11:30am*

The effects of optokinetic nystagmus on visually induced motion sickness after the confounding effects of retinal slip is controlled

Cuiting Guo[1] (ctguoust@ust.hk), Jason Yang[1] , Richard So[1] ; [1]Department of Industrial Engineering and Logistics Management, HKUST

Ebenholtz (1994) predicts that eye movement is a major cause of visually induced motion sickness (VIMS). This paper examines the effects of optkinetic nystagmus (OKN) on VIMS. Past studies had shown that reducing OKN with eye fixation could significantly reduce levels of VIMS. However, the reduction of OKN was confounded with increases in the velocity of image motion projected on viewers' retina (peripherial retinal slip velocity: PRSV). When watching alternating black-and-white vertical stripe rotating at 60 degrees-per-second along the yaw axis, increases in retinal slip velocity had been shown to reduce levels of VIMS (Hu et al., 1989). A within-subject experiment was conducted to study the effects of eye fixation on VIMS with and without the control of the PRSV. After controlling the confounding effect of increasing PRSV, reduction of OKN by eye fixation significantly reduced levels of VIMS as measured by normalized ratio-scale data (p=0.017), mean 7-point nausea ratings (p=0.006) and post simulator-sickness-questionnaire scores (p=0.002). This finding is new and original. It suggests that eye movement by itself rather than its modulating effects on retinal slip velocity is responsible for increases in levels of VIMS. Implications of the results are discussed.

11.8, *11:45am*

Presence while watching movies

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[1]School of Experimental Psychology, University of Bristol

"Presence" is the illusion of being in a mediated experience rather than simply being an observer. It is a concept often applied to the question of realism of virtual environments. However, it is equally applicable to the act of watching a movie. A movie provides a markedly different visual environment to that given by the natural world - particularly because of frequent edits. And yet, the audience in a movie achieves high levels of presence. We investigate the relationship between presence and the optical and temporal parameters of movies. We find effects of mean shot length, colour/b&w, and 3D/2D. We find that short shots, while being unnatural, are associated with high levels of presence. We consider why such artificial stimuli should appear so real and immersive.

Attention and learning

Friday, July 15, 1:30 pm - 3:45 pm
Talk Session, Library Extension 4
Chair: Chia-Huei Tseng

12.1, *1:30pm*

The time course of spatial and semantic processing between audition and vision: evidence from event-related potentials

Xiaoxi Chen[1] (nancy.chen.psy@gmail.com), Zhenzhu Yue[1] , Dingguo Gao[1] ; [1]Department of Psychology, Sun Yat-sen University

Using a crossmodal priming paradigm, this study investigated how the brain bound the spatial and semantic features in multisensory processing. The visual stimuli (pictures of animals) were presented after the auditory stimuli (sounds of animals), and the stimuli from different modalities may match spatially (or semantically) or not. Participants were required to detect the head orientation of the visual target (an oddball paradigm).The event-related potentials (ERPs) to the visual stimuli was enhanced by spatial attention (150-170 ms) irrespectively of semantic information. The early crossmodal attention effect for the visual stimuli was more negative in the spatial-congruent condition than in the spatial-incongruent condition. By contrast, the later effects of spatial ERPs were significant only for the semantic- congruent condition (250-300 ms). These findings indicated that spatial attention modulated early visual processing, and semantic and spatial features were simultaneously used to orient attention and modulate later processing stages.

12.2, *1:45pm*

Failures of Visual Awareness: Inattentional Blindness and Attentional Blink

Vanessa Beanland[1] (vanessa.beanland@monash.edu), Kristen Pammer[2] ; [1]Accident Research Centre, Monash University, [2]Department of Psychology, The Australian National University

Failures of visual awareness occur when attentional processing limitations prevent an observer from detecting clearly visible stimuli. These failures can occur in a variety of contexts; two well-known research examples are inattentional blindness (IB) and attentional blink (AB). IB involves failure to detect an irrelevant, unexpected stimulus when attention is engaged by another primary task. AB involves failure to detect a relevant, expected stimulus, which occurs when a second target is presented within 180-500ms of the first target in a rapid serial visual presentation stream. Because both involve failures of visual awareness, IB and AB are often discussed in conjunction with each other and past research implicated similar cognitive processes underlying both phenomena, however, no evidence directly correlated the two. We tested 54 observers on both an IB task and an AB task. Consistent with our hypotheses, we found that "non-noticers" who failed to detect an unexpected stimulus in the IB task also demonstrated larger AB magnitude, with a particular dip at lag 2, compared to noticers of the unexpected stimulus. This suggests that individual differences play a role in failures of visual awareness and that some observers may be more or less susceptible to failures of visual awareness generally.

12.3, *2:00pm*

The effects of target location probability and repetition on allocation of attention

Takashi Kabata[1] (kabata@stu.kobe-u.ac.jp), Eriko Matsumoto[1] ; [1]Department of Human Communication, Kobe University

The purpose of this study is to investigate the roles of probability and repetition on the mechanism that target location probability modulates allocation of attention. When target items in the visual search task were presented in a given location with high probability, the response times for the targets in the high-probability location improved relative to those in the low-probability locations (Geng & Behrmann, 2002). Two possible mechanisms have been proposed to explain the effects of location bias on attention: statistical learning and repetition priming (e.g., Druker & Anderson, 2010; Walthew & Gilchrist, 2006). In our search tasks, we manipulated not only the spatial probability distributions but also the repetitions of target appearance in each location. When we manipulated the targets appeared in a given location over two consecutive trials, the target location probability worked as an attentional cue, and the probability and repetition had different influences on the response times. On the other hand, when we manipulated the targets did not repeatedly appear in a given location, the effect of probabilistic cuing was not observed. The results suggest spatial repetition priming is a necessary requirement for probabilistic cuing of target location.

12.4, *2:15pm*

Unconscious attentional capture effect can be induced by perceptual learning

Zhe Qu[1] (quzhe001@gmail.com), Yunpeng Lai[1] , Yulong Ding[1] ; [1]Department of Psychology, Sun Yat-Sen University

Previous ERP studies have shown that N2pc serves as an index for salient stimuli that capture attention, even if they are task-irrelevant. This study aims to investigate whether non-salient stimuli can capture attention automatically and unconsciously after perceptual learning. Adult subjects were trained with a visual search task for 8-10 sessions. The training task was to detect whether the target (triangle with one particular direction) was present or not. After training, an ERP session was performed, in which subjects were required to detect the presence of either the trained triangle (i.e., the target triangle in the training sessions) or an untrained triangle. Results showed that, while the untrained triangle did not elicit an N2pc effect, the trained triangle elicited a significant N2pc effect regardless of whether it was perceived correctly or not, even when it was task-irrelevant. Moreover, the N2pc effect for the trained triangle was completely retained 3 months later. These results suggest that, after perceptual learning, previously-unsalient stimuli become more salient and can capture attention automatically and unconsciously. Once the facilitating process of the unsalient stimulus has been built up in the brain, it can last for a long time.

12.5, *2:30pm*

Adolescents Pay More Attention to Gaze Than Children and Adults

Lin Hui Fang[1] (t02204@mail.dyjh.tc.edu.tw), Li Jingling[2] , Lin Hui Feng[1] ; [1]Department of Special Education, National Changhua University of Education, [2]Graduate Institute of Neural and Cognitive Science, China Medical University

Gaze could induce automatic orienting and plays a crucial role in social cognition. The goal of this study was to explore whether the effect of gaze induced orienting varies from children to adults. Three groups of participants were recruited: twenty-two 9-10 year-old children (average 9.5), twenty-three 13-16 year-old adolescents (average 14.5), and twenty 19-23 year-old adults (average 20.2). The participants located a target, while a schematic face was presented next to the target. The face gazed at (valid) or away from (invalid) the target on equal possibility. The gaze cue was presented 200, 1200, or 2400 ms before the onset of the target. Results of adults replicated previous findings that observers responded faster for valid targets than invalid targets (cue effect) at 200 ms interval, and slower at 2400 ms (inhibition of return, IOR), while no effect at 1200 ms. However, children only showed cue effect at 200 ms, while adolescents showed cue effect at 200 and 1200 ms, and IOR at 2400 ms. Thus, adolescents were more attracted by gazes, while children did not show inhibition mechanism of orienting to gazes. Our data thus demonstrated a developmental trend of automatic orienting to gazes.

12.6, *2:45pm*

Asymmetrical transfer of learning effects between signal-based and criterion-based task uncertainties in perceptual decision

Feitong Yang[1] (william1121@126.com), Sheng Li[1] ; [1]Department of Psychology and Key Laboratory of Machine Perception (MoE), Peking University

People frequently encounter diverse uncertainties stemmed from environmental noise or insufficient personal knowledge. It remains unknown whether there is a general neural mechanism dealing with various uncertainties. Investigating the transfer of learning effects between tasks with different uncertainties paves the way to the fully understanding of this issue. Nevertheless, previous literatures have shown controversial evidences due to the contextual difference between tasks. In the present study, we adapted Glass Pattern to manipulate a two dimensional stimulus space incorporating two uncertainties (Signal-Based uncertainty due to noisy stimulus signal and Criterion-Based uncertainty due to unknown category boundary) in one categorization task that was to discriminate radial from concentric patterns. We trained two groups of participants along the Criterion-Based and the Signal-Based dimensions respectively, and tested on both dimensions before and after the training. After four to five successive days of training, learning effect significantly transferred from Criterion-Based task to Signal-Based task (p<0.01), but not vice versa (p=0.18). More interestingly, however, a brief adaptive QUEST test with feedback on Criterion-Based task after Signal-Based training leaded to a rapid transfer of learning effect. Altogether, the current results suggested that two separate but overlapping mechanisms are engaged in processing the two sources of task uncertainty.

12.7, *3:00pm*

Bimodal stimuli do not always facilitate infants' rule learning

Sin Mei Tsui[1] (angelinetsui@gmail.com), Chia-Huei Tseng[1] ; [1]Department of Psychology, University of Hong Kong

Seven-month-old infants possess the ability to extract and generalize abstract rules from unimodal sequences of auditory syllables such as ABA and ABB whereas five-month-old infants are facilitated in their learning of these rules by bimodal sequences. In the current study, we investigated whether bimodal stimuli could also help infants acquire what we consider a more difficult abstract rule: AAB. Nineteen 8 to 9-month-old infants were habituated to the AAB rule with simultaneous visual shapes and speech sounds. They were later tested on their ability to discriminate this sequence from ABA and ABB with their looking times measured after each stimulus presentation at test periods. There was no significant difference in looking times amongst the different sequences, suggesting infants were not able to formulate an AAB rule different from those for ABA and ABB. Older infants' inability to utilize extra sensory information to acquire an abstract rule in which younger ones were ready to learn from unimodal stimulus (speech) was unexpected. It is unclear what leads to the failure of rule learning from bimodal stimuli, but possible explanations including perceptual narrowing in the inter-sensory integration and the difference in sensory

representation of abstract rules with different difficulties are discussed.

12.8, *3:15pm*

Preverbal infants use object features and motion cues in social learning

Hiu Mei Chow[1] (dorischm@gmail.com), Geroldene Tsui[1] , Chia-Huei Tseng[1] ; [1]Department of Psychology, The University of Hong Kong

Studies have shown preverbal infants possess the ability to learn social rules presented in complex perceptual environment, but little is known about how they do it. We investigated the relative contribution of two perceptual cues in social learning. Three groups of six- to twelve-month-old infants were habituated to repeated events in which two agents helped or hindered a climber by pushing it up or down a hill, and who subsequently laughed (when helped) or cried.(when hindered). The three groups then received a test dishabituating stimulus such that for group 1, the climber cried when pushed up the hill and laughed when pushed down; for group 2, the identities of the agents (as defined by geometric shape and color) were reversed; for group 3, the agents kept their identities but reversed their pushing direction. We found infants looked significantly longer in all three dishabituating conditions. The results from group 1 suggest that infants successfully associated the social events with consequential emotions. The discriminability in group 2 and 3 suggests that simple motion direction and complex object (agent identity) cues are both effective for emotion-related social learning.

12.9, *3:30pm*

Long lasting perceptual learning occurs not during but after active training

Yulong Ding[1] (dingyulong007@gmail.com), You Wang[1] , Zhe Qu[1] ; [1]Department of Psychology, Sun Yat-Sen University

Previous behavioral studies have shown that human perceptual learning (PL) occurs not only within active training sessions but also between sessions when no actual training is conducted. Once acquired, the learning effect can last for a long term, from months to even years, without further training (Karni et al, Nature, 1993). It's not clear, however, whether fast (within-session) and slow (between-session) visual PL involves different neural mechanisms, and whether both contribute to the long-term preservation. Recently, by observing the time course of learning-associated ERP changes over a period of six months, we found that fast and slow learning involved distinct ERP changes, which played different role on the preservation of PL: while the ERP changes associated with fast learning can only last for a short term (several days), those associated with slow learning can be retained for a long-term (several months) after training has been stopped. We have observed these findings in two distinct visual tasks: line orientation detection (Qu et al., Neuropsychologia, 2010) and vernier tasks (Ding et al., in preparation) so far. A general model of PL was proposed based on our findings and literatures.

Eyes and brains

Friday, July 15, 1:30 pm - 3:45 pm
Talk Session, Library Extension 2
Chair: Henry H. L. Chan

13.1, *1:30pm*

Myopia progression in children is associated with regional changes in retinal function: a multifocal electroretinogram study

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Introduction: To determine if retinal function is associated with myopia progression in children over a one-year period. Methods: Twenty-two children (mean=11±1 years) were recruited in this study. Refraction and global flash multifocal electroretinogram measurements were performed at 49% and 96% contrasts at the initial visit and after 1 year. The amplitudes and implicit times of direct (DC) and induced components (IC) of the mfERG responses were pooled into 5 concentric rings for analysis. Pearson's correlation (r) was performed to determine if myopia progression was correlated with the changes in these mfERG's parameters. Results: The mean myopia progression was -0.45±0.34D (range=plano∼-1.38). At 49% contrast, the IC implicit times from rings 2 to 5 (r=-0.57∼-0.65, p<0.01), and the DC implicit time at ring 3 (r=0.55, p<0.01), were significantly delayed with myopia progression. At 96% contrast, only the IC implicit time within ring 1 was delayed (r=-0.60, p<0.01). In contrast, neither DC nor IC amplitudes at both contrasts were affected (r=-0.11∼0.28, all p>0.05). Conclusions: Myopia progression in children delayed IC implicit time at 49% contrast predominantly at the paracentral retina. These results support our previous findings (Ho et al., 2011) that the effect of myopia development on retinal function is regional dependent.

13.2, *1:45pm*

Localization and Developmental Expression Patterns of CSPG in the RCS Rat Retina

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Purpose: Investigate changes in chondroitin sulfate proteoglycan (CSPG) distribution in Royal College of Surgeons (RCS) rat retinae. Could CSPGs distribution act as a physical barrier to transplanted cell migration in degenerating retinae? Methods: CSPG expression was examined in RCS and Long-Evans rat retinae from birth to postnatal day 150 (PND150) using immunofluorescence and western-blots. Results: Both groups showed a rapid rise in CSPG expression on PND14, which peaked on PND21 before declining to lower levels by PND35. CSPG expression had risen again by PND90 and remained elevated for the duration of the study (PND150). However, from PND21, CSPG expression was significantly higher (P ≤ 0.05, n = 5) in Long-Evans rat retinae. CSPG-positive

cells were localized in the ganglion cell layer (GCL) and the photoreceptor outer segment debris zone (DZ); CSPG expression in the DZ was the main contributor to the higher expression in older animals for both groups. Conclusions: Increased expression of CSPGs in the DZ may act as a physical barrier following retinal cellular transplantation. CSPGs in the GCL is probably related to dendritic changes. CSPG accumulation in the older retinae suggests that aging influences the microenvironment in the retina, which may affect the efficacy of cell transplantation.

13.3, *2:00pm*

Protective role of aldose reductase deletion in an animal model of oxygen-induced retinopathy

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Retinopathy of prematurity (ROP) is a common disease occurred in premature babies. Both vascular abnormality and neural dysfunction of the retina were reported and oxidative stress was involved. Previously, it has been showed that deficiency of aldose reductase (AR), the rate-limiting enzyme in polyol pathway, lowered oxidative stress. Here, the effect of AR deletion on neonatal retinal injury was investigated by using a mouse model of ROP (oxygen-induced retinopathy, OIR). Seven-day-old pups were exposed to 75% oxygen for five days and then returned to room air. The vascular changes and neuronal/glial responses were examined and compared between wild-type and AR-deficient OIR mice. Significantly reduced vaso-obliterated area, blood vessel leakage and early revascularization were observed in AR-deficient OIR mice. Moreover, recued amacrine cells and less distorted strata were observed in AR-deficient OIR mice. Less astrocytic immunoreactivity and reduced Müller cell gliosis were also observed in AR-deficient mice. After OIR, nitrotyrosine immunoreactivity and poly (ADP-ribose) (PAR) translocation, which are two oxidative stress markers, were decreased in AR-deficient mice. Significant decrease in VEGF, pho-Erk1/2, pho-Akt, and pho-IκB expression was found in AR-deficient OIR retinae. Thus, these observations suggest that the deficiency of aldose reductase may protect the retina in the OIR model.

13.4, *2:15pm*

Biphasic M-cell responses to stimuli producing sound-induced flash illusions

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The illusion of a single pulse of light seen as two flashes has been known for nearly a century (Dunlop, 1915). Bowen (1989) extended this earlier work for multiple bright pulses of light – two flashes seen as three etc. He attempted to explain these illusions in terms of putative multiphasic responses in the visual system. The sound induced flash illusion (SIFI) is another example of extra flashes being reported beyond what is presented. Following Bowen, we modelled the biphasic

temporal responses of actual fast ON- and OFF- midget parasol M cells to visual stimuli we had previously used in our SIFI research. Could the auditory stimuli – beeps – be directing attention to short duration peaks in stimulation, thus biasing the response of the observer in reporting the number of transient events? We show that for square wave temporal profile, such response bias could easily be the case, especially given that 3 or 4 clicks rarely yield an illusion of more than two flashes. On the other hand, we experimentally produced more numerous and reliable fission SIFIs in sawtooth profiles that did not generate such peaks of excitation. This strongly suggests that a decisional-level explanation of the SIFI is not adequate.

13.5, *2:30pm*

Response modulation of V1 neurons by spatiotemporal sequence of oriented stimuli

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Spike activity of V1 neurons in response to natural scene (Vinje and Gallant, 2002; Montemurro et al., 2008; Haider et al., 2010) is surprisingly consistent across repeated trials. While it is clear that these responses are not explained by classical receptive field (cRF) properties, it is not known how surround interaction increases the selectivity of V1 response. Put more generally, we do not completely understand the mapping rules between elementary features of visual scene and V1 activity. In the current study, we examined the possibility that V1 neurons are selective for spatiotemporal sequence of oriented stimuli. We will describe a novel response property of monkey V1 neurons that visual response was modulated depending on the stimulus onset asynchrony (SOA) in the range of tens of milliseconds between two sequentially-presented Gabor stimuli. The preceding stimulus (S1) was presented outside cRF and the following one (S2) inside cRF. S1 alone did not evoke spike response but modulated cell's response to S2. Spike response to S2 was not constant across SOA, and the SOA associated with maximal response modulation varied with the position of S1. These results suggest that V1 neurons are selective for spatiotemporal sequence of oriented stimuli based on surround interaction.

13.6, *2:45pm*

Dynamic property of spatial summation of V1 neurons of the cat

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In the primary visual cortex (V1) of the cat and monkey, there is an extensive surround region beyond the classical receptive field (CRF). This surrounding field is conventionally referred to as "non-classical receptive field" (nCRF). In recent years, some investigators reported that the extent of CRF and/or nCRF of V1 neurons is not fixed, but may vary with stimulus contrast. We have reexamined the spatial summation property for 101 V1 neurons at a high (20-80%) and a low (3-15%) contrast. By fitting the spatial summation curves of the neurons obtained at different contrast using the difference of Gausians (DOG) model,

we were able to estimate quantitatively the contrast-induced variation of the extent of CRF and nCRF for this group of cells. Our results showed that both the excitatory CRF and suppressive nCRF expanded at low stimulus contrast, but the expansion was more marked for the CRF than that for the nCRF. Moreover, the strength of surround suppression decreased or even disappeared under the low contrast condition. Our data suggest that, at higher stimulus contrast, both the shrinkage of excitatory CRF and the increase of surround suppression may improve spatial resolution for the perceived images.

13.7, *3:00pm*

Anisotropic spread of cortical activity in human visual cortex

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A visual stimulus not only evokes spiking activity in neurons whose receptive fields (RFs) are overlapped with the stimulus but also promotes subthreshold activity over an extended cortical region outside the directly stimulated region, known as cortical point spread (PS). Optical imaging studies on animal visual cortex demonstrated that PS is biased to cortical sites whose orientation preferences are similar to stimulus orientation ('co-orientation anisotropy'). Anatomical studies reported also 'co-axial anisotropy', predominant horizontal connections between neurons whose RFs are positioned along the retinotopic axis collinear to their orientation preferences. By conducting fMRI experiments, we observed those two types of anisotropy in PS in early visual areas (V1, V2, V3) of human brains. By defining RFs and stimulus orientation preferences for individual voxels, we could show that PS of fMRI activity that were triggered by a small stimulus at the fovea increased with decreasing angular offset of a given voxel's RF from the axis collinear to stimulus orientation and was strong in voxels whose orientation preferences are similar to stimulus orientation. When anisotropy was probed via traveling waves of PS in a large visual field, we found that the 'co-axial anisotropy' was more pronounced in the fovea than in the periphery.

13.8, *3:15pm*

Where and When Do Objects Become Scenes?

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Scenes can be understood with extraordinary speed and facility, not merely as an inventory of individual objects, but in the coding of the relations among them. These relations, which can be readily described by prepositions or gerunds (e.g., a hand holding a pen), allows the explicit representation of complex structures. Where in the brain are inter-object relations specified? In a series of fMRI experiments, we show that pairs of objects shown as interacting elicit greater activity in LOC than when the objects are depicted side-by-side (e.g., a hand besides a pen). Other visual areas, PPA, IPS, and DLPFC, did not show this sensitivity to scene relations, rendering it unlikely that the relations were computed in these regions. Using EEG and TMS, we further show that LOC's sensitivity to object interactions arises around 170ms post stimulus onset and that disruption of normal LOC activity—but not IPS activity--is detrimental to the behavioral sensitivity of inter-object relations. Insofar as LOC is the earliest cortical region where shape is distinguished from texture, our results provide strong evidence that scene-like relations are achieved simultaneously with the perception of object shape and not inferred at some stage following object identification.

13.9, *3:30pm*

How does visual impairment affect scene perception and object recognition?

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Siong KH, Liu TY, Chu YY, Cheong AMY People with visual impairment may experience difficulties in daily activities. Studies have shown an improvement in visual functions after a short period of visual deprivation. However, little is known on scene perception and its relationship with object recognition in low vision. In this study, we examined the performances of object recognition and scene categorization using photographs of real-world scenes in twenty four young adults with normal vision before, immediately after and 2-hour after simulated low vision. Participants were randomly assigned to either mild or moderate simulated low vision groups. For each viewing condition, participants were required to 1) annotate the objects of interests in the photos; 2) label the annotated objects; and 3) report the theme of the scenes. Results showed that with simulated visual impairment, overall performances in object recognition, object annotation and scene perception significantly deteriorated although the levels of deterioration among tasks were different. After 2-hour adaptation, only the accuracy of object annotation improved significantly. Our study suggests some forms of compensatory perceptual changes in visual pathway after short-term visually-deprived adaption. However, this adaptation effect might be more specific to localized object recognition rather than global perception of the scene.

Saturday Talks

Perception and color

Saturday, July 16, 1:30 pm - 3:30 pm
Talk Session, Library Extension 4
Chair: Chien-Chung Chen

21.1, *1:30pm*

Perceptual Evidence for Interhemispheric Visual Integration

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Visual scenes in the left and right halves of visual fields are processed in separate cortical hemispheres of the brain. Corpus callosum is thought to play an important role in stitching together the split at the vertical meridian. Yet we do not notice any consequence of such interhemispheric integration in our daily lives. Can we find any perceptual evidence for such integration? Specifically, do visual tasks involving interhemispheric integration require extra processing time due to transmission delays of signals that must be exchanged via corpus callosum? To address these questions, we used a visual illusion known as the flash lag effect as a ruler for space and time. Two configurations of flash lag stimuli were presented to normal human subjects. In one configuration, the stimuli were presented to only one visual hemifield so that the processing could be completed within a single cortical hemisphere. In the other configuration, moving and flashed parts of the stimuli were presented to separate hemifields straddling the vertical meridian. Positions of flashed stimuli were manipulated to find a spatial offset necessary to cancel the lag. Our results show that the stimulus configuration that involves interhemispheric integration requires 40~50ms of extra processing time.

21.2, *1:45pm*

The interaction between flanker phase and position in lateral masking

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The visibility of a target pattern can be affected by the presence of an adjacent stimulus (flanker). Here, we showed that such lateral masking effect depends on both the phase and the position of the flanker. The task of the observers was to detect a 4 cy/deg vertical Gabor target with the presence of vertical flankers. The target was in sine phase related to the fixation. The flankers had either the same or the opposite phase as the target and located at either the collinear or the side position from the target. The distance between the target and the flanker varied from 2-7.5 wavelengths. We measured the target threshold at 75% correct level. Compared with the no-flanker condition, the same-phase collinear flankers and the opposite-phase side flankers significantly decreased target threshold while the other flankers had little effects. Hence the side flanker has an effect only if the bright region of the target

is adjacent to the bight regions of the flanker, and the dark region of the target to the dark region of the flanker. This result is consistent with the notion of border ownership in which facilitation occurs when the target and the flankers signal the same border.

21.3, *2:00pm*

Spatiotemporal characteristics for the depth from luminance contrast.

Kazuya Matsubara[1] (kmore@riec.tohoku.ac.jp), Kazumichi Matsumiya[1] , Satoshi Shioiri[1] , Shuichi Takahashi[2] , Yasuhide Hyodo[2] , Isao Ohashi[2] ; [1]Research Institute of Electrical Communication, Tohoku-University, [2]Sony corporation

Images with higher luminance contrast tend to be perceived closer in depth. To investigate a spatiotemporal characteristic of this effect, we evaluated subjective depth of a test stimulus with various spatial and temporal frequencies. For the purpose, the depth of a reference stimulus was matched to that of the test stimulus by changing the binocular disparity. The results showed that the test stimulus was perceived closer with higher luminance contrast for all conditions. Contrast efficiency was obtained from the contrast that provided the subjective depth for each spatiotemporal frequency. The shape of the contrast efficiency function was spatially low-pass and temporally band-pass. This characteristic is different from the one measure for a detection task. This suggests that only subset of contrast signals are used for depth from contrast.

21.4, *2:15pm*

Left global hemineglect in high Autism-spectrum Quotient (AQ) individuals

Daniel Paul Crewther[1] (dcrewther@hotmail.com); [1]Department of Life and Social Science, Swinburne University of Technology

Autism remains as a significant issue for many individuals due to the social impairment accompanying the disorder. Recent theories present potential relationships between autistic tendency and visual perceptual differences to explore differences in underlying visual pathways. These differences have been explored though the use of global and local stimuli to show difference in perception. This study compared the balance of global versus local perception between sub-groups from the normal population both high and low on the Autism Spectrum Quotient (AQ). A diamond illusion task containing rivaling global and local percepts was used to explore the effects of changing the occluder contrast and peripheral viewing upon global/local percept. An increase in global perception relative to increasing eccentricity of the stimulus from a fixation point was also seen in both groups. However, with increasing contrast of the occluding stripes both groups showed an increase in the percentage of global perception. When comparing between groups the high AQ showed a significant reduction in global perception compared to the low AQ group when the stimulus was presented in left hemifield. This difference wasn't present within right hemifield. We

discuss how global perceptual hemineglect may suggest abnormal parietal function in individuals with high AQ.

21.5, *2:30pm*

Seeing differently in near and far: for detection but not identification of peripheral targets

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Do human observers process the same retinal information differently when it comes from near versus far space? Based on neurophysiological and neuropsychological evidence researchers have proposed that visual information for near space (peripersonal, within arm's reach) and far space (extrapersonal, beyond arm's reach) is mediated predominantly by dorsal and ventral visual pathways respectively. Here we provide behavioural evidence showing that neurologically normal human observers perceive visual information in near and far space differently when the visual stimuli in both viewing conditions subtended an equal visual angle and had equal luminance. Specifically, in tasks requiring participants to detect a briefly presented target appearing at one of many possible peripheral locations on a screen, under far viewing-distance conditions, visual accuracy declined more steeply as the eccentricity of the peripheral target increased compared to near viewing-distance conditions. This near-far difference in the slopes of the accuracy-eccentricity curve was not, however, observed for visual identification tasks using the same stimulus configuration. This remarkable near/far influence on perceptual behavior observed here suggests that the brain can actively modulate the information processing in different neural streams based on the target distance information, and consequently facilitate the ecological use of the retinal information.

21.6, *2:45pm*

Synaesthetic colours can behave more like recalled colours, as opposed to physical colours that can be seen

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Grapheme-color synaesthesia is an atypical condition characterized by coloured sensations when reading achromatic text. Different forms have been characterized, but this is somewhat controversial. In associative grapheme-colour synaesthesia, written graphemes can automatically trigger a sensation of colour in the 'mind's eye', but hearing the name of a grapheme does not. This allowed us explore the precision with which synaesthetes match triggered synaesthetic colours across separate presentations, versus the precision for recalled experiences cued by spoken graphemes. We recorded CIE coordinates, and found that matches for triggered sensations were equally variable relative to recalled experiences. To ensure this was not due to insensitivity of our apparatus, we next had synaesthetes and age-matched controls either match the colour of a circular patch while they could see it, or from memory after it had disappeared. Both synaesthetes and controls were more variable when matching from memory, and synaesthetes were more precise when matching colour hue, but

not brightness. Interestingly, the variance of synaesthetes' recalled matches in this experiment matched that associated with synaesthetic colours in the first experiment. Overall, our data suggests that, for associative grapheme-colour synaesthetes, synaesthetic colours behave more like recalled colours, as opposed to physical colours that can be seen.

21.7, *3:00pm*

Enhancement of afterimage colors by surrounding contours

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Presenting luminance contours surrounding the adapted areas in test phase enhances color afterimages in both duration and color appearance. The presence of surrounding contour is crucial to some color phenomenon such as van Lier's afterimage, but the contour-effect itself has not been seriously examined. In this paper, we compared the contour-effect to color afterimages and to actually colored patches to examine the nature of color information subserving color-aftereffect. In the experiment, observers were adapted for 1 sec to a small colored square (red, green, yellow, or blue) presented on a gray background. Then, a test field either with or without surrounding contour was presented. Observers matched the color of a test-patch located near the afterimage to the color of afterimage. It was found that the saturation of negative afterimage was almost doubled by the presence of surrounding contours. There was no effect of luminance contrast or polarity of contours. In contrast, no enhancement of saturation by surrounding contours was observed for actually colored patches even though the colors of patches were equalized to that of afterimage without contours. This dissociation in the contour-effect demonstrates the crucial difference between the color information for aftereffects and for ordinary bottom-up color perception.

21.8, *3:15pm*

Modeling Spectral Alteration and Color Vision Performance

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Laser Eye Protection (LEP) devices selectively alter the spectral environment and affect the ability to identify and discriminate color. Pilots and mariners must wear LEP for their safety and still make decisions based on colored lights and objects. These abilities can be compromised with LEP. Determining the level of degradation caused by LEP remains challenging; LEP devices are not uniform in construction and results from laboratory tests may be poor indicators of actual user performance. In addition, performance deficits in the maritime and aviation environment can be exacerbated by cognitive distracters. However there is little known about the interaction of attentional effects with color performance deficits from the use of LEP. Several different mathematical models of color vision were utilized to model and predict color vision performance. Spectral reflectance or transmission was measured and placed into equations utilizing color matching functions of the standard observer. These values were then translated into

different color spaces. These results were compared with actual performance. Results for modeling indicate that models that take into account color zone shifts, rather than color shifts are more accurate, and that models cannot yet account for all aspects of color vision performance such as when cognitively distracted.

Saturday Posters

Face & Object Recognition

Saturday, 16 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

22.1

Face inversion disproportionately disrupts detection of vertical versus horizontal not long-range versus short-range spatial relations

Kate Crookes[1] (kcrookes@hku.hk), William G. Hayward[1] ; [1]Department of Psychology, University of Hong Kong

Presenting a face inverted disrupts sensitivity to the spacing between the features. Recent evidence suggests that inversion disproportionately affects sensitivity to vertical over horizontal changes in eye position. One explanation is that inversion disrupts the processing of long-range (e.g., eye to mouth) more than short-range (e.g., interocular) spatial relations. Here we investigated whether the size of the shift or the direction (i.e., eyes up vs. eyes down; eyes in vs. eyes out) affects the pattern of the inversion effect. Our results replicated the finding of poor detection of vertical changes in inverted faces (even when these changes were very large). In the vertical condition the inversion effects were just as large for the "eyes down" (short-range, as the eye-mouth distance was small) as the "eyes up" (long-range), while horizontally "eyes in" (short-range, as the eyes were very close) and "eyes out" (long-range) both produced small inversion effects. These results argue against a long-range versus short-range spatial relations explanation of the horizontal versus vertical difference in the inversion effect. Rather, it appears the axis of change rather than the spatial distances between features is behind the difference in the size of the inversion effect.

22.2

Recognition on other-race faces could be worse or better: years of stay in foreign countries modulates the other-race effect

Chiu-Yueh Chen[1] (opclavicle@gmail.com), Chun-Chia Kung[1] ; [1]Department of Psychology and Institute of Cognitive Science, National Cheng Kung University, Tainan, Taiwan, 70101

Studies have shown that life experience is important to the identification of faces of one's and other's races. The latter is known as the other-race effect (ORE). In our previous report (Wang and Kung, 2010 APCV), mimicking the published recognition memory paradigm (Golby et al., 2001 Nature Neuroscience), we found that activation in the left middle fusiform gyrus (l-mFG), along with other areas of interest, including bilateral parahippocampal and inferior frontal, right insular, medial frontal, etc, correlated with subject's years of stay in Asia, though behaviorally no clear concomitant effect of ORE was found. In the present behavioral study, with more face items to remember and for test, we find clearer ORE with Caucasians who are within 1-year of stay, and gradually toward other-race advantage, or better recognition memory for Chinese faces than for own-race Caucasian faces, with more years of stay in Taiwan. This not only indicates that ORE could be observed both in behavior and in their neural substrates, but shows again the influence of life experience upon one's face recognition ability. Attempts to combine a behaviorally established paradigm in the fMRI setting are also underway.

22.3

The near-race and other-race effect in Taiwanese adults: Exploring the featural versus configural face discrimination process

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Other-race-effect (ORE) refers to the observation that we can recognize own-race faces better than other-race faces (Meissner & Brigham, 2001). Yet, whether featural or configural face processing might contribute to other-race effect is still unclear. In the present study, we tested Taiwanese adults with faces of four ethnic groups (Taiwanese, Philippine, Caucasian, African) and each with four levels of discriminability: Easy (change configuration and component: change identity), Medium (change component: change eyes), Hard-I (change configuration: widen eye spacing), and Hard-II (change configuration: mouth moved up). We adopted the visual paired-comparison task with two-alternative-forced-choice (2AFC) procedure. The overall results showed that accuracy decreased and response time increased as the stimulus difficulty increased for each race. The accuracy was highest and the response time was lowest for the Taiwanese easy condition, which suggests an own-race advantage. In addition, the pattern of response time for Philippine faces was similar to that of Taiwanese faces and was shorter than Caucasian faces in the medium and Hard-I conditions. In conclusion, our study had two main findings. First, Philippine faces were seen as more like own-race faces rather than other-race faces. Second, both featural and configural face processing contribute to the other-race-effect.

22.4

The effect of perceptual expertise on visual short-term memory

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Visual working memory (VWM) capacity is larger for faces than other complex objects. Inversion reduces capacity for faces more than nonfaces (Curby and Gauthier, 2007). These findings suggest that VWM is influenced by the encoding processes employed by face experts. Scolari, Vogel and Awh (2008) found that perceptual expertise enables a more detailed memory, instead of a larger WM capacity, for faces than nonfaces. Since people are more expert at recognizing own-race than other-race faces, we investigated whether this advantage is due to a higher resolution of own-race face representations. Six study items (Chinese and Caucasian faces, shaded cubes) were simultaneously shown on screen on each trial. After a short delay, a single image was presented. Participants were asked to judge whether this image was the same or different from the item that originally appeared in that location. Neither own-race nor other-race faces showed an inversion effect when stimuli changed between categories (face to cube, cube to face). However, an inversion effect was found for both own-race and other-race faces when changes occurred within a category (face to face, cube to cube). These results suggest that both own-race and other-race faces are stored with high resolution in working memory.

22.5

Holistic processing happens at later, task-specific stages of face processing

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We examined whether holistic processing, a hallmark of face perception, took place at an early stage of face processing shared by all facial judgments, or at later stages specific for processing different facial information such as identity, expression and gender. In Study 1, a composite paradigm was used where the two face halves could differ in identity, expression, or both. Participants' performance on recognizing the identity (or expression) from half of the face was influenced by incongruent identity (or expression) from the other half, but unaffected by incongruent expression (or identity) from the other half. This indicates that holistic processing of identity and expression are independent of each other. In Study 2, we found that the magnitude of holistic processing for identity and expression as measured by separate face composite tasks were not correlated across individuals. In Study 3, we also found no correlation between the magnitudes of holistic processing for identity and gender. The dissociation found between holistic processing of different facial information suggests that holistic processing does not originate from the general visual encoding required for all facial judgments. Instead it emerges later in processes devoted specifically to different facial judgments.

22.6

Holistic processing and right hemisphere lateralization do not always go together – Evidence from computational modeling

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Studies on face recognition have suggested a relationship between holistic processing and right hemisphere (RH) lateralization. Thus, it has long been assumed that holistic processing is a property of RH processing. Nevertheless, recent studies showed reduced holistic processing and increased RH lateralization in Chinese character recognition expertise, suggesting that these two effects may be separate processes. Through computational modeling, in which we implement a theory of hemispheric asymmetry in perception that posits a low spatial frequency bias in the RH and a high spatial frequency bias in the left hemisphere (i.e. the Double Filtering by Frequency Theory, Ivry & Robertson, 1998), here we show that when the recognition task relies purely on featural information, holistic processing increases whereas RH lateralization decreases with increasing stimulus similarity, and there is a negative correlation between them. In contrast, when the recognition task relies purely on configural information, although holistic processing also increases whereas RH lateralization decreases with increasing stimulus similarity, there is no correlation between them. This result suggests that holistic processing and RH lateralization are separate processes that can be influenced differentially by task requirements.

22.7

Voxel size, dependent measures, or similarity to faces? Review and comparison of various possibilities on explaining the mixed FFA-expertise correlation results

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One of the unsolved debates in imaging neuroscience is whether the fusiform face area, or FFA, is specific to faces or also to the objects of expertise category. The extant literature shows that more studies reporting failures of finding significant expertise-FFA correlations, seemingly supportive of the face specificity hypothesis of FFA. However, systematic comparisons of these literature suggest that at least part of the reasons might be due to the inter-study differences on voxel size differences ($3 \times 3 \times 7$ vs. $3 \times 3 \times 3$ mm3, for example), various dependent measures (e.g, summed t-scores vs. beta coefficients, and different indices of measures, such as [Birds minus Objects] vs. [Birds vs. Cars]), or similarity of expertise stimuli (e.g., Greebles vs. birds/cars) to faces. All these differences have yet to be systematically compared, and in this study we re-analyzed two lab-owned dataset (one has been found a positive and significant FFA-expertise correlation, another not) by resampling into 3 different voxel sizes ($3 \times 3 \times 3$, $3 \times 3 \times 5$, and $3 \times 3 \times 7$ mm3), with 3 dependent measures (summed-t, beta, and percent signal changes). Our results suggest that one should

always list, and hopefully examine, all the possible source of variations before final conclusion.

22.8

Optimal viewing position in Face recognition

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The existence of an optimal viewing position (OVP) in visual word recognition has been consistently reported. For English words, the best recognition performance is usually obtained when the initial fixation is directed to the left of the word center. This effect has been argued to involve interplay of different variables, including perceptual learning, i.e., people prefer fixating at word beginnings during reading, and hemispheric asymmetry, i.e., fixating at word beginning projects most of the word to the left hemisphere, where language processes are lateralized. Here we examine the OVP in face recognition. Previous research showed that people prefer to fixate the left side of a face when viewing faces, suggesting the OVP in face recognition should be to be left of the center. Nevertheless, face processing has been shown to have right hemisphere lateralization, suggesting the OVP should be to the right of the center in order to project most of the face to the right hemisphere. Our results showed that the best face recognition performance was obtained when the initial fixation was directed to the left of the center. This result suggests that perceptual learning has greater influence on the OVP in face recognition than hemispheric asymmetry.

22.9

Preference and familiarity for emotional face

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It is commonly assumed that happy face should be preferred over sad face, and yet tragic dramas and sad songs are popular and seem better memorized. Related studies showed that sad faces are perceived as more familiar than happy faces (Sergerie, et al., 2007), and familiar faces are preferred over novel ones (Park et al., 2010; Liao et al., 2011). Connecting these two lines of studies would lead to a paradoxical conclusion that people should prefer seemingly familiar faces, namely, sad faces. We examine this by pairing an emotional face (happy or sad) with a neutral face of the same identity. All faces were new and viewed only once for each participant. The task was to rate relative preference and familiarity on the paired faces. Results showed that happy faces were preferred over neutral faces whereas sad faces were less preferred, providing empirical support for the common belief. However, while happy faces did not show any bias on familiarity judgment, sad faces were perceived as less familiar than neutral faces, inconsistent with Sergerie et al. (2007). That less favorable sad faces also appear less familiar suggests close relationship between familiarity and preference for sad faces but not for happy ones.

22.10

The effect of attractiveness on recognition memory when women look at female faces

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In previous studies, the relationship between facial attractiveness and memory has been inconsistent. We investigated the effect of facial attractiveness on recognition memory in terms of gender and judgment contents. Both female and male facial images were judged for their attractiveness and personal character, and incidental memory was tested later. Recognition performance was shown as d' and analyzed with 2 (participant's gender) x 2 (condition of attractiveness) ANOVA. The interaction was significant for female faces but not for male faces. It is, therefore, suggested that the difference of gender affects the recognition memory concerning facial attractiveness. In particular, attractiveness of female faces had different effects for female participants when compared to other combinations. As a control, the interaction for female faces was not significant when the task was to judge the physical features such as the size of eyes and the angle of mouth. In sum, unattractive faces were better recognized than attractive faces in general except for the case when women judged attractiveness of female faces. These results suggest that there may be an effect of attention to attractiveness on recognition memory that is particularly strong when women look at female faces.

22.11

Facial features can induce emotion: Evidence from affective priming tasks

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Our previous study found that schematic faces with direct gazes, with mouths, with horizontal oval eyes, or without noses, tend to be perceived as in negative emotion. In this study we further explore these factors by the affective priming task. Faces were taking as prime, and positive or negative words were probe. The task was to judge the valence of the probe. If the faces could induce emotions, a target word with the same emotional valence should be judged faster than with opposite valence (the congruency effect). Experiment 1 used the most positive and negative rated faces in previous study as the primes. The positive faces were with vertical oval eyes and without mouth, while the negative faces were with horizontal eyes and with mouth. Results of 34 participants showed that those faces indeed elicited congruency effects. Experiment 2 manipulated gaze directions (N = 16). After the task the participants were asked to rate the prime faces. According to their rating, faces with direct gaze was perceive as positive, and elicited congruency effect with positive words in affective priming task. Our data thus support the conjecture that shape of eyes, the existence of mouths, and gaze directions could induces emotion.

22.12

The impacts of facial tones and stimulus durations on perceived oldness and attractiveness

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Two experiments were conducted to investigate the impacts of facial tone and stimulus duration on perceived oldness and judgement of attraction. The stimulus were facial images of Asian. Facial tone (bright, middle, dark) and stimulus duration (50ms, 200ms, 800ms) were manipulated. In experiment 1, perceived oldness was measured and in experiment 2, attractiveness was evaluated. The results showed that face was perceived older and less attractive with increase facial tone facial regardless of stimulus duration. This suggest that perceived oldness and judgement of attraction are closely related and affected primarily by facial tone.

22.13

Observer's mood manipulates level of visual processing: evidence from face and non-face stimuli

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For investigating the effect of observer's mood on level of processing of visual stimuli, happy or sad mood was induced in two groups of participants through asking them to deliberate one of their sad or happy memories while listening to a congruent piece of music. This was followed by a computer-based task that required counting some features (arcs or lines) of emotional schematic faces (with either sad or happy expressions) for group 1, and counting same features of meaningless combined shapes for group 2. Reaction time analysis indicated there is a significant difference in RTs after listening to the sad music compared to happy music for group 1; Participants with sad mood were significantly slower when they worked on local levels of schematic faces with sad expression. Happy mood did not show any specific effect on reaction time of participants who were working on local details of emotionally expressive faces. Sad mood or happy mood had no significant effect on reaction time of working on parts of meaningless shapes. It seems that sad mood as a contextual factor elevates the ability of sad expression to grab the attention and blocks fast access to the local parts of the holistic meaningful shapes.

22.14

Visual Scanning in the Recognition of Facial Affect in Traumatic Brain Injury

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We investigated the visual scanning strategy employed by a group of individuals with a severe traumatic brain injury (TBI) during a facial affect recognition task. Four males with a severe TBI were matched for age and gender with 4 healthy controls. Eye movements were recorded while pictures of static emotional faces were viewed (i.e., sad, happy, angry, disgusted, anxious, surprised). Groups were compared with respect to accuracy in labelling the emotional facial expression, reaction time, number and duration of fixations to internal (i.e., eyes + nose + mouth) and external (i.e., all remaining) regions of the stimulus. TBI participants demonstrated significantly reduced accuracy and increased latency in facial affect recognition. Further, they demonstrated no significant difference in the number or duration of fixations to internal versus external facial regions. Control participants, however, fixated more frequently and for longer periods of time upon internal facial features. Impaired visual scanning can contribute to inaccurate interpretation of facial expression and this can disrupt interpersonal communication. The scanning strategy demonstrated by our TBI group appears more 'widespread' than that employed by their normal counterparts. Further work is required to elucidate the nature of the scanning strategy used and its potential variance in TBI.

22.15

Perceiving direction of a walker: effect of body appearance

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Human can perceive others' walking direction accurately even with 117ms observation (Sato, et al., ECVP2008). We aimed to see whether appearance of walker's body affects the accuracy of perceiving direction of the walker. Thus, we employed three different appearances: realistic human computer-graphics body (CG-human), non-realistic cylinder-assembled body (Cylinders), and point-light walker (Points). We made a three-dimensional model of an adult-size walker who walked at a place. CG-human stimuli were generated by rendering the model with smooth shading. We made Cylinders stimuli by replacing body parts such as arms, legs, head, and hands with cylinders. Points stimuli were made by tracking 18 positions (mostly joints) of the body like biological motion. One of walkers was presented for 117, 250, 500 or 1000ms while its direction was randomly varied by 3deg steps to 21deg left or right. Observers judged whether the walker was walking toward them (hit) or not (miss), and self-range was measured in terms of the standard deviation for hit distributions. The perceived self-range was narrowed with long duration, and with CG-human stimulus. It is suggested that the accuracy of perceiving walker's direction depends on body appearance, and it is higher for human-like body than non-human body.

22.16

Modulation of the object/background interaction by spatial frequency

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With regard to the relationship between object and background perception in the natural scene images, functional isolation

hypothesis and interactive hypothesis were proposed. Based on previous studies, the present study investigated the role of spatial frequency in the relationship between object and background perception in the natural scene images. In three experiments, participants reported the object, background, or both after seeing each picture for 500 ms followed by a mask. The authors found that (a) backgrounds were identified more accurately when they contained a consistent rather than an inconsistent object, independently of spatial frequency; (b) objects were identified more accurately in a consistent than an inconsistent background under the condition of low spatial frequencies but not high spatial frequencies; (c) spatial frequency modulation remained when both objects and backgrounds were reported simultaneously. The authors conclude that object/background interaction is partially dependent on spatial frequency.

22.17

Consistency of likability to objects across views and time

Ryosuke Niimi[1] (niimi@L.u-tokyo.ac.jp), Katsumi Watanabe[1] ; [1]RCAST, The University of Tokyo

Human object recognition is largely independent of conditions in which objects are viewed, although affective impressions to the objects may be influenced by viewing conditions. To what degree does viewing condition alter our subjective likability to objects? We tested the effects of viewpoint (frontal view and three-quarter view) and viewing durations (100, 500, and 1000 msec) on the subjective likability to 32 common objects (e.g., vehicles, furniture, stationery). Participants observed the object images on the computer display and rated their likability of the objects by 7-point Likert scale. The viewing conditions affected the likability; the mean rated likability was higher for three-quarter view than for frontal view, and higher for longer duration. However, the object-wise correlations of rated likability were fairly high and significant between the object orientations and among the durations, indicating that the rank order of the objects were largely consistent across the viewing conditions. Our findings suggest that the mechanism for determining likability to visual objects may be composed of two components; one is sensitive to viewing condition and another is robust against viewing condition.

Cognition

Saturday, 16 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

22.18

The image characteristics for perceived naturalness

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To identify the visual characteristics that make a scene looks nature, we investigated the relationship between the distribution of spatial frequency spectrum of an image and its perceived naturalness. The image database contains outdoor images whose perceived naturalness were rated by human observers. Each image was Fourier transformed to the frequency domain. The power spectrum of each image was radial averaged across orientation and then fit with a straight line on log-log coordinates. The slope of the fitted line represents the characteristics of the spatial frequency spectrum of the image. The perceived naturalness increased with the decrease of the spectrum slope. The correlation between these two factors was significant. That is, our result suggests that increasing high spatial frequency content makes a scene more nature for observers. Thus, increase high spatial frequency content in an urban visual environment by planting more trees and adding more detail object or separation line to the architecture façade should make it more like nature environment.

22.19

The effects of novelty and familiarity on beauty perception

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In order to investigate how novelty and familiarity affect on beauty perception, fractal images were presented 5 times over 14 weeks. Fractal images are unfamiliar to people, hence used in this study to control their previous experience. Total 800 fractal images were divided into 5 groups (160 images X 5 group), and 3 groups of images were presented to participants each time for 5 times. The results showed that while beauty perception is decreased until the 3rd exposure, but increased from 3rd to 5th exposure. These results suggest certain level of repeated exposure is necessary for subjects to become familiar, which in turn affect on beauty perception.

22.20

Sex discrimination: Two dimensional hand representations suggest pan-stimulus effects

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Whether buying fruit or negotiating a peace deal, the sexes of the people involved affect the style of their interactions with each other. Indeed, even such an 'objective' act as measuring blood pressure has been found to be influenced by an interaction between patient and observer sex (Millar & Accioly, 1996). As such, understanding the perceptual and neural correlates of the ability is important. Here we tested observer sensitivity to sex cues using a new partial body stimulus set: Static two-dimensional representations of human hands. Our data show that whilst availability of cues including absolute size, colour and texture enhances discrimination, those cues are not required for reliable performance on the task. Moreover, patterns of sensitivity arising in relation to hand stimuli show marked similarities with those associated with other stimulus sets – suggesting the existence of pan-stimulus effects. Implications of those findings for models of the

perceptual and neural correlates of sex discrimination are discussed.

22.21

Individual differences in spatial knowledge acquisition from a virtual environment: An eye-tracking study

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Previous studies have shown that spatial knowledge acquisition differs across individuals in both real and virtual environments. For example, in a real environment, Ishikawa & Montello (2006) showed that some participants had almost perfect configural knowledge of the environment after one or two learning trials, whereas others performed at chance even after repeated learning trials. Using a virtual version of Ishikawa & Montello's layouts, we measured eye movements while participants were learning a layout of a route, as eye movements are shown to be closely linked to performance in spatial navigation tasks. We prepared three different layouts of a route depicted in a desktop virtual environment, along with the locations of 4 landmarks on that route. After learning each of the routes, we administered three different measures of spatial knowledge: numbering the landmark order, estimation of direction, and map sketching. Self-reported sense-of-direction (SDQ-S) was also measured. Behavioral analyses showed positive correlations across the routes in the estimation of direction. However, consistent correlations were not observed between eye movements and performance of the estimation of direction in each route. Those results suggest that eye movements do not predict individual differences in spatial knowledge acquisition.

22.22

Enhancing Assisted Living Technology with Extended Visual Memory

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Human vision and memory are powerful cognitive faculties by which we understand the world. However, they are imperfect and further, subject to deterioration with age. We propose a cognitive-inspired computational model, Extended Visual Memory (EVM), within the Computer-Aided Vision (CAV) framework, to assist human in vision-related tasks. We exploit wearable sensors such as cameras, GPS and ambient computing facilities to complement a user's vision and memory functions by answering four types of queries central to visual activities, namely, Retrieval, Understanding, Navigation and Search. Learning of EVM relies on both frequency-based and attention-driven mechanisms to store view-based visual fragments (VF), which are abstracted into high-level visual schemas (VS), both in the visual long-term memory. During inference, the visual short-term memory plays a key role in visual similarity computation between input (or its schematic representation) and VF, exemplified from VS when necessary. We present an assisted living scenario, termed EViMAL (Extended Visual Memory for Assisted Living), targeted at mild dementia patients to provide novel functions such as

hazard-warning, visual reminder, object look-up and event review. We envisage EVM having the potential benefits in alleviating memory loss, improving recall precision and enhancing memory capacity through external support.

22.23

Attention Inhibition Training Can Reduce Betel Nut Chewing Time

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Betel nut (or areca) is the fourth most commonly used drug worldwide after tobacco, alcohol, and caffeine. Many chemical ingredients of betel nut are carcinogenic. We examined whether the manipulation of attentional inhibition toward the areca-related stimuli could affect betel nut chewing time. Three matched groups of habitual chewers were recruited: inhibit-areca, inhibit-non-areca and control. This study consisted of a Go/No-Go task for inhibition training, followed by a taste test for observing chewing behavior. The Go/No-Go task constituted three phases (pretest, training and posttest). In the taste test, the habitual chewers were asked to rate the flavors of one betel nut and one gum. The purpose (blind to the chewers) of this taste test was to observe whether their picking order and chewing time were affected by experimental manipulation. Results from the Go/No-Go task showed successful training. Further, the training groups (the inhibit-areca and inhibit-non-areca groups) showed a significant reduction in betel nut chewing time, in comparison to the control group. Since both training groups showed reduced chewing time, the inhibition training may affect general control ability, in regardless of the stimulus (areca or not) to be inhibited. Reduced chewing time is important for reducing areca-related diseases.

22.24

Roles of time hazard in perceptual decision making under high time pressure

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The drift diffusion model (DDM) has been successful in capturing the joint dynamics of accuracy and latency data in various perceptual decision making tasks. We evaluated how well the DDM describes dynamics of perceptual decision when subjects were under a varying degree of time pressure. We collected choice and latency responses from human subjects, who discriminated the size of a thin ring stimulus with a varying degree of uncertainty. The degree of time pressure was manipulated both by giving subjects an explicit instruction of different time limits across sessions (.7 ~ 1.2 s) and by providing feedback to responses that were made later than those time limits. When fitted to the data of choice and latency, the three major variants of the DDM (with static bounds & gain, with time-varying bounds, and with time-varying gain) showed a systematic pattern of latency-dependent prediction errors. Here we propose a new variant of the DDM, which adopts a

Saturday Sessions

'boundary for time hazard' on the time axis in addition to the choice boundary on the choice-evidence axis in decision space. Our model did not exhibit the biased pattern of errors and was superior than the other models in goodness of fit to the data.

Reading & Learning

Saturday, 16 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

22.25

The development of spatial configuration processing of visual word forms

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The analysis of spatial relationship, or configuration, among the components of a character is important for visual word form recognition (Kao et al., 2010). We investigated such spatial configuration processing in dyslexics and developing populations. Four types of characters: real- and non-characters and their upside-down versions were used in this study. The task of the observers was to determine whether two characters presented on the display were identical. One group of dyslexic children (Dys) and two groups of non-dyslexic controls, one (RL) matched Dys in reading performance and the other (CA) matched in age, were recruited in this study. Dys performed significantly worse than the control groups for all character types, suggesting a worse visual word form processing in dyslexics. For Dys and CA, the proportional correct response for the upright real characters was better than that for their upside-down versions. RL, (which was younger) showed the same effect for the non-characters. Since the non-characters disrupts the global configuration while the inverted characters disrupted both local and global configurations, our results suggest that younger children recognize a word with an analysis of the local configuration while older children, regardless whether they are dyslexics or not, analyze the global configuration.

22.26

Visual statistical learning works after binding the temporal sequences of shapes and spatial positions

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The human visual system can acquire the statistical structures in temporal sequences of object feature changes, such as changes in shape, color, and its combination. Here we investigate whether the statistical learning for spatial position and shape changes operates separately or not. It is known that the visual system processes these two types of information separately; the spatial information is processed in the parietal cortex, whereas object shapes and colors are detected in the temporal pathway, and, after that, we perceive bound information in the two streams. We examined whether the statistical learning operates before or after binding the shape and the spatial information by using the "re-paired triplet" paradigm proposed by Turk-Browne, Isola, Scholl, and Treat (2008). The result showed that observers acquired combined sequences of shape and position changes, but no statistical information in individual sequence was obtained. This finding suggests that the visual statistical learning works after binding the temporal sequences of shapes and spatial structures and would operate in the higher-order visual system; this is consistent with recent ERP (Abla and Okanoya, 2009) and fMRI (Turk-Browne, Scholl, Chun, and Johnson, 2009) studies.

22.27

Improvement of Reading Speed and Eye Movements

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Although many studies have examined eye movements in reading, little is known which factors differentiate slow and fast readers. Recently, Rayner et al. (2010) reported that fast readers had a larger effective visual field than did slow readers by using the gaze-contingent window method. The fast readers they selected, however, may have acquired better attentional skills inherently or through long experience, and this visual superiority would improve reading performance. To clarify this issue, we investigated eye movements in reading while practicing speed reading. Participants (approx. 600 letters per minute in Japanese) exercised speed reading programs for half an hour per day for about 30 days. Reading performance of Japanese editorial articles was recorded every five days of training by the gaze-contingent window method. Our results showed that the size of the effective visual field did not increase in the same manner as reading speed (up to 1000 lpm). Instead, we found that saccadic length became longer and less varied. Fixation duration and the number of regressions were also reduced. These findings suggest that efficiency of comprehension at a single gaze may be the important factor for reading speed.

22.28

I RAN fast and I remembered what I read : The relationship between reading, rapid automatic naming and auditory and visual short-term memory

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Although rapid automatic naming (RAN) speed and short-term auditory memory are widely recognised as good predictors of reading ability in most age groups the predictive value of short-term memory for visually presented digits for reading and RAN in young typically developing learner readers (mean age 91.5 months) has seldom been investigated. We found that visual digit span is a better predictor of reading ability than auditory digit span in learner readers. A significant correlation has also been found between RAN speed and visual, but not

auditory digit span. These results suggests that RAN speed may be a good predictor of a child's future reading ability and eventual fluency because like visual digit span, it is a measure of rate of access to memory for the visual icons and their semantic name and meaning. The results also suggest that auditory memory is not an important factor in young children learning to read.

22.29

Differential hemispheric processing in the recognition of Chinese characters with different structures in foveal and parafoveal vision

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Whether foveal representation in reading is initially split and contralaterally projected to different hemispheres or bilaterally projected remains a controversial issue. Here we examine visual field asymmetry effects in naming Chinese characters with different structures, with characters presented either to the left visual field or the right visual field (RVF), and either within or outside foveal vision (eccentricity). We show that overall the RVF advantage in naming characters was significant in both eccentricity conditions (fovea vs. parafovea), with a stronger effect in parafoveal vision. This suggests that foveal splitting may not be an all-or-none phenomenon but has a graded effect. When examining characters with different structures separately, this interaction between visual field and eccentricity was significant only in the dominant, right-heavy character structure type, but not in the minority left-heavy or symmetric structure types, suggesting a modulation of character structure or type frequency on the eccentricity effect. In addition, existence of a phonetic radical modulated the visual field asymmetry effect differentially in different character structure types; however this effect did not interact with eccentricity. This result thus suggests that character structure and existence of a phonetic radical have differential modulation on character processing in the foveal and parafoveal vision.

22.30

Temporal dynamics of the modulation of character structure and phonetic radical in Chinese character processing – an ERP study

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Chinese orthography, with semantic and phonetic radicals configured in different character structures, provides a unique opportunity to examine visual word processing. Previous ERP research showed that when participants silently named centrally presented characters, there was greater left hemisphere lateralization in N170 amplitude for sP characters (right-heavy, with a semantic radical on the left and a phonetic radical on the right) than Ps characters (the opposite configuration), suggesting that characters with different structures are processed differently in the brain. Here we utilize four additional character types, sS (right-heavy, no phonetic radical); Ss (the opposite configuration); Syp and Sys characters (symmetric structure, with and without phonetic radical respectively) to further examine how phonetic radical

and character structure influence Chinese character processing. A significant interaction was found between character structure and hemisphere in P120 latency, suggesting that the modulation of character structure happens as early as 120 ms after the stimulus onset. Furthermore, the hemispheric asymmetry effects in N170 and P200 were found to be influenced by both phonetic radical and character structure, while N350 appeared to be modulated by phonetic radical only. These findings demonstrate that the modulation of character structure and phonetic radical have different time courses in Chinese character processing.

22.31

Changes of transient visual evoked potentials in dyslexic children

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Objectives: To investigate the characteristics of Visual Evoked Potentials (VEP) in dyslexics. Methods: Fourteen children, 7 dyslexics and 7 control, aged 7 to 8 years were recruited. All dyslexic subjects were diagnosed by clinical psychologist. All subjects are from mainstream primary schools in Hong Kong, using Chinese and Cantonese as their primary written and spoken language, having normal visual acuity and IQ. Children with reported emotional or behavioral problems or binocular vision problem were excluded. All the subjects participated in pattern-reversal VEP measurements binocularly with 1000msec recording time. Four conditions of stimulations (checkersize: 180 min of arc) were applied. (1) 5-Hz at 15% contrast (2) 5-Hz at 1% contrast (3) 15-Hz at 15% contrast (4) 15-Hz at 1% contrast Results: At 15% contrast stimulus, dyslexic subjects showed smaller amplitudes in both frequencies compared with the control group, especially in higher frequency. At 1% contrast stimulus, dyslexic subjects also showed smaller amplitudes in both frequencies and obvious reduction was observed at the later part of the recording period. No observable difference was showed in the latency of both contrast conditions. Conclusion: The attenuated VEP responses in higher frequency at low contrast condition in dyslexic group showed the changes of the transient visual response and this implies an abnormality in magnocellular pathway in dyslexia.

22.32

Coherent Motion detection in illiterate, literate and dyslexic readers in Papua New Guinea

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Individuals with dyslexia have often been found to have deficits in coherent motion processing, an index of global dorsal stream functioning. In studies involving pre-literate children it has been demonstrated that there could be a relationship between dorsal stream functioning and poor reading ability, lending weight to the claim that dorsal stream deficits may contribute to reading failure. This research looks at coherent motion sensitivity in adult illiterate readers and matched literate and dyslexic readers. The coherent motion sensitivity of lliterate

and literate adult readers from Papua New Guinea, and dyslexic readers from Australia were examined to see if research in adults could likewise illuminate the discussion on the role of dorsal stream functioning in reading ability. The results of this analysis will be discussed as well as possible areas for further investigating the relationship between dorsal stream function and reading ability.

22.33

Perceptual Templates Improvement through Action Video Game Playing and Comparison to Perceptual Learning

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Action video game playing substantially improves visual performance; however, the source of this improvement remains unclear. Here we use the equivalent external noise technique to characterize the mechanism by which action video games may facilitate performance (Lu & Dosher, 1998). In first study, Action Video Game Players (VGPs) and Non-Action Video Game Players (NVGPs) performed a foveal orientation identification task at different external noise levels. VGPs showed lower thresholds than NVGPs with a marked difference at different noise levels. Perceptual Template Model fitting indicated that there were an 11% additive noise reduction and a 25% external noise exclusion. The causal effect of action video game playing was confirmed in a following 50 hour training study, This work establishes that playing action video games leads to robust internal addictive and external noise exclusion, consistent with the use of better matched perceptual templates. To investigate the discrepancy between our results and previous fovea perceptual learning research (Lu et al, 2004), same stimuli in previous experiment were used in perceptual learning experiment and we find same perceptual template improvement pattern. This suggest both action video game playing and perceptual learning could lead to better perceptual template.

Perception and Action

Saturday, 16 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

22.34

Optic flow information influencing heading perception during rotation

Diederick C. Niehorster[1] (dcniehorster@hku.hk), William H. Warren[2] , Li Li[1] ; [1]Department of Psychology, The University of Hong Kong, [2]Deptartment of Cognitive, Linguistic, and Psychological Sciences, Brown University

We investigated what roles global spatial frequency, surface structure, and foreground motion play in heading perception during simulated rotation from optic flow. The display (110°Hx94°V) simulated walking on a straight path over a ground plane (depth range: 1.4-50 m) at 2 m/s while fixating a target off to one side (mean R/T ratios: ±1, ±2, ±3) under six display conditions. Four displays consisted of non-expanding dots that were distributed so as to manipulate the amount of foreground motion and the presence of surface structure. In one further display the ground was covered with disks that expanded during the trial and lastly a textured ground display was created with the same spatial frequency power spectrum as the disk ground. At the end of each 1s trial, observers indicated their perceived heading along a line at the display's center. Mean heading biases were smaller for the textured than for the disk ground, for the displays with more foreground motion and for the displays with surface structure defined by dot motion than without. We conclude that while spatial frequency content is not a crucial factor, dense motion parallax and surface structure in optic flow are important for accurate heading perception during rotation.

22.35

Roles of reference object and extra-retinal information in path perception from optic flow

Joseph C. K. Cheng[1] (josephck@hku.hk), Li Li[1] ; [1]Department of Psychology, The University of Hong Kong

In this study, we investigate the role of reference objects and extra-retinal information on path perception. In Experiment 1, the display simulated an observer traveling on a circular path over a textured ground or a textured ground with 20 posts (depth range: 5-20m). The simulated observer gaze direction was pointed to a target (1)on the path at 30° away from the initial heading, (2)at 15° outside of the path, (3)at 15° inside of the path, or (4)along the Z-axis of the simulated environment. Furthermore, path performance was similar for the two display conditions and consistent with our previous findings, indicating that reference objects did not help path perception. In Experiment 2, instead of pointing to the target, the simulated observer gaze direction pointed to the instantaneous heading thus the target moved on the screen rendering pursuit eye movements. Compared with data from Experiment 1, path performance was more accurate and less affected by path curvature, indicating that extra-retinal signals improved path perception. We conclude that the presence of reference objects do not improve path perception when the scene contains rich optic flow information. Extra-retinal information helps observers accurately estimate path rotation and thus contribute to accurate path perception.

22.36

Effects of viewpoint jitters onf roll vection

Shinji Nakamura[1] (shinji@n-fukushi.ac.jp); [1]Department of Clinical Psychology, Nihon Fukushi University

It has been revealed that random viewpoint jitters or periodical viewpoint oscillation superimposed in visual stimulus which simulates the observer's self-motion can enhance visually induced self-motion perception (vection), even if there are sustained conflicts between visual and vestibular information. The effects of jitter/oscillation have been confirmed both using forward self-motion induced by expanding display and

horizontal linear self-motion induced laterally moving visual pattern. In the present investigation, we examined whether jitter/oscillation advantage would affect visually induced self-rotation (roll vection) induced by rotating visual pattern. In psychophysical experiments with 12 undergraduate participants, we compared perceived strength of roll vection between the stimulus conditions where simulated viewpoint jitters were superimposed or not. The results indicated that viewpoint jitters significantly weakened strength of perceived self-rotation. On the other hand, random roll component superimposed in pure radial expanding pattern can enhance illusory forward self-motion. These results suggest that the effects of viewpoint jitter would affect differently on linear vection induced by expanding optical flow and circular vection induced by visual rotation.

22.37

Errors in perceived self-motion along a circular path persist in the presence of scene information

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Recent evidence suggests that observers have difficulty perceiving path curvature from optic flow when curvature is not accompanied by simulated view rotation. In this study, we investigated whether scene structure could reduce such biases. Landmarks provide reference objects, and a familiar scene might allow self-motion to be perceived from multiple static views. We tested three scenes: textured ground with no landmarks, with landmarks in a fixed configuration, or with landmarks in randomly varied configuration. In the fixed landmark condition, observers were pre-trained to learn the configuration. Observers viewed 1s displays of simulated self-motion along circular paths, with various curvature, and adjusted a pole to lie on their perceived future path. Two pole distances were tested to assess perceived path curvature. Across all conditions, judgments showed errors consistent with underestimation of path curvature, and a bias toward the center of the screen. The presence of landmarks did not reduce these biases, nor improve precision of judgments. In contrast to some previous studies, we found no benefit from rich scene structure. We argue that the biases observed here are due to use of instantaneous optic flow, which provides insufficient information in these conditions even when a scene has rich structure.

22.38

Discriminating Drivers through Human Factor and Behavioral Difference

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Since Greenwood and Woods'(1919) study in tendency of accident, many researchers have insisted that various human factors (sensation seeking, anger, and anxiety et al.) are highly correlated with reckless driving and traffic accidents. Oh and Lee(2011) designed 'Driving Behavior Determinants Questionnaire', a psychological tool to predict danger level of drivers and discriminate them into three groups (normal, unintentionally reckless, and intentionally reckless) by their characteristics, attitude, and expected reckless behavior level.

This tool's overall accuracy of discrimination was 70%. This study aimed to prove that the discrimination reflects the behavioral difference of drivers. Twenty four young drivers were requested to react to the visual stimuli (tests for subjective speed sense, simple visual reaction time, and left turning at own risk). The results showed no differences in subjective speed sense among the driver groups, which means drivers' excessive speeding behaviors occur due to intention based on personality and attitude, not because of sensory disorders. In addition, there were no differences in simple reaction time among driver groups. However, the results of the "Left turning at drivers' own risk task" revealed significant group differences. All reckless drivers showed a greater degree of dangerous left turning behaviors than the normal group did.

22.39

The age differences in estimating speed of drivers' own

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This study focused on estimating speed of drivers' own. The aim of this study is to investigate the age differences in accuracy of estimating speed. Participants were 61 drivers: 20 young (aged 20-39 years), 19 middle-aged (40-59 years), and 22 older drivers (60+ years). The participants watched each of two driving scenarios, showing either a guardrail-equipped or a concrete median. The participants were asked to push a button when they perceived speeds of 60 km/h. The accuracy of estimating speed was estimated by the square of variance; which take 60(target speed) from response speed. The result of two-way analysis of variance showed a main effect of age and an interaction effect of age and median. The accuracy of estimating speed was the highest in middle-age group in both guardrail and concrete conditions. The accuracy in young drivers was the lowest in guardrail condition. In concrete condition, it was the lowest to the accuracy of speed estimating of older drivers .

22.40

How Do Parameters of Motor Response Influence Selective Inhibition? Evidence from the Stop-signal Paradigm.

Chien Hui Tang[1] (u9383025@gmail.com), Erik C. Chang[1] ; [1]Institute of Cognitive and Neuroscience , National Central University, Taiwan

The ability to selectively inhibit the execution of an action while performing other ones is crucial in humans' multitasking daily life. The current study aims to compare selective inhibition for choice reaction involving two effectors or response directions. We adopted a variation of the stop-signal paradigm to examine how selective inhibition is modulated by the way potential motor responses are combined and inhibited. Experiment 1 investigated selective inhibition under different combinations of effectors, namely "index and middle fingers" versus "hand and foot". The results showed SSRT of the index finger was longer when the other response option was the foot than the middle finger. Experiment 2 examined how selective inhibition differs between selective stopping of effectors and movement directions, and that for most of the situations SSRT is longer for stopping a response based on its direction than effector. After

equating complexity of response mapping between direction and effector conditions in Experiment 2, Experiment 3 still showed that SSRT differs between selecting direction or effectors. To summarize, SSRT varies depending on the way response effectors are paired and selectively stopped. Selective inhibition is thus likely not amodal and may involve different inhibitory mechanisms depending on parameters specifying the motor response.

22.41

The Truth-telling Motor Cortex: Response Competition in M1 Discloses Deceptive Behaviour

Aviad A. Hadar[1] (aviad8880@gmail.com), Stergios Makris[1] , Kielan N. Yarrow[1] ; [1]Department of Psychology, City University

Recent studies have suggested that circuits associated with response conflict and response inhibition are strongly implicated in deception. Using single-pulse transcranial magnetic stimulation (TMS), we examined whether conflict between competing responses in primary motor cortex (M1) can be used for discriminating between intentionally false and true facial recognition. Participants used little finger and thumb key-presses to lie or tell the truth regarding their familiarity with a series of famous and non-famous faces. Single-pulse TMS was administered to M1 at three intervals prior to response execution in order to evoke motor evoked potentials (MEPs) in both Abductor Digiti Minimi (ADM) and first dorsal interosseous (FDI) of the right hand. As predicted, we found that the MEP of the non-responding digit was greater than the MEP of the responding digit when participants prepared to engage in deception, while a mirror-reversed pattern was observed for truth telling. This effect did not interact with the stimulation interval suggesting consistent activation of the motor plan representing the truth throughout the response preparation process. We discuss these results with reference to models of response selection and procedures for the detection of deception.

22.42

The Neural Computation on Animal Collision Detection

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Promotion: The time-to-collision (TTC) in collision course is a critical neural computation for an animal to response quickly and accurately on collision detection, such as to avoid a looming object. The physical formula of TTC was not feasible for neural computation realization. Our work: We deduce a new approximation of TTC, i.e. $1/\tau = M\theta - P/(\theta+Q) + N$, where θ is the visual angle subtended to the incoming object while M,P,Q and N are constants determined by a practical collision course. Accordingly, we construct a neural computational model (NCM) to carry out the TTC. Results: The simulated results showed that NCM with neurons of sigmoid response can accurately estimate TTC and well reconstruct the practical animal collision experiments. Conclusion: The NCM might be a potential and realizable neural computation mechanism on animal collision detection.

22.43

Vection Induced by Consistent and Inconsistent Multisensory Stimulation

April E. Ash[1] (april@uow.edu.au), Stephen A. Palmisano[1] , Juno Kim[2] ; [1]School of Psychology, University of Wollongong, [2]School of Psychology, University of Sydney

This study examined physical and simulated self-motion along the horizontal and depth axes. Subjects viewed optic flow which consisted of: (i) a component that simulated constant velocity self-motion; and (ii) a component that simulated oscillation of their viewpoint. In active self-motion conditions, the latter flow component was either in- or out-of-phase with the observer's own (tracked) oscillatory head movements. In passive self-motion conditions, stationary subjects simply viewed playbacks of the oscillating displays generated in previous physical self-motion conditions. We found that adding active in-phase horizontal oscillation to radial flow resulted in a modest vection advantage compared to active out-of-phase horizontal oscillation and passive horizontal display oscillation conditions. By contrast, when actively generated fore-aft display oscillation was added to either radial or lamellar flow we found similar vection strength ratings for both in-phase and out-of-phase depth oscillation. We conclude that multisensory input can enhance the visual perception of self-motion in some situations, but may not have to be consistent (i.e. ecological) to generate compelling vection in depth.

22.44

Temporal Characteristics in Detecting Imminent Collision Events on linear trajectories

Rui Ni[1] (), Yan Zhuo[2] , Jennifer Teves[1] ; [1]Psychology Department, Wichita State University, Wichita, Kansas, USA 67260, [2]Institute of Biophysics, Chinese Academy of Sciences, Beijing, China 100101

Previous research (Andersen & Kim, 2001) has shown that a linear trajectory collision event is specified by objects that expand and maintain a constant bearing (the object projected location in the visual field). In this research, we investigated the temporal characteristics in detecting such imminent collision events. Two experiments were conducted in which participants were presented with displays simulating a single approaching object in the scene while observers were either stationary or moving at one of the 3 speeds (24, 36, or 48 km/h). An object traveled for 9 seconds before colliding with or passing by the observer and the relative speed between object and observer remained constant. Participants were asked to report whether the object was on a collision path or not. In the first experiment, 3 seconds or 4 seconds of displays were presented that ended at the same 2-second time to contact (TTC) position. In the second experiment, 3 seconds of displays were presented that ended at different TTC positions. Results show that observers were more accurate in collision detection in stationary condition than in motion. More importantly, results suggest that observers used information on bearing change rate to distinguish non-collision objects from collision objects.

Sunday Talks

Reading and crowding

Sunday, July 17, 1:30 pm - 3:30 pm
Talk Session, Library Extension 4
Chair: Janet H. Hsiao

31.1, *1:30pm*

Word type frequency alone can modulate hemispheric asymmetry in visual word recognition: Evidence from modeling Chinese character recognition

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In Chinese orthography, a dominant structure exists in which a semantic radical appears on the left and a phonetic radical on the right (SP characters); the minority, opposite arrangement also exists (PS characters). Recent studies showed that SP character processing is more left hemisphere (LH) lateralized than PS character processing; nevertheless, it remains unclear whether this is due to phonetic radical position or character type frequency. Through computational modeling with artificial lexicons, in which we implement a theory of hemispheric asymmetry in perception that posits differential frequency bias in the two hemispheres (i.e. the DFF theory, Ivry & Robertson, 1998), but do not assume phonological processing being LH lateralized, we show that although phonetic radical position, visual complexity of the radicals, and character information structure may all modulate lateralization effects, the difference in character type frequency alone is sufficient to exhibit the effect that the dominant type has a stronger LH lateralization than the minority type. Further analysis suggests that this effect is due to higher visual similarity among characters in the dominant type as compared with those in the minority type. This result demonstrates that word type frequency alone can modulate hemispheric lateralization effects in visual word recognition.

31.2, *1:45pm*

Bilinguals Have Different Hemispheric Lateralization in Visual Word Processing from Monolinguals

Sze-Man Lam[1] (fannylam@graduate.hku.hk), Janet Hui-Wen Hsiao[1] ; [1]Department of Psychology, The University of Hong Kong

Previous bilingual studies showed reduced hemispheric asymmetry in visual tasks such as face perception in bilinguals compared with monolinguals, suggesting experience in reading one or two languages could be a modulating factor. Here we examined whether difference in hemispheric asymmetry in visual tasks can also be observed in bilinguals who have different language backgrounds. We compared the behavior of three language groups in a tachistoscopic English word sequential matching task: English monolinguals (or alphabetic monolinguals, A-Ms), bilinguals with an alphabetic-L1 and English-L2 (alphabetic-alphabetic bilinguals, AA-Bs), and bilinguals with Chinese-L1 and English-L2

(logographic-alphabetic bilinguals, LA-Bs). The results showed that AA-Bs had a stronger right visual field/ left hemispheric (LH) advantage than A-Ms and LA-Bs, suggesting that different language learning experiences can influence how visual words are processed in the brain. In addition, we showed that this effect could be accounted for by a computational model that implements a theory of hemispheric asymmetry in perception (i.e. the Double Filtering by Frequency theory, Ivry & Robertson, 1998); the modeling data suggested that this difference may be due to both the difference in participants' vocabulary size and the difference in word-to-sound mapping between alphabetic and logographic languages.

31.3, *2:00pm*

The Influence of Writing Experiences on Holistic Processing in Chinese Character Recognition

Ricky Van Yip Tso[1] (richie13@hku.hk), Terry Kit-Fong Au[1] , Janet Hui-Wen Hsiao[1] ; [1]Department of Psychology, University of Hong Kong

Holistic processing has been shown to be a behavioral marker of face recognition and object recognition in experts. In contrast, Hsiao and Cottrell (2009) showed that reduced holistic processing is a marker of visual expertise in Chinese character recognition. Here we tested Chinese-literates who can read and write Chinese characters (Writers) and literates whose reading performance far exceeded their writing ability (Limited-writers). We found that Writers perceived Chinese characters less holistically than Limited-writers. In addition to Hsiao and Cottrell (2009)'s findings, our study further showed that such reduction in holistic processing can be explained by writing experience in Chinese. This result may be because Chinese Writers exhibit a better awareness of the orthographic components of Chinese characters than Limited-writers due to their writing experience. This study also showed that Limited-writers are better at recognizing a character embedded in a word of a familiar font than when it is alone or of an unfamiliar font, suggesting that their reading performances depend on both the context and font familiarity. This study is also the first to report on the Chinese reading population that has far poorer writing performance than reading performance.

31.4, *2:15pm*

Holistic processing of Chinese characters

Alan Chun-Nang Wong[1] (alancnwong@gmail.com), Cindy M. Bukach[2] , W. S. Yuen[1] , Lizhuang Yang[1] , Shirley Leung[2] , Emma Greenspon[2] ; [1]Department of Psychology, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, [2]Department of Psychology, University of Richmond, Richmond, VA, USA

Enhanced holistic processing (obligatory attention to all parts of an object) has been associated with different types of

perceptual expertise involving faces, cars, fingerprints, musical notes, English words, etc. Curiously Chinese characters are regarded as an exception, as indicated by the lack of holistic processing found for experts (Hsiao and Cottrell, 2009). The ceiling performance of experts, however, may have caused this null effect. We revisit this issue by adopting the often-used face-composite sequential-matching task to two-part Chinese characters. Participants matched the target halves (left or right) of two characters while ignoring the irrelevant halves. Both Chinese readers (experts) and non-Chinese readers (novices) showed holistic processing. Follow-up experiments suggested different origins of the effects for the two groups. For experts, holistic processing was sensitive to the amount of experience with the characters, as it was larger for words than non-words (formed by swapping the two parts of a valid character). Novices, however, showed similar degree of holistic processing to words and non-words, suggesting that their effects were more related to their inefficient decomposition of a complex, character-like pattern into parts. Overall these findings suggest that holistic processing may be a marker of expertise with Chinese characters, contrary to previous claims.

31.5, *2:30pm*

Music reading expertise selectively improves categorical judgment with musical notation

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Different domains of perceptual expertise often lead to different hemispheric engagement (e.g. Kanwisher et al., 1997). Recent work suggests that the neural substrates engaged in musical reading are shifted from left hemisphere novice processing to bilateral processing in experts (Wong & Gauthier, 2010). To relate this shift to behavior, we tested whether music-reading training improves categorical and coordinate perceptual judgments, which are argued to rely on the left and right hemisphere respectively (Kosslyn et al., 1989). Music-reading experts and novices judged whether two sequentially presented music sequences were identical. The notes were either on a staff (categorical) or without a staff (coordinate) in either trained or untrained (90º rotated) orientations. Experts performed better than novices for categorical judgments, and the advantage was larger for the trained than untrained orientation. The two groups performed similarly for coordinate judgments. Music-reading fluency predicted performance in categorical judgments in the trained orientation in experts, while it predicted performance in all conditions in novices. This suggests that music-reading training selectively improves categorical judgments in the trained orientation, while music-reading ability in novices reflects general perceptual ability with notes. Future studies will clarify how these findings are related to the hemispheric shift in music-reading expertise.

31.6, *2:45pm*

Musical sight-reading expertise: cross modality investigations

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It is often said that expert musicians are capable of hearing what they read and vice versa. This suggests that they are able to process and to integrate multimodal information. The study investigates this issue with an eye-tracking technique. Two groups of musicians chosen on the basis of their level of expertise (expert and non-experts) had to read excerpts of classical piano music and play them on a keyboard. In half the conditions, the participants heard the music before the reading phases. The excerpts contained suggested fingering of variable difficulty (difficult, easy, or no fingering). Analyses of first-pass fixation duration, second-pass fixation duration, probability of refixations, and playing mistakes validated the hypothesized modal independence of information among expert musicians as compared to non-experts. The results are discussed in terms of amodal memory for expert musicians, and they extend clearly our previous findings (Drai-Zerbib & Baccino, 2005). The talk will demonstrate that more experienced performers are better able to transfer learning from one modality to another, which can be in support of theoretical work by Ericsson and Kintsch (1995): more experienced performers better integrate knowledge across modalities. This view relies on the general flexibility shown in the experts' behaviour.

31.7, *3:00pm*

Crowding of upright Chinese character is stronger with inverted than upright flankers: an exception of the similarity rule

Siu-Fung Lau[1] (jonathan01hk@gmail.com), Sing-Hang Cheung[1]; [1]Department of Psychology, HKU

Upright flanking faces have stronger detrimental effects on the recognition of upright target face, than inverted flanking faces. One possible explanation for this "flanker-inversion effect" was that the more holistically processed upright flanking faces allowed for more erroneous feature integration. Alternatively, crowding was known to be stronger when target and flankers were more similar. Here we investigate flanker-inversion effect on crowding in Chinese character identification. Five normally-sighted young adults participated. Targets of size 1.2° were presented at 5° in the lower visual field. Four flankers with center-to-center distance of 1.8° were presented in the crowded condition. Three types of flankers were used, upright or inverted Chinese and upright Korean characters. The identification contrast thresholds were estimated by QUEST and crowding strength was measured through threshold elevation (TE). Crowding on upright Chinese target was significantly stronger with inverted Chinese flankers (TE=1.59±0.32) than with upright Chinese flankers (TE=1.47±0.29). No inversion effect was observed for inverted Chinese target. Korean flankers produced similar crowding as upright Chinese flankers. Our results go against the similarity rule that predicts upright Chinese flankers would produce stronger crowding for upright Chinese target. Holistic processing preferred for inverted Chinese characters may account for the findings.

Full report uncovers correctly identified but incorrectly positioned target information under visual crowding

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Current models attribute visual crowding to feature pooling, limited attentional resolution, and flanker substitution that compromise the identity of the target flanked by additional objects. An untested hypothesis is that the flankers may sometimes only disturb the target's perceived position, not its identity, which also causes report errors. To test this hypothesis, observers were asked to report either the central target of a three-letter string (partial report), or all letters (full report), in alternating blocks of trials. In full report, the rate of reporting the central target to the central position was comparable to that in partial report. Importantly, there was also a significant rate of reporting the correct target identity but at a wrong flanker position, supporting our hypothesis. Error analyses indicated that target-flanker position swapping and misalignment underlay observed target misplacement. In addition, target misplacement was only significant in radial, but not tangential, stimulus orientations, and could be observed at both short and long durations. Our results thus suggest a new and previously unknown crowding mechanism that interferes with the perceived position of a correctly identified target. The new mechanism, along with previously revealed ones that impair target identity, provides a more comprehensive account of visual crowding.

Sunday Posters

Multisensory

Sunday, 17 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

32.1

The Hong Kong Peak Tram Illusion

Ping-Hui Chiu[1] (chiupinghui@gmail.com), Hiu-Mei Chow[1] , Chia-Huei Tseng[1], Lothar Spillmann[2] ; [1]Department of Psychology, The University of Hong Kong, [2]Graduate Institute of Neural and Cognitive Sciences, China Medical University, Taiwan, ROC

Hong Kong Peak Tram Illusion is the perceived slant of buildings towards the peak away from the vertical while observers travel on the Hong Kong peak tram. We measured the perceived tilt of the buildings from true vertical (illusion size) using a rotary pitch while an identical pitch read the slope of the hill. The illusion was hypothesized to be jointly determined by at least four factors: (i) the reclining position of the observer, (ii) the frame of the tram window, (iii) the direction of motion, and (iv) additional reference cues from outside the window. Our results showed that the illusion: (i)

was reduced by up to 20% when observers sat with a wedge on their back and up to 40% when they stood up. (ii) remained even when observers moved closer to the window to avoid the effect of the frame. (iii) was 20% larger when the tram was descending, as opposed to ascending. (iv) was less apparent during the day. The illusion appears to be due to integration of the above sensory information as it cannot be accounted for by each factor alone. The illusion provides a unique venue to study cross-modal sensory interaction in the nature setting.

32.2

Visual and haptic size perception of stimulus length, area and volume

Shoko Doi[1] (dodon888@gmail.com), Shigeko Takahashi[2] , Yoshio Ohtani[1] ; [1]Graduate School of Science and Technology, Kyoto institute of technology, [2]Psychology Laboratory, Department of Fine Art, Kyoto City University of Arts

Visual and haptic size perception of length (1D), area (2D) and volume (3D) was investigated with the magnitude estimation method. In the visual condition, subjects viewed lines, outlined circles or shaded spheres presented on LCD monitor, and assigned numbers to the perceived length, area or volume of the stimuli. In the haptic condition, subjects grasped rectilinear, cylindrical or spherical blocks which were occluded from subjects' view and assigned numbers. For both conditions, the data were well described by power functions of length, area or volume of the stimuli, and exponents of the power functions became smaller with increasing dimensionality. For the visual (but not haptic) condition, when the data were described by power functions of length (for 1D) or diameter (for 2D and 3D), exponents were approximately constant at around1.0. This suggests that the determinant of the visual size perception for 2D and 3D stimuli may be length rather than area or volume. The critical role of 1D cue for the visual size perception may cause elongation bias, as termed by Holmberg (1975).

32.3

Semantic Representations In 3D Perceptual Space

Suncica Zdravkovic[1] (szdravko@f.bg.ac.rs), Petar Milin[1] ; [1]Department of Psychology, Faculty of Philosophy, Novi Sad, Serbia

Barsalou's (1999) perceptual theory of knowledge echoes the pre-20th century tradition of conceptualizing all knowledge as inherently perceptual. Hence conceptual space has an infinite number of dimensions and heavily relies on perceptual experience. Osgood's (1952) semantic differential technique was developed as a bridge between perception and semantics. We updated Osgood's methodology in order to investigate current issues in visual cognition by: (1) using a 2D rather than a 1D space to place the concepts, (2) having dimensions that were perceptual while the targets were conceptual, (3) coupling visual experience with another two perceptual domains (audition and touch), (4) analyzing the data using MDS (not factor analysis). In three experiments, subjects (N=57) judged five concrete and five abstract words on seven bipolar scales in three perceptual modalities. The 2D space led to different patterns of response compared to the classic 1D space. MDS revealed that perceptual modalities are not equally informative for mapping word-meaning distances (Mantel min = -.23; Mantel max = .88). There was no reliable differences due to test administration modality (paper vs. computer), nor scale

orientation. The present findings are consistent with multidimensionality of conceptual space, a perceptual basis for knowledge and dynamic characteristics of concepts discussed in contemporary theories.

Physiology

Sunday, 17 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm

Poster Session, Loke Yew Hall

32.4

A New Acute Attack of Angle Closure Glaucoma Animal Model With Healon 5

Silvania Y. F. Lau[1] (silvania.lau@gmail.com), Kwok Fai So[2], Amy C. Y. Lo[1], Henry H. L. Chan[3], Jimmy S. M. Lai[1]; [1]Eye Institute, The University of Hong Kong, [2]Department of Anatomy, The University of Hong Kong, [3]School of Optometry, The Hong Kong Polytechnic University

Acute angle closure glaucoma (AACG) is an ocular emergency and sight -threatening disease in which the intraocular ocular pressure (IOP) rises suddenly due to blockage of aqueous humor outflow. It can cause permanent loss in visual acuity and visual field. In animal study, the well-established model to study AACG is by fluid infusion and by adjusting the bottle level, a high IOP can be induced in a few seconds. However, there is no blockage of aqueous outflow and the pressure rise is unrealistically fast. To mimic human AACG, we suggest to use Healon 5, an ophthalmic viscosurgical device, which is injected intracamerally to block the aqueous outflow. The IOP is allowed to build up naturally. We found that, with this technique, the IOP elevated at a rate of 0.57 mmHg/min before it hit 40 mmHg, which is considered as AACG in human. The maximum IOP registered was above 70 mmHg. Thinning of retinal nerve fiber layer (RNFL) and neural cells lost were seen. Visual function evaluated by ERG showed reduction in a-wave, b-wave, photopic negative response (PhNR) and oscillatory potentials (OPs) activities. In conclusion, Healon 5 is effective in inducing acute transient rise in IOP which mimics human AACG.

32.5

Investigation of retinal spatial interaction using mfERG stimulation

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Introduction: Adaptation is one of the key characteristic of our vision which can maximize the visual function. It applies to both spatial and temporal characteristics. The fast flickering stimulation characteristics of the multifocal electroretinogram (mfERG) can be applied to analyze retinal interactions between flashes and to investigate retinal temporal processing mechanism. Besides, its localized stimulus pattern can also be used as a tool for investigation of retinal spatial interaction.

Methods: The mfERG recordings were obtained from 13 eyes of 9, normal, six-week-old Yorkshire pigs. The control mfERG was measured using the pattern consisting of 103 non-scaled hexagons, where each hexagon will follow a pre-set m-sequence. Nine isolated hexagons from the 103 non-scaled pattern were chosen in the masking mfERG stimulation, where the remaining hexagons were kept at constant luminance. First-order and the second-order kernel responses were analyzed, which represent the outer and inner retinal responses, respectively. Results: The second-order kernel response amplitude from the visual streak region showed a significant enhancement under the masking stimulation. Conclusions: The enhancement found under the masking condition indicates that the retinal signal will be suppressed under surrounding flicker stimulation, and this spatial inhibitory mechanism may originate from the inner retina.

32.6

Lectin from Agaricus Bisporus Suppresses Akt Phosphorylation and Arrests Cell Cycle Progression in Primary Human Retinal Pigment Epithelial Cells

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Anomalous retinal pigment epithelial (RPE) cells have been implicated in the development of retinal diseases. Lectin from the edible mushroom Agaricus bisporus (ABL) was found to inhibit growth of RPE cells. To elucidate the mechanism through which ABL inhibits RPE cell proliferation, we investigated the changes in cell proliferation-related signaling pathways and cell cycle distribution patterns. Primary human RPE cells were grown with or without the lectin (ABL) supplement (20ug or 90ug/ml) for three days. Phosphorylation statuses of Akt, Jnk and p38 as well as p53 expression level were investigated by Western blotting. Cellular distributions in various cell cycle phases were investigated using flow cytometry. After ABL treatment (90ug/ml), Akt was found to be hypo-phosphorylated while the expression levels of p53, phosphorylated-Jnk and phosphorylated-p38 were not altered. The amount of cells present at S phase was reduced. Our results showed that ABL hypo-phosphorylated Akt and this observation is in line with the finding that ABL could attenuate cell proliferation. As the level of p53 was not significantly altered by ABL, this suggested that the mechanism in which ABL arrested cell proliferation was independent of Akt-mediated MDM2 activation but was possibly mediated by altering G1 to S phase transition.

32.7

The Protective Effects of Lycium Barbarum Polysaccharides on Transient Retinal Ischemia

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Retinal ischemia/reperfusion (I/R) injury leads to irreversible neuronal death, glial activation, retinal swelling and oxidative stress. It is a common feature in various ocular diseases, such as glaucoma, diabetic retinopathy and amaurosis fugax. In the present study, we aimed to evaluate the effects of Lycium Barbarum Polysaccharides (LBP) in a murine retinal I/R model. Mice were orally treated with either vehicle (PBS) or LBP (1mg/kg) daily for 1 week before induction of retinal ischemia. Retinae were collected after 2 hours ischemia and 22 hours reperfusion. Paraffin-embedded sections were prepared for immunohistochemical analyses. Significantly fewer viable cells were found in vehicle-treated retinae comparing to LBP group. This finding was further confirmed by TUNEL assay where significantly fewer apoptotic cells were identified in LBP-treated retinae. Additionally, retinal swelling induced by retinal I/R injury in the vehicle-treated group was not observed in LBP-treated group. Moreover, intense GFAP immunoreactivity and IgG extravasation were observed in vehicle-treated group but not in LBP treated group. The results showed that pre-treatment with LBP was protective in retinal I/R injury via reducing neuronal death, apoptosis, retinal swelling, GFAP activation and blood vessel leakage. LBP may be used as a preventive agent for retinal ischemia diseases.

32.8

The Antagonistic Interaction of Cones in Human Eyes - a Pilot Study

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Multifocal electroretinogram (mfERG) by Sutter (1992) provides a measuring tool of the retinal responses at different locations. Traditional mfERG stimulus at each base period is a pseudorandom m-sequence focal flash. By interleaving seven dark frames between the focal flashes, a slow-sequence stimulus can be formed to trigger retinal responses which are originated predominantly from the bipolar cells and inner retinal cells. In this study, the antagonistic interaction of cones in human eye was investigated by this slow-flash mfERG (sfmfERG) under different colour stimuli (white and blue colour conditions). The N1, P1 and photopic negative response (PhNR) of the sfmfERG were used to investigate the effect on the local retinal responses. It was found that the blue stimulus could trigger greater amplitudes of the N1, P1 and PhNR than the white stimulus did. In terms of the implicit time, the white stimulus would trigger P1 and PhNR with longer implicit time than the blue stimulus. White stimulus provides a broader spectrum signal than blue stimulus. The changes of cone responses from a broad to narrow spectrum stimulation may illustrate a decrease in the involvement of retinal antagonism and thus leads to an increase in amplitude and a decrease in implicit time.

32.9

Fabrication of prototype of artificial retina adapted to a curved image plane based on arrayed PMMA microfibers

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The traditional visual prosthesis combines both a camera and an electrode array implanted on the visual neural networks. Here, we introduce a new design of artificial retina which integrate the transmission of image and the electrical stimulation of cortical neurons on a single PMMA micro fiber. It is comprised of multiple PMMA microfibers with both ends connected with one flexible and one rigid substrates. The flexible one is a PDMS mold of microrods and ready to conform to a curved image plane. The rigid one is in the form of a silica plate coated with a PMMA thin film and could be attached to a CMOS image sensor for the evaluation of its optical performance. The multiple PMMA microfibers were directly drawn from liquid PMMA thin film with PDMS rods. With arrayed PMMA microfibers, the image planes could be transferred from the flexible to rigid substrate. Each PMMA microfiber delivers a part of the image the PDMS mold transmits. Incorporated with O/E convertors, each micro fiber could function as an unit of electrical stimulation in accordance with part of the image the artificial retina delivered and is ready to function as a cortical neural prosthesis in the future application.

32.10

The cellular origins of chick global flash multifocal electroretinogram

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Purpose: The aim of this study was to obtain a better understanding of the cellular contributions to the chick global flash mfERG by using a pharmacological dissection method. Method: Global flash mfERGs were recorded from 11 white leghorn chicks (Gallus gallus). The inner retinal response was suppressed by injection of tetrodotoxin (TTX) and N-methyl-D-aspartic acid (NMDA). Responses from ON- and OFF-pathway were isolated by further injection of 2-amino-4-phosphonobutyric acid (APB). Results: The global flash mfERG of white leghorn chicks consist of a direct component (DC) originated from outer retina and a late induced component (IC) originated from the inner retina which are comparable to the global flash mfERG responses from primate, porcine and human. The ON- and OFF- responses found in chicks are also similar to that of porcine and primate with the N1 component is mainly from OFF-bipolar responses and the ON-response contributes mainly in the P1 component. Conclusion: Because of the similarities for the global flash mfERG found in chick to other species, this makes the possibility of using chick retina as a potential animal model for eye research in the area of mfERG.

32.11

Haze estimation of crystalline lens by contrast sensitivity as a function of scattering light intensity

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Cataract is one of the most typical age-related eye diseases. As the cataract progresses, the crystalline lens becomes hazier and the visual ability deteriorates. Since the main cause of visual impairment is light scattered by the hazy crystalline lens inside eyeball, both brighter environments and hazier lenses worsen visual ability. In this study, increase of contrast thresholds were measured for pseudo-cataract subjects (young subjects with foggy filters of known haze factor) when the intensity of scattering light was increased. The rate of increase was larger with higher haze factor of lens. We propose, as an easy method for assessing the degree of cataract, the haze estimation of crystalline lens using the obtained contrast threshold as a function of scattering light intensity.

32.12

Culture of Iris Pigment Epithelial Cells on Expanded-polytetrafluroethylene (ePTFE) Substrates for the Treatment of Age-related Macular Degeneration

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Introduction: Transplantation of an intact differentiated retinal pigment epithelial (RPE) cell layer may provide a means to treat Age-Related Macular Degeneration (AMD). However, harvesting RPE cells can be a technically complicated procedure. Our current work aimed to prepare intact differentiated iris pigment epithelial (IPE) cell layers, which are easy to obtain and have the same embryonic origin and similar properties as RPE cells, on ePTFE substrates for transplantation purposes to rescue deteriorated photoreceptors in AMD. Methods: IPE cells isolated from rat eyes were seeded on different substrates, including fibronectin n-heptylamine (HA) ePTFE substrates, HA ePTFE substrates, ePTFE substrates and fibronectin tissue culture polystyrene (TCPS) as control. Cell number and morphology were assessed at each time interval. The formation of tight junction was examined by immunostaining of junction proteins. Results: An obvious increasing trend of cell number was observed in IPE cells on fibronectin n-heptylamine (HA) ePTFE substrate, exhibiting heavy pigmentation and epithelial morphology. At Day 28, tight junction formation was indicated by cell-cell junctional proteins along cell borders. Conclusion: Harvested IPE cells cultured on fibronectin HA-ePTFE substrates can differentiate and form a cell monolayer that may be suitable for transplantation.

32.13

The effect of contact lens correction and accommodation upon monochromatic higher order aberrations in myopia and hyperopia

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Purpose: To measure the effects of contact lens correction and accommodation upon SA in myopia and hyperopia. Methods: Eleven myopes (Average MSE -3.22±2.21D; mean age 20.7±1.1 years) and eleven hyperopes (Average MSE 4.20±2.20; mean age 20.1±1.5) participated. Subjects were corrected with daily disposable contact lenses and pupil dilation was induced with 2.5% phenylephrine hydrochloride. SA was measured at accommodation stimulus levels of 0D and 4D, using the Zywave Aberrometer while subjects viewed a high contrast letter target array in a +5D Badal system, aligned perpendicularly to the measurement axis of the instrument via a semi-silvered mirror. Results: For 0D of accommodation, the hyperopic group had significantly (p<0.01) greater positive SA. Contact lens correction produced a positive shift in SA in the hyperopic group (p<0.01), whereas there was a negative shift in SA in the myopic group (p<0.01). Negative shifts in SA were found with accommodation in both myopic (p<0.01) and hyperopic (p<0.01) groups, with the shift being greater in the hyperopic group (p<0.01). Conclusions: The net effect of contact lens correction and accommodation result in SA for near visual tasks, which is predominantly negative in myopia and positive in hyperopia.

32.14

Relation between visual acuity and slope of psychometric function in young adults

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Mita et al. (2010) devised a technique of comparing a visual acuity (VA) change in an individual with more accurate VA than conventional VA tests by significant difference examined logarithmic (Log) VA ± standard deviation (SD). Using this technique, in this study, we examined a relation between VA and the slope of the psychometric function in normal young subjects. Six occlusion foil conditions were employed (1.0, 0.8, 0.6, 0.4, 0.1 and without the foil) under a full refractive correction. Ten normal young adults (22.8 years old in average) who have no ophthalmologic disease except ametropia participated in the measurement. The experiment was carried out with the constant method, a series of ten Landolt rings were used and each ring was presented 20 times randomly in a measurement. A 5.6-inch type of liquid crystal display driven by a computer, which has 1,280×800 pixels spatial resolution, was used to present the stimulus. In the normal young adults, the slope of the psychometric function did not change as the VA change systematically, and there was almost no correlation between them (r =-0.103).

32.15

Improvement of visual acuity as an aftereffect of blur adaptation through a defocusing lens

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Our previous study has shown that blur adaptation through a foggy filter temporarily improved visual acuity (VA). Here we report the influence on VA from the adaptation to blurred

images by a defocusing lens. In the experiment, a subject adapted to the blurred visual field by observing motion pictures through a trial lens either of 2.5D, 3.0D, 4.0D, or 5.0D. The visual acuity was measured in the periods of pre- and post-adaptation by a quick and simplified staircase method with Landolt C. The moment the lens was removed, subject's VA was obviously higher than the original VA and then gradually returned to the original level in a few minutes. However the degree of transient improvement in VA was not necessarily larger with longer period of adaptation. The enhancement in VA demonstrated here is presumably caused by blur adaptation and its aftereffect. The usual VA might not be the optimum performance of the hardware of an eye, or rather, be suppressed by the visual system in the level of the cortex.

32.16

The Use of COVD-QOL Questionnaire in School Vision Screening

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Purpose: To evaluate the application of College of Optometrist in Vision Development (COVD) Quality of Life (QOL) questionnaire in vision screening for normal school children and children with learning disabilities (LD) and to determine appropriate referral-score for different target population. Methods: A total of 90 children (Normal: 45, LD: 45) who attended government primary schools aged between 6 to 12 years old were recruited. An interview session with normal children and parents or teachers in children with LD was made to determine visual symptoms using shorter version of COVD-QOL questionnaire. A comprehensive eye examination was performed after completion of the questionnaire. The evaluation was made base on the sensitivity and specificity for detection of refractive error, amblyopia, strabismus, vergence and accommodative disorders. Results: The mean score for normal children and children with LD were 22.47±10.75 and 12.24±8.72 respectively. Rapidity of the test in normal children and children with LD were 177.27±9.52 seconds and 162.16±16.58 seconds respectively. In normal children referral score of ≥20 showed highest sensitivity (66.7%) and specificity (95.8%) for detection of amblyopia. Sensitivity and specificity for referral-score of ≥20, ≥10 and ≥4 for detection of overall vision problems in children with LD were (20.4%, 100.0%), (54.5%, 100.0%) and (81.8%, 100.0%) respectively. Conclusion: COVD-QOL questionnaire was recommended as an easy, rapid and cost-effective tool for school vision screening. Different referral-score was suggested for different target population.

32.17

A simplified method of assessing the progress of a cataract based on deterioration in color discrimination by scattering light

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Cataract is one of the most typical age-related eye diseases. As a cataract progress, the crystalline lens becomes hazier and

visual ability deteriorates. Since the main cause of visual impairment is light scattered by the hazy lens, both brighter environments and hazier lenses worsen visual ability. In this study, error scores of 50 Hue test were measured for pseudo-cataract subjects (young observer with foggy filters of known as haze factor) when the intensity of scattering light was increased. The rate of increase in error score of 50 Hue test was larger with higher haze factor.We propose, as an easy method for assessing the progress of a cataract, the haze estimation of elderly crystalline lens using the obtained error scores of 50 Hue test as a function of the intensity of scattering light.

32.18

Neurotransmitter receptor bases of the long-rage interactions of cat striate cortical neurons revealed by in-vivo intracellular injection

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In the primary visual cortex, activity of neurons evoked by stimuli within the classical receptive field (CRF) can be modulated by stimuli in the extra-receptive field (ERF). This modulating effect can be facilitatory (F-ERF) or inhibitory (I-ERF) that play different roles in visual information processing. Little is known on the neurotransmitter receptor bases of the two types of long-range interactions. Using in vivo intracellular injection technique, combined with the technique of immunocytochemistry, we have studied the immunocytochemical features of the F-ERF and I-ERF neurons. Significant differences were found in type, density and distribution of neurotransmitter receptors between the two types of neurons. F-ERF neurons have densely distributed Glu2/3 receptors and relatively small amount of GABAA receptors on the surface of proximal dendrites and cell body, and the reverse is true for I-ERF neurons. As the Glu2/3 receptors are the main targets of excitatory synaptic input and the GABAA receptors are the main targets of inhibibory synaptic input, the differences in receptor characteristics between the I-ERF and F-ERF neurons may underlie the distinct long-range modulation effects of the two types of neurons.

32.19

Probing the perceptual functions of the human lateral geniculate nucleus and primary visual cortex with signal-detection theory: an fMRI study

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As the roles of the thalamic nuclei have become better understood, the traditional view of the human lateral geniculate nucleus as a mere relay station has been expanded. For example, robust effects of attentional modulation have been found in the LGN. Such effects have also been found in the primary visual cortex. Capitalizing on this, we used signal-detection theory to further our understanding into their relationship. In our study, subjects identify the presence of a low-contrast grating on a noise annulus pattern in a slow event-related fMRI paradigm (see Ress & Heeger, 2000). BOLD

responses were analyzed with a receiver-operator-characteristic (ROC) area under the curve (AUC) approach (e.g. Pessoa & Padmala, 2005), separating the target present/absent (or bottom-up) and response yes/no (top-down) regions. Preliminary results have identified adjacent and partially overlapping voxels of V1 and LGN that discriminate between bottom-up and top-down processing. Furthermore, other areas, like the posterior parietal and frontal cortices, were found to be similarly discriminative. Time-shifted correlation analysis between V1 and LGN is also underway. Our results further elaborate the role of the LGN and extend its involvement in perceptual decisions.

32.20

Negative BOLD in the Lateral Geniculate Nucleus: Neuronal Implications and Cortico-thalamic Feedback

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Previous research has demonstrated a sustained negative BOLD response (NBR) that is negatively correlated with the spatio-temporal properties of a visual stimulus. Whilst it has been suggested that the NBR surrounding the positive BOLD response (PBR) may reflect blood-stealing, evidence indicates that the extensive NBR distal to the PBR is a manifestation of neuronal suppression. This study aimed to evaluate NBR in the lateral geniculate nucleus (LGN), and to explore the source of the NBR. fMRI data were obtained from six subjects, while they viewed a grating stimulus. The NBR was identified in the LGN ipsilateral to the stimulus. The results also verified the NBR in V1 ipsilateral to the stimulus and revealed the PBR in bilateral V5. It was concluded that the NBR can be found in the LGN, and is most likely driven by feedback from ipsilateral V1. The finding that the stimulus that stimulates the LGN in one hemisphere can cause extensive suppression in the LGN of the opposite hemisphere rejects the notion that the effect is purely a blood-stealing effect as the two LGN have different blood supplies. The results, together with previous research, indicate that the NBR may reflect neuronal suppression.

32.21

The functional architecture of noise correlation in fMRI responses from human visual cortex

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When an identical stimulus is presented repeatedly, the activity of sensory cortical neurons varies from trial to trial, dubbed 'neuronal noise'. Recent electrophysiological and imaging studies reported that the 'noise' is not just a random and independent deviation from signal and reflects correlated activity among local cortical sites. Here we investigated the structure of correlated 'noises' in early human visual areas by monitoring moment-to-moment fluctuations in fMRI responses to visual stimuli. By defining receptive fields and stimulus preferences of individual voxels, we could reveal a reliable functional architecture of noise correlation: noise correlation was high in pairs of voxels whose stimulus preferences are similar and whose receptive fields are close to each other. The

analysis of residual correlation confirmed that this functionally defined structure of noise correlation could not be explained by trivial correlations due to anatomical proximity. The spectral analysis of time series revealed that the stimulus-preference-dependent correlation was maximal at a low (<0.035Hz) band of temporal frequency whereas the receptive field-dependent correlation was maximal at a medium (0.035~0.082Hz) band. Furthermore, the functional structure of noise correlation was held true for voxel pairs within and between different visual areas, regardless of the presence or types of visual stimulation.

Development

Sunday, 17 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm
Poster Session, Loke Yew Hall

32.22

Noise Exclusion Ability in Infants

Geroldene Tsui[1] (gtsui113@hku.hk), Hiu-Mei Chow[1] , Chia-Huei Tseng[1] ; [1]Department of Psychology, The University of Hong Kong

An important perceptual ability is to filter out background distractions from relevant information. However, prior research has not identified when this begins in humans. Our study aims to investigate whether noise exclusion ability occurs in infancy. Infants' contrast sensitivity function (CSF) was measured by a Baynesian adaptive inference method. Infants' attention was directed to the middle of a monitor where an 8.72 degree static Gabor grating was presented on the left or right side of the monitor. In half the trials, the grating was presented against a gray background; in the other half, against a 16% contrast random-dot noise background. The experimenter and two independent coders judged which side the infants gazed at (force-choice preferential looking paradigm). 100 babies aged from 4 to 10 months satisfied the 70% inter-rater consistency criterion for inclusion. Four parameters defined the best-fitted CSF for each infant. Of these, peak spatial frequency, bandwidth and truncation of CSF were similar in conditions with and without noise. The peak gain estimate was most significantly impaired by external noise, but a marked 31% improvement was observed in 7 – 10 month-olds. This may be the first sign of development of human's noise exclusion ability, and is worth further study.

32.23

With or without a hole: Young infant's sensitivity for topological

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Evidence from adult psychophysics, brain imaging, and honeybee's behavior has been reported to support the notion that topological properties are the primitives of visual representation (Chen, 1982). The present study aims to explore the question of how the sensitivity to topological property

might originate during development. Specifically, we tested 1.5- to 6-month-old infants' visual sensitivity for topological versus geometric properties with the forced-choice novelty preference technique. A disk and a ring were used in the topologically-different condition (Exp. 1), while a disk and a triangle were used in the geometrically-different condition (Exp. 2). The results showed that infants could reliably discriminate stimuli based on topological differences, but failed to do so based on geometric differences. Moreover, infants preferred the topologically-different figure (the ring) in the test phase of the generalization task. Further analysis on individual infants' age and performance revealed two distinct developmental trends. Infants seem to be sensitive to topological differences as young as 1.5 months while their ability to discriminate geometric differences was at chance before 3 months and gradually improves with age. Taken together, our findings suggested an early sensitivity for topological property, at least for the detection of stimuli with or without a hole.

Attention

Sunday, 17 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm

Poster Session, Loke Yew Hall

32.24

On the relationship between space- and object-based attention

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Visual attention research has suggested two distinct and complementary forms of selection: space- and object-based attention. Though attention can be allocated to regions of space as well as perceptual objects, the exact relationship between the two modes of selection is not fully understood yet. Egly, Driver, and Rafal (1994) first demonstrated spatial and object-based effects within a single paradigm. However, the space- and object-based reference frames overlapped – targets appeared at the cued location inside the cued object on a large majority of trials. The present study dissociated object and location using a variant of the Egly paradigm. Participants performed a shape discrimination task (T- vs. L-shaped stimuli) in which the target appeared at a cued or uncued location inside a cued or uncued object. The cue denoted object, but not spatial, validity. We found both spatial- and object-cueing effects, as well as an interaction between spatial and object validity – the object-based effect occurred at both uncued and cued locations, but was smaller when the spatial location was cued. The results suggest that selection is fundamentally location-based, which occurs automatically even under conditions of high object validity.

32.25

Object-based attention guided by an invisible object

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Many studies have demonstrated that attention can be object based. One line of evidence supporting object-based attention showed that observers respond to a target faster when the target and cue are in the same object than when they are in different objects, which is called the same-object advantage. By adopting the double-rectangle cuing paradigm (Egly, Driver and Rafal, 1994), we tested whether this advantage can occur with invisible rectangles. The original paradigm was slightly modified. Rectangles had a low luminance level against a dark background and were presented for only 10 ms, along with a cue or a target. These two characteristics rendered the rectangles invisible to subjects, as confirmed by a forced-choice test. We found a conventional object-based attention effect even when the rectangles were invisible. We also found that the object-based attention was dependent on the orientation of the rectangles presented along with the target, consistent with the finding by Ho and Yeh (2009). These results suggest that object based attention can be guided by an invisible object in an automatic way, with a minimal influence from the high level top-down control.

32.26

Search termination time in visual search is determined by expectation of target prevalence

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Reaction times for search termination decisions ("no" RTs) are shorter when targets are rarer (lower "target prevalence"). Is this "prevalence effect" a result of the observers' expectation of target prevalence or of repetition priming from repeated "no" responses? If number of repetitions determines "no" RTs, independent of target prevalence, evidence would favor a repetition priming account. In contrast, if implicit or explicit knowledge of the target prevalence determines "no" RTs, regardless of repetitions, evidence would favor an expectation account. In experiment 1, we conducted visual search tasks where prevalence varied across blocks, and analyzed correct rejection trials in time series. The main effect of number of repetitions was not statistically significant, but the main effect of target prevalence was statistically significant. In experiment 2, high-prevalence and low-prevalence trials were randomly mixed and the prevalence for the next trial was cued. The result showed that the "no" RTs in the low prevalence trials were still faster than those on high prevalence trials. These results suggest that the prevalence effect on the "no" RTs is the result of the expectation of target prevalence.

32.27

Eyes do not have it: A collinear salient line interferes with visual search responses but not eye movements

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Our previous study found that a task-irrelevant salient line impaired visual search when the salient line was composite of collinear bars (Jingling, 2010). In this study, we further investigated whether this inhibition can be observed in eye movements. The search display was a lattice of 21 by 27 bars. The task was to discriminate the orientation of a target, which was presented on one of seven bars in the central of search display. One of the columns of the bars was vertical, thus bars on this line were collinear to each other. The other bars were horizontal, making the collinear line salient. The target was on the bars at salient line by chance. Eight participants were recruited, and eye movements were recorded by EyeLink 1000 with 250 Hz sampling rate. Results of hand response times replicated our previous findings: Responses were slower for targets on the bars at the salient line than that in the background. However, saccadic duration was not statistically different for these two types of targets. Our data showed that a collinear salient line interferes with key press but not eye movements, suggesting that the inhibitory effect emerged later than sensory information process.

32.28

Two sudden onsets capture attention, but do not improve visual short-term memory

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Onset stimulus can capture attention and then transfer into visual short-term memory. It remains unknown whether two sudden onsets also capture attention and are stored in vSTM. We modified Belopolsky, Kramer, & Godijn's (2008) visual search paradigm to test this issue. Experiment 1 using one onset and replicated Belopolsky et al's results. Two onsets in Experiment 2 were found to capture attention; however, recognition performance for the onsets was only at chance level, showing poor memory. Experiment 3 used a retro-cue to test whether only one of these two onsets can be stored in vSTM. Experiment 4 tested whehter this poor recognition was caused by interference from meory probe. This study has important insights on how attention interacts with memory.

32.29

Dissociating goal-directed and stimulus-driven determinants in attentional capture

Louis K. H. Chan[1] (clouis@graduate.hku.hk), William G. Hayward[1] ; [1]Department of Psychology, University of Hong Kong

Although attentional capture is now a commonplace finding, the exact roles played by goal-directed and stimulus-driven determents remain elusive. An unsettled issue is on the relative contribution of attentional set and visual saliency. In the present study, we investigated this issue by mixing color and orientation search trials, so that distractors of either feature dimension fell into the current attentional set. In our test, color features were more salient. As a result, in orientation search, whereas a color distractor produced huge capture (109 ms), an orientation distractor produced moderate capture (50 ms). With color targets, distractors were not interfering. On one hand, these results reflect that relative salience of the target and the distractor is critical for producing capture; on the other hand, a huge capture size associated with a non-target dimension feature is novel. Similar previous measurements, but without matching the attentional set, consistently report attentional capture of only 20-30 ms. This comparison shows the role played by attentional set. Taken together, we suggest that visual saliency determines search order, and sets the platform for capture. However, attentional dwell time on the distractor is determined by how much it matches the current attentional set, and in turn explains the capture size.

32.30

The reference frame of IOR depends on how you measure it

Hannah M. Krueger[1] (h.m.krueger@abdn.ac.uk), Silke Jensen[1] , Amelia R. Hunt[1] ; [1]Department of Psychology, University of Aberdeen

Attention is biased from returning to recently-inspected locations, an effect known as Inhibition of Return (IOR). For IOR to facilitate visual search, it should be coded in spatial, not retinal, coordinates. Here we report two studies indicating that the reference frame of IOR is flexible and determined by task demands. When participants performed a manual target detection task with an intervening saccade between cue-offset and target-onset, we found retinotopic IOR. The cue occurred in one of four markers on the screen; this meant the target was more likely to occur in the spatiotopic location of the cue than in its retinotopic location. In a second experiment we inverted this pattern so that the target was less likely to occur in the retinotopic location of the cue. Now target detection was relatively facilitated in the retinotopic location and relatively inhibited in the spatiotopic location of the cue. However, spatiotopic IOR in this experiment was not as robust as retinotopic IOR in the previous experiment. These findings show that decreasing the probability of targets aligning with cues in retinotopic or spatiotopic coordinates increases IOR in that frame of reference, although IOR is more robustly retinotopic than spatiotopic in a traditional cue-target paradigm.

32.31

Does media multitasking always hurt?

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Chronic heavy media multitaskers have been found impaired cognitive performance on certain cognitive tasks (Ophir, Nass & Wagner, 2009). However, the poor performance may be caused by their breadth-biased style of cognitive control rather than a

deficit in cognitive abilities such as the ability to filter out interference from irrelevant stimuli and representations in memory. In this study, a new media multitasking index was invented to differentiate heavy and light media multitaskers by adding three open ended questions to the Media Use Questionnaire used by Ophir, Nass and Wagner (2009). Also, four different cognitive tasks, which access the ability of attentional capture, attention allocation to infrequent information, task switching and crossmodal integration, were used to investigate whether the poor performance of heavy media multitaskers is general to a wider range of tasks. Preliminary results found that heavy media multitaskers showed better improvement in accuracy between the sound present condition and sound absent condition of Pip and Pop Task (Van der Burg, Olivers, Bronkhorst, & theeuwes, 2008). Heavy media multitaskers appeared to have better ability of crossmodal integration than light medie multitaskers; hence, their poor performance is limited in only certain cognitive tasks.

32.32

Computational Modeling of Saliency from Image Histogram

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Computational model of image saliency plays an important role for vision tasks such as visual search and attention modeling. We developed a computational model that captures both shape and color image saliency based on histograms. The designed model has been evaluated over a set of fixation maps of 120 natural images that are recorded from 20 subjects for the purpose of saliency computation within visual cortex [Neil D. B. Bruce, et al, 2009]. We present four key observations. First, saliency in both image color and image shape can be efficiently computed by histograms that encode both local and overall distributions of image values in different color channels. Second, due to the use of image histogram the designed saliency model is much more tolerant to the variation of image scales compared with other common saliency models. Third, the designed saliency model is much more tolerant to image edges whereas other common saliency models are often biased towards image edges especially when the saliency is computed on a large image scale. Last but not least, the designed saliency model shows that compared with image brightness, image color contributes much more to the overall image saliency for natural scene images.

32.33

The Effects of Emotional Target and Mood State of Participants on Attentional Blink

Wai-Shan Chan[1] (gcws@hku.hk), Hiu-Mei Chow[1], Wenjin Tan[1], Chan Jeong Park[1], Chia-Huei Tseng[1] ; [1]Department of Psychology, The University of Hong Kong

Previous studies have found that attentional blink (AB), a failure to report targets temporally close to each other, can be attenuated separately by (1) emotionally significant test stimuli (T2) and (2) the emotional state of the observer. In the present study, we asked whether and how the (1) and (2) interact. Participants were induced with either positive or negative music and asked to complete an AB task which consisted of

low-arousal positive, neutral and negative words as T2. We found low arousal negative words significantly reduced AB more than did other words, while no main nor interaction effect for mood was observed. However, on repeating the experiment and replacing low arousal words with high-arousal ones we not only were able to replicate the finding of an advantage of negative words over others, but detected an effect for the mood of the observer: participants who were induced to become happier using music performed better in detecting T2 across lags and word categories than did participants who became sadder. Our findings suggest an interaction of arousal level of emotional target with the induced mood of participants although the underlying mechanisms responsible for this effect need further investigation.

32.34

Comparison of Single and Dual Target Visual Attention Tasks in Children With Down Syndrome

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Understanding the nature of attentional processing in children with Down Syndrome (DS) is imperative for developing effective education practices. The aim of the current study was to investigate whether children with DS exhibit impairment in sustained, transient, single-, or dual-target continuous performance tasks. Target detection time and accuracy was compared in children with DS to Typically Developing (TD) children of similar non-verbal mental age (as measured by the Raven's Coloured Progressive Matrices), on single and dual-target continuous performance tasks measuring sustained attention, a visual change detection task measuring transient attention, and feature and conjunctive visual search tasks measuring both sustained and transient attention. Results showed that children with DS performed similarly to TD children on sustained and transient attention tasks that only required the detection of a single unique target, but were impaired in overall accuracy on tasks that required dual-target detection. Findings suggest a possible impairment in attention and working memory in children with DS. Error analysis of task responses revealed differences in problem solving strategy between children with DS and TD children, despite similar overall performance. Findings have implications for the education of children with DS and understanding of the nature of intellectual disability per se.

32.35

How do we detect one's eye movements

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When we see someone in the front of us, how we get information from his (her) eyes? To understand how we pay attention to one's eye movements and when we notice the eye movements, we investigated the detection of eye movements. In the experiment, the observers were asked to judge the direction of one eye or both eyes by the 2AFC procedure in three tasks. In one of tasks, one face was presented and both eyes moved either rightward or leftward. In the remaining two tasks, only the right half side (or only the left side) of one face

was presented and the right (or the left) eye moved either rightward or leftward. The relationship between the detection thresholds based on correct judgments and the rotating degrees of eye movements was analyzed. The result showed that no difference of thresholds among tasks was found, although most observers preferentially looked at the right side of the face. However, observers detected the eye movements in the right direction more easily than the eye movements in the left direction, in the right half side of one face. These results suggest that the asymmetrical distributions of gaze fixations and the attention are not related.

Eye movements

Sunday, 17 July, 10:30 am - 12:00 pm, 3:45 pm - 5:15 pm

Poster Session, Loke Yew Hall

32.36

Spatial attention triggered by eye gaze: Evidence from a microsaccade study

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Although human spatial attention is elicited toward gaze direction of another, it remains one unanswered question whether shift of spatial attention elicited by gaze direction of another is exogenous or endogenous orienting. The purpose of this study is to examine which type of attentional orienting is related to attentional shift elicited by gaze direction. To pursue this question, we conducted the attentional cuing paradigm and measured microsaccades during the task. In experiment 1, a facial stimulus was positioned in the center of the screen as a gaze cue whose direction showed the validity of the target presentation. We measured microsaccades after presentation of the cue. In the result, microsaccade direction was toward cue direction only in the 200 – 400ms time window after presentation of the cue. In experiment 2, we conducted the anti-saccade task for directionally separating exogenous and endogenous orienting, thus, gaze direction and cue direction were different unlike experiment 1. The result of experiment 2 agreed with the results of experiment 1, therefore, microsaccade direction was toward cue direction, not gaze direction. These results indicate that spatial attention elicited by gaze direction is endogenous orienting, not exogenous orienting.

32.37

Involuntary eye movement during fixation is influenced by spatio-temporal frequency of visual stimuli

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Involuntary eye movement during fixation is essential for visual information acquisition. Previous studies have suggested that such eye movement depends on the attributes of visual stimuli (e.g. Yokota, APCV2010). In this study, we focus on spatio-temporal frequency, as an attribute of visual stimuli in order to understand spatio-temporal frequency property in the pathway of human vision. We measured eye movement during fixation for three subjects when 16 random-dot dynamic textures that have various frequency bands in spatially and temporally, are presented to the subjects as visual stimuli. The result shows that eye movement depends on the spatio-temporal frequency of visual stimuli. The eye movement includes higher frequency components, in other words, higher velocity components, when visual stimulus has higher spatial frequency and/or higher temporal frequency. Future detailed experiments will show that involuntary eye movement during fixation might be influenced by spatio-temporal frequency sensitivity in vision.

32.38

Relationship between the frequency of microsaccade and attentional state

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It has been shown that the attentional state affects the properties of microsaccade. In this study, we investigated the relationship between the time courses of attentional state and of microsaccade frequency. In one experimental trial, one-digit random number (0-9) was sequentially presented within a pre-indicated area of the display and one of the numbers (test stimulus) was appeared in a different color. Participants were required to respond the numbers of the test stimulus. We manipulated the size and location of the area within which the stimuli were presented. In the trial, the attentional states before and after the test presentation should be relatively high and low, respectively. Microsaccades, defined as the saccades less than 1 degree of amplitude, were identified using an eye tracker with sampling frequency of 2000 Hz and the change of the frequency was analyzed offline. The result showed that the frequency of microsaccade decreased immediately after the test presentation and then increased relative to that before the test presentation. The size and location of attentional state did not affect the frequency of microsaccade systematically in the present experiments. These results suggest that the frequency of microsaccade could be an indicator of the strength of attention.

32.39

The influence of the saccade direction on the direction of the consecutive saccade during free viewing

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Motter and Belky (1997) analyzed monkey eye movements during search tasks. They took the relative directional headings for consecutive saccades and found a slight directional bias against saccades to areas between the previously fixated stimulus and the current fixation location. In the current research, an analysis of human eye movements during free viewing was made. Eight images of natural scene were tested

with 118 subjects. The subject viewed every image freely for 10 sec. The relative directional headings for consecutive saccade were broken out of the data set and analyzed for directional biases. Saccade direction polar histograms average across subjects showed directional biases: a consecutive saccade took a straight line slightly more than a left or right turn, and it went backward definitely more than the other directions.

32.40

Saccadic disinhibition on the saccade trace

Hongmei Yan[1] (hmyan@uestc.edu.cn), Hao Zhang[1] ; [1]Department of Biomedical, UESTC

It has generally thought that information from the eyes is made available during a fixation, but not during a saccade when reading. Some researchers even suggested the duration of saccades should be subtracted from the reading time in eye movement research. During a saccadic eye movement, visual sensitivity is greatly reduced, this phenomenon called saccadic suppression, which let us unaware of blurred motion images produced by saccades and are not disturbed by them. Actually, we frequently make saccadic eye movement during reading, however, the exact function of saccades except redirecting the fovea to objects of interest still remain unknown. In this research, a two-alternative forced-choice character detection task was used to investigate the sensitivity of perception during saccade execution. The experimental results showed that the accuracy of character perception during saccades is indeed lower compared with fixation situation. However, the perception accuracy on the trace of saccades is remarkably higher than that of non-saccade-trace, which indicated a saccadic disinhibiton on the saccade trace. Our research proved that visual information might also be processed in a certain extent during saccade onset.

32.41

Anticipatory Eye Movements in Congkak

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Congkak is a traditional Malaysian board game involving two players taking turns to pick up marbles from a series of holes on the board. We used this game as a model to explore the role of anticipatory eye movements during natural actions (in this case serially picking up/putting marbles) as novices learnt the game. Prior work on eye and hand movements in natural behaviour shows that much of the demand on the visual system is computed at the moment it is needed and doesn't depend on information acquired from previous fixations. Vision is driven by the task demands. However, anticipatory fixations to upcoming targets of manipulation have recently been shown to confer spatial accuracy and influence the eye-hand latency. We find that experience with the game also influences the deployment of these anticipatory "look-ahead" fixations, and that their influence on eye-hand latency varies with experience. Results suggest that as our experience in Congkak grows, so

does our knowledge of the space relationships necessary for task success.

32.42

The influence of the number of decision branches on saccade latency

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Saccades are rapid eye movements whose function is to bring new objects of interest to the fovea. A saccade is a ballistic movement: once it has begun, its trajectory cannot be altered. A single saccade takes about 150-200 ms to plan and execute (saccade latency). In the current study, the influence of the number of decision branches that are candidates of the saccadic target on saccade latency is investigated. Each presentation of the test display was preceded by a fixation stimulus, which is at the center of the screen. The test display consisted of white disks on a black background. The disks that were the same in size appeared at random positions. The task of the subject was to move the eyes to any of the targets as soon as possible. Saccade latency was shortest when one target was given. Latency was longer when more targets were given. This suggests that a display with more targets requires more time to choose target and plan of saccade.

32.43

The Attraction of Visual Attention to Texts in Real-World Scenes – Are Chinese Texts Attractive to Non-Chinese Speakers?

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When we look at real-world scenes, attention seems disproportionately attracted by texts. In the present study, we tested this hypothesis and examined the underlying factors. In Experiment 1, texts in real-world scenes were compared with paired control regions of similar size, eccentricity, and low-level visual saliency. The greater fixation probability and shorter minimum fixation distance of texts showed their higher attractiveness, possibly caused by prominent locations or special visual features of text. In Experiment 2, texts were removed from the scenes, and the results indicated that the locations that used to contain texts still drew more attention than controls. In Experiment 3, texts were placed in unexpected positions in front of homogeneous and inhomogeneous backgrounds. These unconstrained texts were found more attractive than controls, with background noise reducing this difference, which indicates that the attraction by specific visual features of text was superior to typical saliency. In Experiment 4, non-Chinese speakers were shown scenes in which texts were turned upside-down or replaced by Chinese texts. Both upside-down and Chinese texts were found approximately as attractive as the original texts in Experiment 1, with a slight advantage for upside-down texts. This finding indicates that text attraction also depends on familiarity.

32.44

The effect of viscosity of PDMS based Silicone-oil tamponade agents on the movement relative to the eye wall during eye movements

Chan Yau Kei[1] (josephyk@hku.hk), Wong David[1] ; [1]Eye Institute, Department of Anatomy, LKS Faculty of Medicine, University of Hong Kong

Silicone oil tamponade is used as vitreous substitute to treat complicated retinal diseases. It provides support to the retina and acts against contraction of the retina and as such plays a vital role in preventing eyes from certain blindness. Silicone oil however has a tendency to emulsify and is accountable to inflammation and glaucoma. In in-vitro study, it was found that using silicone-oil with higher viscosity reduce the occurrences of emulsifications. In this study, an eye model chamber was used to capture the movement of silicone oil bubbles inside the model eye chamber by rapid serial photography. A few tamponades derived from the same material but with different shear viscosities were used. Our objective of this experiment is to investigate the effect of viscosity of tamponade to the movement of tamponade relative to retinal phase in model eye chambers mimicking saccadic eye movements. Our experiment confirms that shear viscosity determines the relative movement between the silicone bubble and the chamber wall. The higher the viscosity, the smaller the movement of tamponade relative to the chamber wall. We suggested that using much viscous tamponade may reduce the onset of emulsification due to the reduction of relative movement.

Monday Talks

Faces and bodies

Monday, July 18, 9:00 am - 11:00 am
Talk Session, Library Extension 4
Chair: Guomei Zhou

41.1, *9:00am*

Investigating the other-race effect in different face recognition tasks

Ryo Kyung Lee[1] (ytblues@korea.ac.kr), Isabelle Bülthoff[2] , Regine Armann[2] , Christian Wallraven[1] , Heinrich Bülthoff[2] ; [1]Department of Brain and Cognitive Engineering, Korea University, [2]Department of of Perception, Cognition and Action, Max Planck Institute for Biological Cybernetics, Tübingen, Germany

Faces convey various types of information like identity, ethnicity, sex or emotion. We investigated whether the well-known other-race effect (ORE) is observable when facial information other than identity varies between test faces. First, in a race comparison task, German and Korean participants compared the ethnicity of two faces sharing similar identity information but differing in ethnicity. Participants reported which face looked more Asian or Caucasian. Their behavioral results showed that Koreans and Germans were equally good at discriminating ethnicity information in Asian and Caucasian faces. The nationality of participants, however, affected their eye-movement strategy when the test faces were shown sequentially, thus, when memory was involved. In the second study, we focused on ORE in terms of recognition of facial expressions. Korean participants viewed Asian and Caucasian faces showing different facial expressions for 100ms to 800ms and reported the emotion of the faces. Surprisingly, under all three presentation times, Koreans were significantly better with Caucasian faces. These two studies suggest that ORE does not appear in all recognition tasks involving other-race faces. Here, when identity information is not involved in the task, we are not better at discriminating ethnicity and facial expressions in same race compared to other race faces.

41.2, *9:15am*

Eyes like it, brain likes it: Tracking the neural tuning of cultural diversity in eye movements for faces

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Eye movement strategies deployed by humans to identify conspecifics are not universal. Westerners preferentially fixate the eyes and the mouth during face recognition, whereas strikingly Easterners focus more on the face central region. However, when, where and how Preferred Viewing Locations (PVLs) for high-level visual stimuli are coded in the human brain has never been directly investigated. Here, we simultaneously recorded eye-movements and electroencephalographic (EEG) signals of Westerners and Easterners during face identification of learnt identities. After defining 9 equidistant Viewing Positions (VPs) covering all facial internal features, we presented the learned faces centered on a random VP for 100ms. We then extracted from prior free-viewing fixation maps the average Z-scored fixation intensity for the non-overlapping facial VP regions (VPZs). Finally, we computed a component-free data-driven spatio-temporal regression between the VPZs and EEG amplitudes. This analysis revealed a universal direct relationship between VPZ and EEG amplitudes over the face-sensitive N170 network at around 350ms, an effect unrelated to a burst of microsaccades occurring in this time-window. Our data show that the distinct cultural fixation preferences for faces are related to a universal post-perceptual tuning in the occipito-temporal cortex. Culture shapes visual information sampling, but does not regulate neural information coding.

41.3, *9:30am*

The race consistency of face and context modulates the race searching advantage

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Levin (1996, 2000) has found that, in race searching task, compared to own race, other races were preferentially detected. The present study investigated whether this other-race advantage will also be observed when faces were presented in certain contexts. Twenty subjects were asked to search a Chinese face among Caucasian faces in a block, and to search a Caucasian face among Chinese faces in the other block. These faces were presented in a neutral grey background, a Chinese background (e.g., the Great Wall), or a Caucasian background (e.g., the White House) separately in three sub-blocks. The set size varied from 2, 4, to 6. Results showed the other-race advantage in the neutral grey background, and the other-race advantage when the races of target and context were inconsistent. However, an own-race advantage was observed when the races of target and context were consistent.

41.4, *9:45am*

Anger superiority in single-face judgements

Hiroshi Ashida[1] (ashida@psy.bun.kyoto-u.ac.jp), Kana Kuraguchi[1] ; [1]Graduate School of Letters, Kyoto University

We investigated "anger superiority" in single-face judgements. Angry, or threatening, faces are easier to find than smiling ones (Hansen & Hansen, 1988) but it remains controversial whether this reflects emotional effects on the basis of the whole face or rather perceptual effects on the basis of parts. We sought this question differently from most previous studies that used the visual search paradigm. We presented a picture of angry, smiling, or neutral face (extracted from ATR DB99 database that has been confirmed for emotional strength) either to the left or to the right of the fixation mark, which was followed by a

mask, and the participants were asked to make a forced-choice judgement of anger or smile. The results showed that neutral faces were significantly biased towards anger with upright presentation but not with inverted presentation. Angry and smiling faces were judged equally well with upright presentation, while there was notable reduction of correct responses only for angry face with inverted presentation. Difference between hemifields was not clear. The results suggest that angry faces are judged on the basis of configural processing of the whole face, while smiling faces may be judged more locally on the basis of parts.

41.5, *10:00am*

Searching for faces is easiest when they are cross(es)

Guy M. Wallis[1] (gwallis@hms.uq.edu.au), Steven Cloete[1] , Carlos Coelho[1] ; [1]University of Queensland

It has been suggested that certain facial expressions are subject to enhanced processing to maximize the speed and accuracy with which humans locate individuals posing an imminant threat. Evidence supporting this proposal comes largely from visual search tasks which have demonstrated that threatening expressions are more rapidly detected than non-threatening ones. An open criticism of this effect is that it may be due to low-level visual artifacts, rather than biological preparedness. One successful approach for controlling low-level, image-based differences has been to use schematic faces (simplified line drawings). We report experiments aimed at discovering whether the enhanced processing of threatening schematic faces, might also be due to low-level features. The first study replicated the standard threat search advantage, but also measured an effect using similar stimuli comprised of obliquely oriented lines. The effect was also present with these stimuli rotated, a manipulation which served to remove any residual resemblance the abstract images had to a face. The results suggest that low-level features underlie the search advantage for angry, schematic faces, thereby undermining a key source of evidence of a search advantage for specific facial expressions.

41.6, *10:15am*

Probing the feature map for faces in visual search

Hua Yang[1] (hua.yang@dartmouth.edu), Ming Meng[1] ; [1]Department of Psychological and Brain Sciences, Dartmouth College

Controversy surrounds the mechanisms underlying the pop-out effect for faces in visual search. Is there a feature map for faces? If so, does it rely on the categorical distinction between faces and non-faces, or on image-level face semblance? To probe the feature map, we compared search efficiency for faces, and non-face stimuli with high, low, and no face semblance. First, subjects performed a visual search task with objects as distractors. Only faces popped-out. Moreover, search efficiency for non-faces correlated with image-level face semblance of the target. In a second experiment, faces were used as distractors but non-faces did not pop-out. Interestingly, search efficiency for non-faces was not modulated by face semblance, although searching for a face among faces was particularly difficult, reflecting a categorical boundary between non-faces and faces. Finally, inversion and contrast negation significantly interacted with the effect of face semblance, ruling out the possibility that search efficiency solely depends on low-level features. Our study supports a parallel search for

faces that is perhaps preattentive. Like other features (color, orientation etc.), there appears to be a continuous face feature map for visual search. Our results also suggest that this map may include both image-level face semblance and face categoricity.

41.7, *10:30am*

Visual Form Cues, Biological Motions, Auditory Cues, and Even Olfactory Cues Interact to Affect Visual Sex Discriminations.

Rick Van Der Zwan[1] (rick.vanderzwan@scu.edu.au), Anna Brooks[1] , Duncan Blair[1] , Coralia Machatch[1] , Graeme Hacker[1] ; [1]Department of Psychology, Southern Cross University

Johnson and Tassinary (2005) proposed that visually perceived sex is signalled by structural or form cues. They suggested also that biological motion cues signal sex, but do so indirectly. We previously have shown that auditory cues can mediate visual sex perceptions (van der Zwan et al 2009). Here we demonstrate that structural cues to body shape are alone sufficient for visual sex discriminations but that biological motion cues alone are not. Interestingly, biological motions can resolve ambiguous structural cues to sex, but so can olfactory cues even when those cues are not salient. To accommodate these findings we propose an alternative model of the processes mediating visual sex discriminations: Form cues can be used directly if they are available and unambiguous. If there is any ambiguity other sensory cues are used to resolve it, suggesting there may exist sex-detectors that are stimulus independent.

41.8, *10:45am*

The rubber hand illusion in a mirror

Marco Bertamini[1] (m.bertamini@liv.ac.uk); [1]Department of Experimental Psychology, University of Liverpool

In the rubber-hand illusion (RHI) one's hand is hidden, and a fake hand is visible. We explored the situation in which visual information was available indirectly in a mirror. Unlike most species, humans are capable of mirror self-recognition. In the mirror condition, compared to the standard condition (fake hand visible directly), we found no reduction of the RHI following synchronised stimulation, as measured by crossmanual pointing and a questionnaire. We replicated the finding with a smaller mirror that prevented visibility of the face. The RHI was eliminated when a wooden block replaced the fake hand, or when the hand belonged to another person. We conclude that awareness of the reflection is the critical variable, despite the distant visual localisation of the hand in a mirror and the third-person perspective. Stimuli seen in a mirror activate the same response as stimuli seen in peripersonal space, through knowledge that they are near one's body.

Motion

Monday, July 18, 2:15 pm - 4:15 pm
Talk Session, Library Extension 4
Chair: David P. Crewther

42.1, *2:15pm*

Spatial motion coordinates that determine the perceptual dominance in binocular rivalry

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It is known that moving stimuli perceptually dominate over static stimuli during binocular rivalry. Recent evidence shows that visual motions can be processed in spatiotopic, or object-based as well as retinotopic coordinates. Here we examined which spatial coordinate determines the motion dominance in binocular rivalry. Observers viewed a dichoptic pair of stimuli, each consisting of a fixation marker, a gray square background, and a diagonal grating (45 deg in one eye and 135 deg in the other). The observer judged which grating appeared dominant. Drifting gratings were dominant over static gratings when observers maintained stationary fixation. However, when they tracked the fixation marker that moved together with the drifting grating, the physically drifting but retinotopically stationary grating became dominant. When observers tracked fixation marker and stimulus background both moving together, the gratings that were physically stationary but moving in retinotopic and object-based coordinates were perceptually dominant. Subsequent quantitative analyses revealed that spatiotopic and object-based motions contribute equally with or even more than retinotopic motion. These results demonstrate a significant role of non-retinotopic motion signals in triggering the conscious awareness of visual stimuli.

42.2, *2:30pm*

Effects of a seen hand on visuo-haptic motion processing

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It has been shown that adaptation to tactile motion across the observer's hand induces a visual motion aftereffect (MAE). This crossmodal aftereffect supports the view that MAEs originate from adaptation in neural substrates underlying multisensory integration, challenging the conventional view that MAEs reflect modality-specific processing in early cortical areas. However, it is not clear how information about a seen hand influences visuo-haptic motion processing. We measured the strength of the visual MAE after visuo-haptic adaptation to the rotation of a radial grating presented with a realistic virtual hand. During the adaptation period, observers moved the arm of a force-feedback device with the right hand, and the grating and the virtual hand moved in synchrony with the observer's hand movements. We found that, after adaptation to visuo-haptic movements, the visual MAE was enhanced when the orientation of the virtual hand was aligned with the unseen observer's own hand. Our results suggest the presence of a visual motion system that is sensitive to both to visual and haptic information about one's own hand.

42.3, *2:45pm*

Psychophysical evidence for spatiotemporal tuning in human motion sensing receptive fields

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According to current models of motion detection, cortical motion sensors are tuned in both space and time to create spatiotemporally-oriented receptive fields. Motion direction is encoded by summing activity across sensors tuned to the same direction, and subtracting the outputs of sensors tuned to different directions. A psychophysical adaptation experiment tested for (i) subtractive interactions between sensors tuned to different directions and (ii) spatiotemporal tuning in motion sensing receptive fields. Participants viewed a counter-phase stimulus containing superimposed saw-tooth gratings moving in opposite directions. The contrast of one grating (pedestal) was fixed, while the contrast of the other (test) was varied to establish a motion null (no net apparent motion in the counter-phase). After adapting to a single grating drifting in the same direction as the test component, more test contrast was required to achieve a null relative to baseline. After adapting to a grating drifting in the opposite direction to the test component, less contrast was required to achieve a null. When both adapting and test gratings were counter-phase gratings, a small degree of test contrast threshold elevation was found which depended on the spatiotemporal phases of adapting and test components, consistent with spatiotemporally tuned motion sensor receptive fields.

42.4, *3:00pm*

Illusory Motion Reversals are Driven by Temporal Frequency Adaptation

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The continuous wagon wheel illusion, also known as illusory motion reversal (IMR), refers to the intermittent perception of illusory motion in the opposite direction while viewing movement. Previous studies suggest IMR occurs most for stimuli with a temporal frequency of ~10Hz. This was taken as evidence for IMR resulting from temporal sub-sampling by a visual system with a fixed sampling rate. Other explanations have highlighted similarities between IMR and motion aftereffects, speculating that IMR is a form of adaptation induced 'motion during-effect'. To investigate these possibilities we first estimated the optimal rates for IMR using colour and luminance defined movements. The optimal rate for colour defined movement was ~4Hz, whereas the optimal rate for luminance defined motion was ~10Hz, contradicting the idea of a global sampling rate for the visual system. We then investigated the effect of TF adaptation on subsequent 10Hz tests. IMR was maximal after adaptation to ~1Hz or 30Hz, and minimal after adaptation to 20Hz. Contrary to what would be expected of a motion during-effect, adaptation TF tuning was

not modulated by direction of motion, and the effects of directionless flicker were qualitatively equivalent. Our results suggest that IMR is driven by adaptation of TF channels.

42.5, *3:15pm*

Isolation of binocular cues for motion in depth

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There are two binocular cues of motion in depth: the interocular velocity difference (IOVD) and changing disparity over time (CDOT). Psychophysical evidence for the contribution to perceiving motion in depth has been accumulated for both of the two cues, using techniques to isolate each cue. However, no study estimated seriously how reliably each cue is isolated in the techniques. In this study, we apply a model of motion in depth to estimate how each type of stimuli isolates each of IOVD and CDOT cues. The model consists of the motion energy and the disparity energy detectors as subunits and adds their outputs to built the IOVD and CDOT detectors. Simulations show that some, but not all of stimuli used in the literature are appropriate for isolating cues. The temporally uncorrelated randomdot stereogram isolates CDOT cue and the binocularly uncorrelated randomdot kinematogram isolates IOVD cues. However, temporally anticorreated version of randomdot stereogram has influence of reverse motion components of IOVD and binocularly anticorreated version of randomdot kinematogram has influence of reverse motion components of CDOT. Gratings with opposite orientation between the eyes are also good for isolation of IOVD. We performed psychophysical experiments to examine the plausibility of the model prediction.

42.6, *3:30pm*

The Relationship Between Spatial Velocity, Vection, and Visually Induced Motion Sickness: An experimental study

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Spatial velocity (SV), a product of scene complexity and navigation velocity, is a metric to quantify virtual scene movement for the study of visually induced motion sickness (VIMS) (So et al., 2001). As SV increases, VIMS increases, peaks, and then decreases. Watching VIMS provoking stimuli of similar SV is hypothesized to produce similar levels of vection and VIMS. An experiment was conducted to test the hypothesis. Ten participants were exposed to five visual motion oscillating along fore-and-aft axis at different frequencies (from 0.05 to 0.8Hz). The r.m.s. velocity was kept constant and the frequency changes were achieved by changing the amplitudes of oscillation. These five stimuli had similar SVs. To our surprise, participants reported significantly different vection as the frequency increased even though the SVs were kept the same (p<0.001). Levels of VIMS was not significantly different because the exposure duration was too short (20 seconds). A second experiment using stimuli with 30 minutes was

conducted. Preliminary results indicated that levels of nausea significantly changed when viewers were exposed to visual oscillations with similar SVs but different frequency. Modifications to the previously reported SV metric are proposed.

42.7, *3:45pm*

Visual magnocellular function in perceptual disorders

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Developmental disorders such as autism spectrum disorders (ASD), dyslexia, schizophrenia and dyscalculia have also been reported to show abnormal visual perception. Central to the four disorders are observations of altered global/local perception, motion sensation and grouping that are suggestive of a magnocellular abnormality(s). Such psychophysical observations do not easily yield neurophysiological mechanisms that can explain the altered perception/vision. Non-linear visual evoked potentials have allowed the separation of magnocellular (M) and parvocellular (P) contributions to the VEP (Klistorner et al 1997). Using these tools we compare the patterns of abnormality in groups with visual disorders. The second order kernel responses of the VEP in autistic tendency show interference between P and M non-linearities at high contrast (Sutherland and Crewther, 2010) resulting in a delay of completion of firing. While afferent latencies of M and P cortical activation are not different in ASD, the delay in completion may allow a revision of the ideas surrounding the "magnocellular advantage" which relate to the alterations observed in global and local perception.

42.8, *4:00pm*

A re-evaluation of achromatic spatiotemporal vision: Non-oriented filters are monocular, they adapt and can be used for decision-making at high flicker speeds

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Masking, adaptation and summation paradigms have been used to investigate the characteristics of early spatiotemporal vision. Each has been taken to provide evidence for (i) oriented and (ii) non-oriented spatial filtering mechanisms. However, subsequent findings suggest that the evidence for non-oriented mechanisms has been misinterpreted: possibly, those experiments revealed the characteristics of suppression (e.g. gain control) not excitation, or merely the isotropic subunits of the oriented detecting-mechanisms. To shed light on this we used all three paradigms to focus on the 'high-speed' corner of spatiotemporal vision (low spatial frequency, high temporal frequency) where cross-oriented achromatic effects are greatest. We used flickering Gabor patches as targets and a 2IFC procedure for monocular, binocular and dichoptic stimulus presentations. To account for our results we devised a simple model involving an isotropic monocular filter-stage feeding orientation-tuned binocular filters. Both filter stages

are adaptable and their outputs are available to the decision-stage following nonlinear contrast transduction. However, the monocular isotropic filters adapt only to high-speed stimuli—consistent with a magnocellular sub-cortical substrate—and benefit decision making only for high-speed stimuli. According to this model, the visual processes revealed by masking, adaptation and summation are related but not identical.

Monday Posters

Shape, Form & Texture Perception

Monday, 18 July, 11:15 am - 12:45 pm, 4:30 pm - 6:00 pm
Poster Session, Loke Yew Hall

43.2

Shape processing in perceptual decisions of detection, identification and categorization

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With three tasks, it was investigated what kind of shape information was involved in the visual object processing in perceptual decisions, such as detection, identification and categorization. Stimuli taken from Snodgrass and Vanderwart (1980) were modified with different levels of random noise. In the detection task, a modified line-drawing object (target) and a lure of random noise (non-target) were sequentially presented in random order. Observers were asked to choose which stimulus was the target. Detection thresholds (the level of random noise to detect target) were measured. In the identification task, an object description of the target was given before two modified line-drawing objects were presented. Observers were asked to choose the target. The procedure of the categorization task was almost identical to that of the identification task except that the object description was replaced with the category name. Accuracies were calculated in the last two tasks. The results of correlation analyses between the measurements and the shape-variables (e.g., the number of edges, the degree of the circularity or visual complexity) indicated that detection was related to the perception of the local edge, identification involved complexity of shape, and categorization depended on edge detection.

43.3

Afterimages Reveal Interocular Transfer of Shape Adaptation

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An afterimage's shape changes systematically depending on the adapted shape. Adapting to circles produces polygonal afterimages, whereas adapting to hexagons sometimes produce circular afterimages. In this study, a right-eye afterimage produced by adapting to circles was tested while the left eye adapted to a plain background, static circles, rotating circles, rotating stars, or rotating hexagons. Subjects rated the subjective roundness of the right-eye afterimage. Although the right eye adapted to circles, the ratings varied with the left-eye adaptation. After the left eye adapted to rotating hexagons, the right-eye afterimages were rated highest (most circular). In contrast, after the left eye adapted to rotating circles, the right-eye afterimages were rated lowest (most angular). This interocular transfer of shape adaptation demonstrates that afterimage shape is determined in a cortical area that collects information from both eyes.

43.4

Complexity reduction explains preference to symmetric patterns

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Symmetric patterns are more appealing to human observers than asymmetric ones. Here, we investigated the possible mechanisms underlying such preference. All Stimuli were derived from phase scrambled versions of forty face or nature images. There were four types of test images: symmetry, in which one part of the image was the reflective transform of the other part about an axis; repetition, one part of the image was a copy of the other part; anti-symmetry, similar to symmetry but the contrast of one side was reversed; and interleaved patterns, half of the symmetric pattern was replaced by a scrambled image. The number of axes ranged from 1 to 16 for all image types. The task of our 20 observers was to give a preference rating to each image on a 6-point Lickert Scale. The preference rating increased with the number of axis for all stimulus type. The preference to symmetry was similar to that to repetition and was slightly better than anti-symmetry. The preference to interleaved pattern was much less than other types of stimuli. The preference rating of an image has little correlation with the slope of the power spectrum but of the image but is inversely correlated with its complexity.

43.5

Glossiness perception enhanced by retinal-image motion from object-motion and self-motion

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Specular highlight, which is one of physical correlates of glossiness perception, moves on an object surface depending on the illumination, viewpoint and motion of the object. We aimed to investigate effects of retinal-image motions induced by self-motion or object motion on glossiness perception. One of seven lumpy spheres with different specular reflectance was presented for a trial (6s). The sphere was either stationary or

rotated back and forth at 0.25Hz on a CRT display as retinal-image motion, where we simulated lateral viewpoint motion in 15cm range under three stationary point-lights. Eight observers perceived it either without or with head motion, which was monitored by a magnetic 3-D tracker at 120Hz and sphere's retinal-image motion was veridically synchronized with the self-motion. They were asked to rate its glossiness using visual-analog scale. We found that the perceived glossiness was significantly higher with retinal-image motions than without them. However, self-motion and valid motion parallax did not enhance the glossiness in comparison with only retinal-image motions. These results suggest that retinal-image motion of structural surface or change of highlights enhances the glossiness perception regardless of whether it is caused by object-motion or self-motion, and that the valid motion parallax has no superiority.

43.6

Localization of human cortical areas underlying glossiness perception: an fMRI study

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We conducted two fMRI experiments to clarify what cortical areas are involved in perception of surface glossiness. To dissociate activations caused by glossiness from those caused by low-level features such as luminance and luminance contrast of the stimulus, we utilized the perceptual glossiness constancy (Experiment 1) and the selective attention technique (Experiment 2). In Experiment 1, subjects viewed glossy or matte objects under bright or dim illumination. The mean luminance and luminance RMS contrast of glossy objects under dim illumination were lower than those of matte objects under bright illumination. Thus, if certain areas are more activated by the former stimulus than the latter, the activation differences can be explained by the differences in surface glossiness but not by the differences in mean luminance or luminance RMS contrast of the stimulus. In Experiment 2, subjects judged whether the paired objects were the same or different in terms of glossiness, 3D form, or 3D orientation. If certain areas are more activated during the glossiness discrimination task than the other two tasks, it is suggested that the areas are involved in glossiness perception. Common areas identified as those involved in glossiness perception in both experiments are bilateral ventral occipital areas.

43.7

The role of luminance and chromaticity on symmetry detection

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We investigated the effect of luminance and chromaticity on symmetry detection with the noise masking paradigm. In each trial, a random dot noise mask was presented in both intervals. A symmetric target was randomly presented in one interval while a random dot control was presented in the other. The orientation of the symmetric axis of the target was either 45°or -45° diagonal. The task of the observer was to determine which interval contained a symmetric target. The dots in both the target and the mask was painted with 1 to 4 colors selected from white, black, red, green, blue and yellow. We measured the target density threshold at various noise densities. Our results showed that when the number of the colors in the images was equal, the thresholds were lower in the luminance conditions than in the chromaticity conditions. In addition, the thresholds decreased with the increment of the number of the colors in the images. This suggests that (1) the luminance symmetry detection mechanism is more sensitive than chromaticity one and (2) that, contrasted to the prediction of an uncertainty model, the diversity in color facilitates symmetry detection.

Color, Light and Contour

Monday, 18 July, 11:15 am - 12:45 pm, 4:30 pm - 6:00 pm
Poster Session, Loke Yew Hall

43.8

Effect of interior chromaticness on space brightness

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To design a lighting environment, horizontal illuminance is generally used as the brightness of a room. But it is reported that a subjective brightness does not always match the horizontal illuminance. For example, the room furnished with high saturated colored objects is perceived brighter than the room furnished with achromatic objects, even though the horizontal illuminance is the same.   To investigate a effect of interior chromaticness on space brightness, we conducted the experiment in four miniature rooms that were different in terms of chromaticness of interior decorating surfaces, but kept lightness of surfaces constant. Subjects were asked to set the illuminance of reference room, that is furnished with achromatic objects, to equate the brightness of the test room, that is with chromatic objects. Four of seven subjects needed less illuminance to get the equality of space brightness if the test room had a saturated objects. The illuminance ratio of test to reference room was about 1.4. Other three subjects set the illuminance of reference room almost equal to test room. Thus, there are differences between individuals so further work would be needed to estimate the quantitative effect of interior chromaticness on space brightness.

43.9

Luminous impulse response of positive- and negative-contrast stimuli in different spatial frequencies

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An interesting question is whether positive- and negative-contrast stimulations have temporally different visual responses. Luminous impulse response functions (IRF) were measured to investigate this question. The IRF represents a theoretical response to a flash of infinitely short duration. It can

be estimated from detection thresholds of double-pulses divided by various inter-stimuli-intervals (ISI). Each threshold was measured independently 5 times included 20∼30 trials each, controlled by a psi method combined with a spatial 4-alternative-forced-choice (4AFC) method. The stimulus, which has a water-wave-like structure in terms of luminance with one of various spatial frequency configurations (0 cpd, 1 cpd, 2 cpd, 4 cpd, 8 cpd, and 16 cpd), was presented on a 10 cd/m2 background (equal-energy-white). About 135,000 trials were measured for five observers. The results show that; (1) thresholds of positive contrast detection were significantly higher than that of negative contrast detection except a part of spatial frequencies on two observers; (2) there was no significant difference between positive and negative contrast IRFs. These results suggest that the responses for positive- and negative-contrast stimulations are the same in terms of IRF.

43.10

Space Brightness Evaluation for a daylit room

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One of the most important problems for lighting design is how to reduce an electric energy. One way to solve this problem is use of daylight, but little is known how to perceive a brightness of a room illuminated by daylight come in through a window and artificial light. Although the horizontal illuminance increases because of daylight, we would not perceive the room as bright as brightness estimated by the illuminance. The purpose of this study is to measure the space brightness for daylit room and to propose a evaluation method. The experiment was conducted with a couple of miniature office rooms, standard room and test room. Test room has several types of windows and standard room has no window. Subject was asked to evaluate the brightness of the test room relative to the standard room with method of magnitude estimation. It was found that brightness of daylit room did not increase simply with horizontal illuminance. Subject perceived a daylit room darker than a room illuminated only by the artificial light even if horizontal illuminance of these room was same. The effect of daylight on space brightness would vary with the window size and intensity of daylight or artificial light.

43.11

The influence of environmental spatial layout on perceived lightness

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It is obvious that perceived lightness of a surface depends on the surrounding luminance distribution in 2D and 3D. These effects are usually explained by the mechanisms at relatively low level of visual system. However, there seems to be a relation between the illuminance and spatial layout of the scene regardless of the surrounding luminance distribution. If this is valid, perceived lightness of a surface in the scene could be influenced by the spatial layout in the scene. In this research, we investigated the relation between the perceived lightness of surface and the spatial layout of the scene. The subject matched the lightness of test patch presented on a natural picture with various spatial layout to that of comparison stimulus presented on a uniform gray background. The mean luminance of the surround stimuli were the same and the local contrast between the text patch and the surround was kept constant. Results showed that the perceived lightness of a stimulus depended on the spatial structure presented in the background. This result indicates that the spatial layout of the scene is related to the illuminance of that and influenced on perceived lightness.

43.12

Spatial suppression of the perceived contrast is polarity selective

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The apparent contrast of a texture is reduced when it is surrounded by another texture with high contrast. This contrast-contrast illusion has been thought to be a result of spatial interactions between visual channels that encode contrast energy. In the present study, we show that the contrast-contrast is selective to the luminance polarity by using texture patterns composed of sparse elongated blobs. The apparent contrast of a texture of bright (dark) elements was substantially reduced only when it was surrounded by a texture of elements with the same polarity. This polarity specificity was not found for textures of dense elements, which was similar to those used in previous studies, probably because such stimuli should inevitably activate both on- and off-type sensors. The polarity selective suppression decreased as the difference in orientation between the centre and surround elements increased, but still remained as for orthogonally-oriented elements. These results suggest that the contrast-contrast illusion largely depends on spatial interactions between visual channels that are selective to the luminance polarity and partially to the orientation.

43.13

Brightness comparison with central and peripheral vision by using a dual-task

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Brightness comparison with central and peripheral vision was conducted to investigate the relation between brightness perception and attention. A dual-task was employed which consisted of a central vision task to detect a character with different luminance from others on RSVP (Rapid Serial Visual Presentation), and a brightness comparison task just after the former task. In brightness comparison, the luminance was 6cd/m2 for central stimulus and from 3 to 12 cd/m2 for the peripherals with 10 or 20 degrees eccentricity. SOA was 200 or 500 ms in the both task. As the results, the change of the perceived peripheral brightness with the luminance was larger

(i.e., the perceived brightness was more affected by the luminance change of the stimulus), when the SOA was longer, the eccentricity was smaller and / or the subject was more experienced. The duration of the stimulus presentation was longer than the critical duration of the photoreceptors. SOA, eccentricity and skills generally change attention status. Therefore, the results suggest that the brightness was affected by attention in this experiment.

43.14

Influence of surrounding colors in the illuminant-color mode on color constancy

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On color constancy, we showed that brighter surrounding colors had greater influence than dim colors (Uchikawa, Kitazawa, MacLeod, Fukuda, 2010 APCV). Increasing luminance of a stimulus causes the change in appearance from the surface-color to the illuminant-color mode. However it is unknown whether the visual system considers such color appearance mode of surrounding colors to achieve color constancy. We investigated the influence of surrounding colors that appeared illuminant on color constancy. The stimulus was composed of a central test stimulus and surrounding six colors: bright and dim red, green and blue. The observers adjusted the chromaticity of the test stimulus to be appeared as an achromatic surface. The luminance balance of three bright surrounding colors was equalized with that of the optimal colors in three illuminant conditions, then, the luminance of one of the three bright colors was varied in the range beyond the critical luminance of color appearance mode transition. The results showed that increasing luminance of a bright surrounding color shifted the observers' achromatic setting toward its chromaticity, but this effect diminished for the surrounding color in the illuminant-color mode. These results suggest that the visual system considers color appearance mode of surrounding colors to accomplish color constancy.

43.15

Chromaticity and glossiness of gold, silver, and bronze colors

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Appearance of metallic colors, such as gold, silver and bronze, depends on chromaticity and glossiness of a surface. We aim to obtain the chromaticity region of gold, silver, and bronze by using CG simulated surfaces with various glossiness. The physical glossiness was defined by the intensity ratio of specular reflectance of the surface stimulus. The observer estimated degree of perceived glossiness, and also degree of gold, silver, or bronze appearance of the stimulus with a physical glossiness and a chromaticity. The results showed that the stimulus began to appear gold, silver or bronze at a certain chromaticity point only when the stimulus had glossiness. The chromaticity range, where gold, silver and bronze colors were observed, expanded as the degree of glossiness increased. Furthermore the ratio of the degree of gold, silver or bronze

colors to that of glossiness of the stimulus was found to be different among the chromaticity points of the stimulus. This ratio was highest with highly saturated stimuli for gold and bronze colors, and with achromatic stimuli for silver color.

43.16

Aftereffect of Adaptation to Illusory Brightness

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Several figures are known to induce illusory brightness. We tested whether adaptation to illusory brightness produced an aftereffect in brightness. After viewing a gray square area having illusory brightness (e.g., due to brightness contrast or illusory contours) for ten seconds, the illusion-inducing surround vanished. After three seconds, subjects reported whether the square area was seen as brighter than, darker than, or the same brightness as a control gray square area. The luminance of the tested square area was physically unchanged. The results show that when the black surround inducing brightness contrast suddenly became gray (i.e., vanished), the center gray square tended to look darker than a control gray square. Similarly, after viewing a subjective square consisting of black-line terminations, the square area tended to look darker than the control even though the afterimage of the lines could not be seen. These results indicate that induced or illusory brightness causes an aftereffect in brightness regardless of the appearance of negative afterimages of the illusion-inducing components.

43.17

Derivation of color confusion lines for pseudo-dichromat observers from color discrimination thresholds

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The objective is to develop a method of defining color confusion lines in the display RGB color space through color discrimination tasks. In the experiment, reference and test square patches were presented side by side on a CRT display. The subject's task is to set the test color where the color difference from the reference is just noticeable to him/her. In a single trial, the test color was only adjustable along one of 26 directions around the reference. Thus 26 colors with just noticeable difference (JND) were obtained and made up a tube-like or an ellipsoidal shape around each reference. With color-anomalous subjects, the major axes of these shapes should be parallel to color confusion lines that have a common orientation vector corresponding to one of the cone excitation axes L, M, or S. In our method, the orientation vector was determined by minimizing the sum of the squares of the distances from JND colors to each confusion line. To assess the performance the method, the orientation vectors obtained by pseudo-dichromats (color normal observers with a dichromat simulator) were compared to those theoretically calculated from the color vision model used in the simulator.

43.18

Calibration of illumination loss to measure luminance and chromaticity distribution by using digital camera

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It is required to obtain chromaticity and luminance distribution of the natural scene with a digital camera. One of the problem to measure with the digital camera is that it has low dynamic range. The purpose of this study is to derive relational expressions between pixel values of several images with different exposure times and chromaticity or luminance. The prediction functions are derived by using the multiple regression analysis from XYZ obtained by measured values and pixel values ($\log_{10}Y = \alpha R + \beta G + \gamma B + \delta(\Delta t)$). The coefficients of RGB of the prediction function were constant regardless of exposure time, in contrast, the δ value was represented by the exposure time function. Therefore, the prediction function moves parallel by the exposure times. The error between the actual measurement values and the predictive values were 8%, 6%, 5% in X,Y,Z. Therefore, it was able to acquire the chromaticity and the luminance distribution with a digital camera. There is problem that amount of light of the surrounding imaging area decreases more than center imaging area actual measured values. We construct a model of calibrate prediction function by the eccentricity from damping rate of the center of the lens.

43.19

Contrast Effect on the P300 Component: Passive versus Active Tasks

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Objective: Contrast perception could be influenced by top-down factors. We measured P300 component, a well-documented index for top-down influence in visual functions, to examine such effect. Methods: Twelve participants, 18-50 years old, with normal or correct-to-normal visual acuity participated in the study. Standard two-stimulus oddball paradigm was employed. Target stimuli were Gabor patch with 4 cy/degree spatial frequency and 90% contrast. In an attempt to mimic clinical population, event-related potential (ERP) was recorded in (1) the passive viewing condition, in which the participants were instructed to fixate at the center of screen; and (2) the active condition, in which the participants were required to press a button to indicate the presence of a target. Participants performed passive task before active task. The probability that a target was presented in a trial was either 50% or 30% in a run. P300 oddball effect was defined as the difference in ERP between 30% and 50% probability conditions. Results: A reliable P300 oddball effects was found under active condition. For passive viewing condition, P300 oddball effects were not apparent. Conclusion: The findings support the hypothesis that P300 reflects the task-dependent top-down effect in visual functions.

43.20

P300 ERP Component depends on both spatial frequency and contrast

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Contrast perception depends on not only the early visual responses, but also top-down modulations. We measured how does P300, a well-documented event-related potential (ERP) index for top-down influence, change with both spatial frequency and contrast. ERP were acquired from 10 participants, aged 18-50, when they were performing a visual oddball task. The target was a Gabor patch whose spatial frequency was either 4 or 8 cy/degree and contrasts 90% or 30%. The probability of target presence in a trial was 30%. All target stimuli produced a reliable P300 component. At the low spatial frequency, the amplitude of P300 was larger and the latency was shorter for the low contrast patterns than for the higher contrast ones for all electrodes. Such difference was not observed in high spatial frequency patterns. The latency was slightly longer for high spatial frequency patterns than the low spatial frequency ones. Our results showed an interaction between spatial frequency and contrast in P300. The characteristics of P300 at low spatial frequency correlated with task difficulty, but not at high spatial frequency. This suggests that the top-down influence on contrast perception may be spatial frequency depended.

43.22

A McCollough effect generated at binocular site

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Following exposures to alternating gratings with unique combination of orientation and colors, an achromatic grating would appear tinted with its perceived color contingent on the grating's orientation. This orientation-contingent color after effect is called the McCollough effect. The lack of interocular transfer of the McCollough effect suggests that the McCollough effect is primarily established in monocular channels. Here we explored the possibility that the McCollough effect can be induced at a binocular site. During adaptation, a red vertical grating and a green horizontal grating are dichoptically presented to the two eyes. In the 'binocular rivalry' condition, these two gratings were constantly presented throughout the adaptation duration and subjects experienced the rivalry between the two gratings. In the 'physical alternation' condition, the two dichoptic gratings physically alternated during adaptation, perceptually similar to binocular rivalry. Interestingly, following dichoptic adaptation either in the rivalry condition or in the physical alternation condition, a binocularly viewed achromatic test grating appeared colored depending on its orientation: a vertical grating appeared greenish and a horizontal grating pinkish. In other words, we observed a McCollough effect following dichoptic adaptation, which can only be explained by a binocular site of orientation-contingent color adaptation.

43.23

Neural Correlates of the Poggendorff Illusion driven by Illusory Contour: an fMRI Study

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The Poggendorff illusion is a well-documented geometric illusion that involves the brain's perception of the interaction between oblique lines and object contours: an oblique line is apparently misaligned once interrupted by two parallel contours . This illusion occurs even when the parallel contours are defined subjectively or illusorily. In this fMRI study, we adopted a 4 (type of stimuli: Poggendorff illusion under real contour and its corresponding control condition; Poggendorff illusion under illusory contour and its corresponding control condition) by 4 (degree of angle between the oblique line and the two vertical contours: 22.5°, 45°, 67.5°, and 90°) factorial design to investigate the neural correlates of Poggendorff illusion induced by real and illusory contours. By computing the parametric modulation effect of the angle for different type of stimuli, we found that, as compared with the control conditions, the two types of Poggendorff illusion conjointly activated the right intraparietal sulcus (IPS). Moreover, the right IPS was involved in the neural interaction between the two types of illusions by showing higher neural activity in the illusory than in the real contour condition . Taken together, our results suggest that the right IPS is responsible for constructing the Poggendorff illusion driven by illusory contours.

43.24

A Color-opponency based Biological Model for Color Constancy

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Color constancy is the ability of the human visual system to adaptively correct color-biased scenes under different illuminants. Most of the existing color constancy models are non-physiologically plausible. Among the limited biological models, the great majority is Retinex and its variations, and only two or three models directly simulate the feature of color-opponency, but only of the very earliest stages of visual pathway, i.e., the single-opponent mechanisms involved at the levels of retinal ganglion cells and lateral geniculate nucleus (LGN) neurons. Considering the extensive physiological evidences supporting that both the single-opponent cells in retina and LGN and the double-opponent neurons in primary visual cortex (V1) are the building blocks for color constancy, in this study we construct a color-opponency based color constancy model by simulating the opponent fashions of both the single-opponent and double-opponent cells in a forward manner. As for the spatial structure of the receptive fields (RF), both the classical RF (CRF) center and the non-classical RF (nCRF) surround are taken into account for all the cells. The proposed model was tested on several typical image databases commonly used for performance evaluation of color constancy methods, and exciting results were achieved.

43.25

Within-category advantage in perceiving color contrast: a new case of categorical perception

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Categorical perception of color has conventionally been demonstrated as bringing advantage to the discrimination of equally-spaced colors that belong to different lexical categories. The perceptual expansion of distance between categorically separable pairs and compression of that between categorically identical pairs have widely been demonstrated by quicker and more reliable detection of a unicolor image from lexically discrete backgrounds than term-sharing ones. Meanwhile, categorical effects that enhance performance in within-category condition have not been documented. The current study, however, found that comparing the degree of color contrasts inside two bicolor images is significantly faster and more accurate if the contrasting colors belonged to a single color term. This within-category advantage suggests that non-discrete variation of hue inside one color category aids contrast judgment task while discrete lexical boundary impairs it. Consonant with the previous studies which document left-hemisphere dominance in categorical perception, the novel example of categorical effect was expressed only in the right visual field. Furthermore, significantly shorter reaction time was required for males than for females to make contrast judgment for a low contrast stimulus, but not for a high contrast target, suggesting possible gender difference in perceiving color contrast.

Motion

Monday, 18 July, 11:15 am - 12:45 pm, 4:30 pm - 6:00 pm
Poster Session, Loke Yew Hall

43.26

Temporal order judgments of two moving objects

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When we perceive two objects that are moving toward a target and judge which object reached first, how accurate is the temporal order judgment? In order to investigate this, the present study examined a situation in which two objects move in the horizontal opposite direction each other. In the experiment, two small circles, whose positions were horizontally out of alignment, moved rightward and leftward from the ends of left and right in the monitor. These circles crossed around the target in the center position. Observers judged which circle reached to the target first in the conditions of some velocities and start positions of two circles. The results showed that observers tend to judge that the slow circle reached earlier than the fast circle though two circles reached simultaneously. However, the individual difference of judgments was great. Some observers tend to choose circles moving rightward as the first one and other observers tend to

choose circles in the upper position. The reason why these results occurred was discussed.

43.27

The effect of binocular integration on illusory motion: using the modified rotating snake

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Two experiments were performed to investigate the impacts of binocular disparity and rivalry on illusory motion. The figure used by Kitaoka(2004) were modified and consisted of five disks. In the experiment 1, the effect of binocular disparity was tested when components of illusory motion figure were placed in a different depth plane. In the experiment 2, the effect of binocular rivalry was tested. The result showed that illusory motion was reduced when the binocular disparity was added. Also, illusory motion was dramatically reduced or vanished when binocular rivalry condition was introduced. These results suggest that the illusory motion was processed prior to the integration of binocular information.

43.28

Illusory Object Motion on Stripes

Yuanyuan Bai[1] (baiyuany05@gmail.com), Hiroyuki Ito[1] ; [1]Department of Design, Kyushu University

A circular object placed in the center of a radial pattern consisting of thin sectors causes a robust motion illusion during smooth-pursuit eye movement. We tested whether the motion illusion also arose when the radial background was replaced by horizontal or vertical stripes or a plain background in light gray (in the averaged luminance of the striped area). Subjects reported the illusion strength of a comparison stimulus having stripes or a plain background by a magnitude estimation method, comparing it with the standard stimulus having a radial background. The results show that this illusion occurred when the direction of eye movement and the orientation of the stripes were orthogonal or the yellow circular object was equiluminant with the surroundings. In the tested range, the finer the stripes were, the stronger the illusions were. However, the illusion caused by the stripes was much weaker than that caused by the radial pattern. With the plain light-gray background, the illusion was very weak. Thus, these factors alone cannot fully explain the strong illusory effect of the radial background.

43.29

Illusory centrifugal motion direction observed in brief stimuli:psychophysics and energy model

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All stationary stimuli of fixed duration have motion energy and the amount of motion energy increases with decreasing duration. Consequently, perception of motion direction could be biased if the readout mechanisms are unbalanced. Previous physiological study showed prefered direction of MT neurons in peripheral tend to be oriented away from fovea(Albright, 1989). Given the broadening of motion energy in brief stimuli, such effect should increase as the stimulus duration decreases. Here, we tested this hypothesis by presenting vertical gratings (0.5c/deg, raised cosine spatial envelope, radius = 5deg, 98% contrast) with different speeds(2,4,8 16deg/sec) and direction(moving towards fovea or moving away from fovea). And Stimuli were presented in a temporal Gaussian envelope with durations ranging between 5 and 500ms. Observers' task was to identify perceived motion direction (guessing when unsure). Results showed that as predicted, the observers were biased to perceive these stimuli as moving away from fovea. In summary, briefly presented stationary stimuli are perceived as moving in centrifugal direction when presented in visual periphery. One possible explanation for this illusion is that these stimuli, by virtue of their broad temporal frequency spectrum, stimulate centrifugally biased motion mechanisms in area MT.

43.30

Neural mechanisms of illusory motion: evidence from ERP study

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ERPs were used to examine the neural correlates of illusory motion, by presenting the Rice Wave illusion (CI), its two variants (WI and NI) and a real motion video (RM). Results showed that: Firstly, RM elicited a more negative deflection than CI, NI and WI between 200-350ms. Secondly, between 500-600ms, CI elicited a more positive deflection than NI and WI, and RM elicited a more positive deflection than CI, what's more interesting was the sequential enhancement of brain activity with the corresponding motion strength. We inferred that the former component might reflect the successful encoding of the local motion signals in detectors at the lower stage; while the latter one might be involved in the intensive representations of visual input in real/illusory motion perception, this was the whole motion-signal organization in the later stage of motion perception. Finally, between 1185-1450 ms, a significant positive component was found between illusory/real motion tasks than NI (no motion). Overall, we demonstrated that there was a stronger deflection under the corresponding lager motion strength. These results reflected not only the different temporal patterns between illusory and real motion but also extending to their distinguishing working memory representation and storage.

Monday Sessions

3D Perception

Monday, 18 July, 11:15 am - 12:45 pm, 4:30 pm - 6:00 pm

Poster Session, Loke Yew Hall

43.31

Influence of background patterns in the Reverse Perspective illusion

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The reverse perspective (RP) illusion is classified as a motion illusion due to inverted depth perception, similar to the Mach book and hollow mask illusions. Distortional motion of a rigid object surface is observed when an observer moves in front of the object which has a texture pattern giving inverted perspective cues (RP object). In this research, we studied the influence of the background pattern of the RP objects on the strength of the illusion. To perform quantitative evaluation, a stereo computer-graphics technique was used. Computer generated right- and left-eye images of an RP object were shown separately to the subjects' eyes through a haploscope. Using a computer key board, they adjusted the binocular disparity of the stereo images so that depth inversion due to the surface texture occurs. We evaluated the strength of the illusion by the critical value of the disparity and found that the background texture is an important factor determining the strength of the RP illusion. Especially, the texture in the horizontal direction creates stronger depth inversion effect compared to the vertical pattern. Using our experimental system, the influences of various pictorial cues on the RP illusion can be studied quantitatively.

43.32

Properties of Surface Reconstruction Based on Binocular Disparity and Motion Parallax

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Binocular disparity and motion parallax are particularly important for our 3D surface perception, and the properties of perceived surfaces are similar when these cues are presented separately. Moreover, when we perceive surfaces on random dot patterns, we can perceive smooth surfaces even though the dot density may be low. That is, we reconstruct a surface by interpolating areas between dots. In this research, we used random dot patterns in which we can perceive 3D surfaces by disparity or parallax. We made a region without dots (a gap) on the surface, and investigated the surface properties perceived. The experimental results were then compared with output of a computational model based on the standard regularization theory. We conclude as follows; (1) The ability for surface reconstruction due to binocular disparity is more effective than that by parallax. (2) The experimental data corresponded well to a model which uses the second order differential of depth data. This indicates the usage of the curvature of the disparity or parallax in the surface perception. (3) The gap width

difference between disparity and parallax can be explained by considering the magnitude of the receptive fields in the neural pathways where disparity and parallax are processed.

43.33

Comparison between lateral head movement and to-and-fro head movement on depth perception from motion parallax

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Depth perception from motion parallax has been investigated with right-and-left head movement. From ecological point of view, humans move forward more frequently than sideways. The aim of this study was to determine the influence of the head movement direction on depth perception from motion parallax. We investigated depth perception at and above threshold level with lateral head movement and to-and-fro movement. Stimuli were vertical half cylinders, which was concave or convex, depicted with random dots that move synchronously with head. The viewing distance was 78.5 cm on average. The size of each display was 6.6 x 6.6 deg. The dot density in the entire display was always maintained constant for prevention of depth impression from difference in dot density. Four subjects participated the experiments. Mean threshold for lateral and to-and-fro motion were about 0.1 cm and 5 cm respectively. Mean gains of apparent depth for lateral and to-and-fro motion were about 1 and 0.2 respectively.

43.34

The influence of binocular disparity and motion parallax on shape constancy

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Many studies on shape constancy have been made with 2D shapes presented at varying slants. When object is close, shape constancy is quite good (Lappin and Preble 1975). Shape constancy declines as the degree of slant increases even with binocular presentation (Massaro 1973). At large viewing distance, the degree of shape constancy depends on pictorial information (Gogel 1978). These results suggest that shape constancy is influenced by whether accurate depth is provided. In the current study, the influence of binocular disparity and motion parallax on shape constancy is investigated at near distance. Test stimulus was a square presented at varying slants in a dark room. Subjects responded apparent slant and shape with stereo cue only, with motion cue only, or with the both cues. The apparent slant was veridical with stereo cue only, with motion cue only, and with the both cues. The decline of the shape constancy, however, differed according to cue. The binocular cue yielded shape constancy more than monocular cue.

43.35

Combination of binocular disparity and motion parallax does not contribute to the fixing of depth reversal

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The visual phenomenon that perceived depth sign is opposite to depth sign geometrically predicted from binocular disparity or motion parallax is known as depth reversal (Gillam 1967, Hayashibe 1991). Combination of binocular disparity and motion parallax generally improve depth perception (Nawrot and Blake 1991). In the current study, we investigated if the combined display contributes to the fixing of depth reversal. In a dark room, a surface slanted about a vertical axis was displayed for 800 ms by binocular cue only, by motion cue only, or by binocular and motion cues. Six subjects judged the apparent slant. Overall, mean frequencies of reports of reverse slant were 78.2%, 36.8%, and 78.6% for binocular cue only, motion cue only, and binocular and motion cues, respectively. Namely, combination of binocular disparity and motion parallax does not contribute to the fixing of depth reversal.

43.36

The influence of observer's voluntary action on perception of kinetic depth display

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A 3D object such as plural points distributed in 3D space appears flat when rear projected onto a translucent screen. Its 3D shape becomes apparent when it is rotated about an axis parallel to the screen (KDE). The relative motion of the points gives depth information but perspective information is not present. So, the relative depth of points can be perceived but not their depth order. It is impossible to tell which is the front and which is the back of the objects. The 3D object is ambiguous with respect to its reflection in the projection plane. As a result the object periodically appears to reverse in depth as well as direction of rotation. This study investigated if observer's manual control for the stimulus change removes ambiguity of KDE. In the experiment, the stimulus change was coincided with the rotation of a crank handle rotated rightward or leftward by the observer. The result showed that manual control considerably removed the ambiguity: the perceived direction of rotation from KDE coincided the manual control at a high rate. Prolonged viewing, however, made reverse the apparent rotation. We measured duration of initial rotation. The manual control extended the mean duration.

43.37

Comparison between monocular and binocular observation on continuous-motion perception

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In several psychophysical functions, thresholds may be lower when the test is performed binocularly than when performed monocularly. We evaluated binocular advantage on continuous motion perception at and above threshold. Firstly, thresholds of motion direction were determined under monocular and binocular conditions. Stimuli were briefly presented Gabor patches with translation of a sinusoidal carrier. Subjects observed the stimuli using a mirror stereoscope. The apparent contrasts of stimuli were equivalent between monocular and binocular conditions. The observer's task was to decide if the stimulus moved rightward or leftward. We found a binocular advantage of approximately 1.3. Secondly, binocular advantage on motion perception at suprathreshold levels was determined by measuring point of subjective equality (PSE) between monocular and binocular conditions. Monocular condition was the reference and binocular one was the test. Two Gabor patches with carrier translation were presented in succession in random order. The observer's task was to decide if the second stimulus was faster or slower than the first. We found a binocular influence of approximately 1.5 at three times the speed of the motion threshold, no influence at ten times the speed of the threshold.

43.38

The effect of binocular disparities on the space distortion

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When one pair of dots is located in an object, the perceived space between those two dots is larger than the space of two dots which have same interval and are placed out of object. This is space distortion. Two experiments were performed to investigate the effect of binocular disparities on space distortion. The depth plane of surrounding object (in experiment 1) and of two pairs of dots (in experiment 2) was manipulated. The results showed that when objects or dots were perceived on a different depth plane from an original depth plane, the strength of space distortion was reduced. These results imply that space distortion is more related to early visual processing than attention.

43.39

Scaling of retinal image induced by vertical magnification disparity

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A surface lying in a frontal plane appears slanted about a vertical axis when the image in one eye is horizontally magnified relative to the image in the other eye. This is predicted from the geometry of the situation. The same surface appears to slant in the opposite direction when the image in the first eye is vertically magnified relative to the image in the other eye (induced effect). One explanation of the induced effect is that the retinal image is isotropically scaled to the same height and the horizontal magnification disparity as a by-product elicits the slant impression. In the current study, scaling of retinal image induced by the stereogram with vertical magnification disparity is investigated. Two horizontal lines were superimposed on the stereogram to measure the scaling. One line presented to one eye was parallel to the other line presented to the other eye, to avoid problems of rivalry or fusion. Three subjects responded apparent lengths of the lines.

The result showed that the line superimposed on the vertically magnified image appeared longer than the other line. This supports that scaling of retinal image induced by vertical magnification exists.

43.40

Interaction between accommodation and vergence on distance perception

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Fisher and Ciuffreda (1988) and Mon-Williams and Tresilian (1999) reported that, without vergence cue, diopter change in accommodation induced change in apparent distance. Meanwhile, there is conflicting evidence about the relative roles of accommodation and vergence in distance perception (Richards and Miller 1969; von Holst 1973). In the current study, we investigated interaction between accommodation and vergence on distance perception. The perceived distance from integration of vergence evoked by a fixation target and accommodation by a pair of concave or convex lenses in front of eyes is measured with a mirror stereoscope. The stimulus was a white square with a black cross-shaped fixation on a black background. In dark surroundings, subjects were asked to commit the apparent distance of the target to memory, and then without the lenses, re-create the distance by changing distance of another fixation target. The apparent size of the target through lenses were equivalent to the size without lenses. The results showed that not only vergence but accommodation affect the apparent distance, and they were summed linearly.

43.41

The effect of stimulus size on stereoscopic fusion limits and response criteria

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The stereoscopic fusion limit denotes the largest binocular disparity for which a single fused image is perceived. With few exceptions, this limit has been measured with thin lines or bars employing a criterion of single or double images. We wondered if the fusion limit and criterion for fusion (for example, diplopia or lustre) changed systematically as a function of bar width. We first measured horizontal and vertical disparity fusion limits for thin bars and for the edge of an extended surface. Seven observers increased or decreased the disparity of the target and responded when fusion broke or reappeared, respectively, using either the criterion of diplopia or lustre. Fusion limits were equal for thin bars and extended surfaces in both horizontal and vertical disparity conditions. We next measured fusion limits for a range of bar widths and instructed four observers from experiment 1 to indicate which criterion they employed on each trial. Fusion limits were constant across all stimulus widths. However, there was a sharp change in criterion from diplopia to luster when the bar width was approximately twice the fusion limit. Stereoscopic fusion limits do not depend on stimulus size, but the criterion for fusion does.

43.42

the effect of repeated exposure to 3D contents on visual discomfort

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Due to the technological advance, people can enjoy 3D contents at home through 3D TV. This means that people can more easily access 3D contents nowdays. Considering the fact that visual discomfort caused from 3D environment was still unsolved, it is important to investigate the effect of repeated exposure to 3D contents on visual discomfort. In the present study, visual discomfort was measured through three different sessions with intervals of one and half months. In each session, while viewing 3D video clips for 80 minutes, participants were asked to press button whenever they felt discomfort. While the results showed a general tendency of decrease in button press, it was also found that there were individual differences. A rapid reduction in button press was found over repeated exposure in the results from participants with higher button press during the first session. A small increase in button press, however, was found in the results from participants with lower button press. Further studies should be needed to elucidate the characteristics of those potential risk individuals.

43.43

Symmetry facilitates 3D shape discrimination across changes in viewpoint

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Perceiving 3D shape constancy across changes in viewpoint is a challenging problem. We tested whether the presence of symmetry can facilitate shape discrimination for smoothly-curved, solid 3D objects. Symmetric and asymmetric random shapes were generated to have the same angular power spectra, expressed as spherical harmonics. Objects were presented in three viewing conditions: shading-only, stereo-only, and combined shading and stereo. Shaded objects were illuminated by a diffused point light source, and a mirror haploscope was used to present binocular images. Objects were presented sequentially and observers judged whether the two shapes were same or different. The test objects were either the same orientation or differed by a rotation in depth of ±15°, ±30°, or ±60° relative to the standard object. In all conditions, we found that shape discrimination performance decreased with rotation in depth. Overall, shape discrimination for symmetric objects was better than for asymmetric objects. The presence of stereo information improved performance for both symmetric and asymmetric objects. The results suggest that structural constraints like symmetry are important for viewpoint invariant shape perception, and that stereo information improves shape perception even for structured 3D objects.

43.44

3D surface configuration modulated 2D Symmetry detection

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To perceive a symmetric pattern, an observer needs to find correspondence between two image elements across the symmetric axis, implying an excitatory relationship between perceptual mechanisms responding to these elements. To perceive a 3D structure in a random dot stereogram (RDS), the perceptual mechanisms tuned to different disparities would inhibit each other. We investigated whether putting corresponding elements of a symmetric pattern in different depths would affect symmetry detection. The symmetry patterns consisted of dots (0.19degx0.19deg) occupying .5% of the display. We measured the coherence threshold for detecting symmetric patterns rendered on 14 possible 3D structures that were produced by an RDS. The coherence threshold for symmetric patterns on a slant surface was similar to that on a frontoparallel plane even though in the former the depths of the two sides of the symmetric axis were different. The threshold increased dramatically when one side of the axis inclined toward the observer while the other side inclined away though the depth difference between the two sides was the same as that in the slant condition. The threshold reduced on a hinge configuration whose joint coincide with the symmetry axis. Our result suggests that co-planarity is a decisive factor for symmetry detection.

43.45

Relationship between anisotropic slant perception and the probability distribution of environmental slants

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It is known that perception of surface slant is more sensitive about the horizontal axis than it is about the vertical axis. This study investigates the anisotropy of slant perception by applying the approach of natural scene statistics, which measures various physical properties to find probability regularities in the environment. We sampled 17 environments (2 indoor and 15 outdoor ones) from those routinely experienced by the first author. In each environment, a 3D laser scanner measured the spatial layout by collecting the radial distances to the surrounding surfaces. On the basis of the measurements, we analyzed the probability distribution of the magnitude of surface slant about both the horizontal and vertical axes. Consequently, the probability of the slant about the horizontal axis, compared to that about the vertical axis, shows a remarkably high and narrow peak around 0° (i.e., the vertical plane). This indicates that the environment contains nearly vertical surfaces with a relatively high probability. The result suggests that our visual system often needs to perceive a small deviation from the vertical plane and accordingly becomes anisotropically sensitive to the slant about the horizontal axis.

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