ECVP '22 Symposia

Computational perspectives on perceptual confidence

Organizers: Laura Geurts & Janneke Jehee (Donders Institute)

Contributors: Laura Geurts (Donders Institute), Joshua Calder-Travis (UKE Hamburg), Pierre Le Denmat (KU Leuven), Pascal Mamassian (École Normal Supérieure Paris), Marika Constant (Bernstein Center for Computational Neuroscience)

Abstract: Perceptual decisions typically come with a sense of confidence – a subjective feeling about the quality of the decision. Confidence often plays a key role in our perceptual decision making. For example, when driving in foggy conditions, we reduce speed because we are less certain about the distance to surrounding traffic. But what gives rise to these feelings of confidence? Although it is well established that subjective confidence is often linked to objective performance, how the human brain computes confidence is currently unclear. What sources of information drive confidence judgments? What computational mechanisms underlie the human sense of confidence? Is confidence based on computations of Bayesian probability, or on proxies for or approximations of statistical uncertainty? This symposium will cover recent research on the computational mechanisms of perceptual confidence. Laura Geurts will focus on a probabilistic representation of evidence quality in the human visual cortex and its relationship to reported confidence. Joshua Calder-Travis and Pierre Le Denmat will discuss how confidence might be derived from the observer's perceptual evidence, and whether or not these computations are probabilistic. Pascal Mamassian will talk about noise and additional sources of information, and how these affect higher-level computations of perceptual confidence. Marika Constant will discuss how prior knowledge affects confidence. Taken together, these talks will provide an overview of current ideas and hypotheses about the computational basis of perceptual confidence.

Visual expertise: real-life applications and underlying mechanisms

Organizers: Meike Ramon (University of Lausanne) & Mauro Manassi (University of Aberdeen)

Contributors: Karla Evans (University of York), Martin Dresler (Donders Institute), Mauro Manassi (University of Aberdeen), Hans Op de Beeck (KU Leuven), Meike Ramon (University of Lausanne), Jessica Taubert (The University of Queensland)

Abstract: Visual expertise has been defined as "the superior visual skill shown when executing domain-specific visual tasks" (Gegenfurtner et al., 2017). Since the 90ies, visual expertise has received substantial empirical interest within the vision science community and beyond. Originally, much attention was placed on expertise emerging from deliberate training. The expertise of interest could range from everyday tasks like reading or shape discrimination, to more unique cases such as chess players or "greeble" experts. However,

contrary to chess and greeble related expertise, some individuals possess superior abilities which apparently do not result from training, but seem to be innate. For example, individual differences in processing facial identity are largely genetically determined (Wilmer et al., 2010). This raises the question: Should all flavors of visual processing proficiency - i.e. visual expertise – be considered equal? In this symposium, we aim to revisit the concept and our knowledge of visual expertise. To this end, we bring together contributions on visual expertise from different fields. The talks will focus on ecologically relevant visual expertise, which can be largely innate (face identity processing in monkeys, normal individuals and superrecognizers), or acquired due to personal interests (ornithologists, chess players) or professional choices (radiologists). Importantly, the symposium will offer an overview of the underlying mechanism(s) of visual expertise using various experimental techniques, ranging from human psychophysics and neuroimaging, to work with non-human primates. Taken together, this variety will characterize different contexts where visual expertise is applied, outlining commonalities and differences in their underlying mechanisms.

Large-scale spatial vision

Organizers: Peter Neri (École Normale Supérieure), Michael Herzog (Ecole Polytechnique Fédérale de Lausanne)

Contributors: Marco Bertamini (Università di Padova, Italy; University of Liverpool, UK), Michael Herzog (Ecole Polytechnique Fédérale de Lausanne), Peter Neri (École Normale Supérieure), Christoph Teufel (Cardiff University), Petra Vetter (University of Fribourg)

Abstract: Most vision research of the last 50 years has focused on well-controlled stimulus displays with few elements that are perceptually integrated via local interactions. Such laboratory settings have little in common with the large-scale integration that happens in natural vision: many local interactions do not generalize to more complex settings. In a non-controversial symposium, we wish to bring together researchers who will (i) demonstrate the importance of long-range interactions, (ii) identify commonalities and differences across effects and phenomena associated with such interactions, and (iii) discuss their underlying mechanisms and functional role. Petra Vetter will show how predictive signals along a long-range apparent motion trajectory are generated and transferred across saccades. Michael Herzog will assess how small changes at far locations in the visual field may crowd or mask a target, and propose a new framework for long-range spatio-temporal integration. Marco Bertamini will discuss how information about symmetry requires integration of elements across the visual field, and how this integration is carried out quickly and automatically. Christoph Teufel will assess how this integration affects the interactions between local, low-level features and global, high-level object representations. Peter Neri will examine these interactions within the context of ecologically motivated paradigms, such as active exploration of virtual environments.

Cortical Circuitry Mapping using Connective Field Modelling (CFM) in perception and ophthalmic and neurologic disease

Organizer: Frans Cornelissen (UMC Groningen)

Contributors: Frans Cornelissen (UMC Groningen), Thomas Knapen (Spinoza Center for Neuroimaging), Netta Levin (UMC Jerusalem), Azzurra Invernizzi (Mt Sinai Hospital), Ron van de Klundert (VU Amsterdam), Koen Haak (Donders Institute)

Abstract: Most cortical neurons process signals from other cortical neurons rather than sensory signals. For this reason, establishing how neurons in one cortical map connect to and integrate the signals of neurons in other maps is key to understanding how the brain processes information. CFM enables this by translating the concept of the stimulus-referred receptive field to that of an intracortical neural-referred receptive field. In this symposium, we will discuss how fMRI in combination with CFM has provided a deeper understanding of cortical processing and plasticity in health and disease. Cornelissen will introduce the topic and speakers and explain the concept of CFM and provide examples how his group used CFM to isolate the contribution of CF dynamics from those of population receptive fields during visual filling-in, a process critical to both normal and abnormal visual perception. Moreover, he will illustrate how CFM in combination with rs-fMRI enabled to infer changes in the early visual cortical circuitry of participants suffering from glaucoma. Knapen applied CFM to study the cortex of participants during movie-watching, retinotopic-mapping and resting-state (rs). This revealed how multisensory and visuo-spatial cortical representations are modulated by task and cognitive state. Illustrating CFM's clinical relevance, Levin will address how CFM can explain an ensemble of visuo-cognitive function impairments observed in Posterior Cortical Atrophy, a visual variant of Alzheimer disease. It shows how atrophy in one part of the visual system can affect other areas within the network. It often remains challenging to interpret stimulus-driven findings in terms of plasticity. Therefore, Invernizzi will illustrate how CFM in combination with rs-fMRI enabled her to infer changes in the early visual cortical circuitry of participants suffering from glaucoma. Klundert will describe a new type of CF model based on divisive normalisation.l Finally, Haak will describe how CFM has further evolved into fully data-driven methods for mapping connectopies that can trace biologically plausible, overlapping topographies in distinct individuals. He will close off by summarising the presented work and discussing which enhancements to circuitry mapping will further improve our ability to link visual cortical anatomy, function, and dynamics.

Perception and (inter)actions in the real world and XR: Virtually the same or really different?

Organizers: Constanze Hesse & Martin Giesel (University of Aberdeen)

Contributors: Gavin Buckingham (University of Exeter), Manuela Chessa (University of Genoa), Katja Fiehler (JLU Giessen), Simon Watt (Bangor University), Katja Zibrek (Inria Rennes)

Abstract: Extended reality (XR) settings, such as virtual reality (VR) and augmented reality (AR), are becoming increasingly popular in the experimental investigation of various aspects of human perception, motor behaviour as well as social interactions. Moreover, XR environments have become an important tool for acquiring, honing, or restoring perceptual, motor, and/or cognitive skills in areas such as sports or medicine, e.g., rehabilitation and robot assisted surgery. One of the main reasons for the increasing use of virtual settings in studying human behaviour is their potential to create complex ecologically valid environments which can be fully experimentally controlled – something that usually cannot be as easily achieved in traditional laboratory settings. However, despite the widespread use of this technology, it is still not well understood to what degree virtual environments, and our interactions with virtual objects and characters are representative of our behaviour in natural settings. Furthermore, it is to date unclear how much correspondence between virtual and natural worlds can theoretically be achieved, and is practically needed, to encourage natural behaviour. If we want perception and behaviour in XR to be an adequate model for perception and behaviour in the real world, we not only have to identify sources of task relevant (multi-)sensory information and their appropriate technological implementation but also need to consider the role cognitive factors may play in shaping perception and behaviour in XR. For example, the awareness of interacting with virtual entities may limit the correspondence between virtual and natural settings despite advances in simulation technology. This symposium will provide an exciting opportunity to gain an overview of current research investigating perception, motor and social behaviour in XR and their relation to performance in the natural world by bringing together leading researchers from different disciplines whose talks focus on different ways of measuring and evaluating (inter)actions in XR.

ToddFest: Perception of 3D Shape, Space, and Materials Celebrating 43 Years of Jim Todd

Organizers: William Warren (Brown University), Ennio Mingolla (Northeastern University), Jan Koenderink (Utrecht University)

Contributors: Flip Phillips (Rochester Institute of Technology), Farley Norman (Western Kentucky University), Sylvia Pont (TU Delft), Joseph Lappin (Vanderbilt University), James Todd (Ohio State University)

Abstract: No, Jim Todd is not 43 years old, but he did publish his first research article in 1979 (on transient and sustained channels). Since that time he has made fundamental contributions to our understanding of how the visual system recovers properties of objects and events from spatiotemporal patterns of light. He was a pioneer in applying computer graphics to perceptual psychophysics. But his most outstanding contribution has been a new understanding of perceived 3D shape, and how it interacts with light and materials. Early on, he challenged Marr's 2.5-D sketch as a model of perceived shape, and disconfirmed Ullman's structure-from-motion theorem for human vision. There followed a remarkable series of experiments in which Todd and his colleagues showed that the visual system does not recover Euclidean properties such as metric distance, slant, and curvature, but weaker properties related to affine shape and topological structure. This insight led to

current theories of shape from motion, stereo, texture, shading, and contour. Todd's work holds the promise of a unified field theory of information for 3D shape, in place of what are normally thought of as a collection of ad hoc depth cues.

In this Symposium, five of those colleagues will celebrate Todd's contributions and discuss the current state of play, on the occasion of his retirement from Ohio State University. His close collaborators Jan Koenderink and Joe Lappin will address theoretical issues of perceptual geometry and optical information. His former students Farley Norman and Flip Phillips will discuss the perception of shape, space, and materials. His colleague Sylvia Pont will present current thinking on interactions between 3D shape, material properties, and the light field. Forty years ago, Todd and Mingolla first used computer graphics to study the perception of shape from shading – and Jim will finally reveal the answer in his talk.

Multistable perception: when and how bottom-up and top-down interact?

Organizers: Alexander Pastukhov (Otto-Friedrich-Universität Bamberg) & Jürgen Kornmeier (Freiburg University)

Contributors: Alexander Pastukhov (Otto-Friedrich-Universität Bamberg), Maartje C. de Jong (University of Amsterdam), Veith Andreas Weilnhammer (Charité Berlin), Mareike Wilson & Jürgen Kornmeier (Freiburg University)

Abstract: During observation of ambiguous figures our perception becomes unstable and alternates spontaneously between two or more about equally probable interpretations, even though the sensory evidence stays unchanged. This phenomenon has fascinated researchers from different disciplines for more than 200 years and is vividly discussed in the context of perceptual processing and consciousness. Different lines of research have tried to illuminate the processing underlying such spontaneous perceptual reversals, their temporal order, the contributing brain sources, and the related interaction of bottom-up sensory evidence with top-down influence from higher cortical areas. Knowledge about the timing is necessary to disentangle processing steps that precede reversal and are potentially causal from processes that follow and are potential consequences. The endogenous nature of reversals makes it difficult to determine the precise temporal order of events. The symposium presents different approaches, ranging from intracranial recordings, scalp EEG, model-driven fMRI to psychophysics, to better understand the mechanisms underlying changes of perception given an unchanged world. Veith Weilnhammer will talk about evidence from modelling, fMRI and TMS stimulation that the inferior frontal cortex computes the error between conscious interpretations and the available sensory evidence from ambiguous motion stimuli, thereby regulating the access of conflicting information into awareness. Maartje de Jong will discuss the role of occipital and ventro-temporal cortex during binocular rivalry as revealed by intracranial recordings in humans. Alexander Pastukhov will talk about the immediate perceptual aftermath of a spontaneous switch and how information about a perceptual change is used to update and reevaluate perceptual representations within a spatial surround. Mareike Wilson and Jürgen Kornmeier will discuss the destabilization of neural representations, which is

regarded as a precondition for spontaneous perceptual reversals. The underlying timeline is however unclear. They will provide EEG evidence for destabilization at least one second before a perceptual reversal of the Necker cube.

From vision to attention: the development of visual perception in early childhood

Organizers: Joanna Rutkowska & Sabine Hunnius (Donders Institute)

Contributors: Chiara Capparini (Lancaster University), Audrey van der Meer (Norwegian University of Science and Technology), Joanna Rutkowska (Donders Institute), Hsing-Fen Tu (Uppsala University), Ursula Schöllkopf (Leibniz Institute for Neurobiology)

Abstract: Investigating the development of adult-like abilities is a window into the mechanisms driving them. This symposium will showcase new insights from the field of visual perception development, from low-level visual processing to attention. First, Chiara Capparini's contribution will be an investigation of infants' peripheral visual processing during the first year of life. She will present a series of studies on infants' peripheral visual sensitivity to different kinds of information, from low-level stimuli such as Gabor patches to more complex stimuli, such as emotional faces. Gloria Gehb will focus on the interplay of motor and perceptual development in infancy by investigating differences in the perception of visuo-spatial stimuli and facial emotional expressions in crawling versus non-crawling 9-month-old infants. Audrey van der Meer examines the brain mechanisms of motion perception in infants and young children born pre-term and full-term. Joanna Rutkowska will present a large study examining 14-month-old infants' ability to perceive subtle differences in biological motion caused by differences in action intention (i.e. grasp-to-drink vs grasp-to-place). Finally, the last two contributions explore the development of visual attention in early childhood. Hsing-Fen Tu will present findings on the robustness of attention measures from eye-tracking data and how they relate to children's later development. Ursula Schöllkopf will provide an insight into pupil size as a marker for attentional mechanisms in typically and atypically (ADHD) developing infants and children. Collectively, this symposium explores the development of visual perception during infancy and early childhood. The speakers will present a variety of perspectives on the factors responsible for this process, and we expect the symposium to allow for a lively discussion on the topic.

Advantages of virtual reality developments for perception research

Organizer: Szonya Durant (Royal Holloway University of London)

Contributors: Enkelejda Kasneci (University of Tubingen), David Harris (University of Exeter), Maria Gallagher (University of Cardiff), David Erwan (Goethe University Frankfurt), Doga Gulhan (Royal Holloway), Peter Scarfe (University of Reading)

Abstract: The use of head mounted displays that update the visual display in response to head movements and can display a 360-degree world is not new and has been exploited since the seventies for investigating human perception. However, a large part of our

understanding of concepts such as visual search, multisensory integration, human-computer interaction and aesthetic preference rely on research carried out using 2D screen-based stimuli and tasks. With recent advances in virtual reality (VR) technology leading to reduced display latencies, high-resolution displays with built-in eye tracking and more widely accessible hardware and software, there has been an explosion of research that now enables us to evaluate to what extent results found with 2D screens hold in in a 3D world. Furthermore, immersive technologies have opened up a virtual universe for experimentation that allows researchers to examine multisensory combination and action by tracking body movements and allowing participants locomotion and manual interaction. VR allows for all these experiments to be carried out in realistic, controlled, reproducible environments from which highly accurate measures can be derived. Meanwhile, VR is gaining traction beyond the lab as a mainstream tool for entertainment, education and training, remote procedures and certain therapeutic applications. This process was somewhat accelerated by the COVID-19 pandemic creating demand for remote interaction solutions. Research into the effects of VR on human perceptual processing and behaviour has a great deal to offer in providing insight into the further development of these technologies, where optimizing the human experience is critical. This symposium will give an overview of some of the research making use of the latest VR technology into the areas outlined above.

Population Receptive Field Modelling: Recent advances and applications

Organizer: Ben Harvey (Utrecht University)

Contributors: Serge Dumoulin (Spinoza Centre for Neuroimaging & Utrecht University), Betina Ip (University of Oxford), Marco Aqil (Spinoza Centre for Neuroimaging), Evi Hendrikx (Utrecht University), Hinke Halbertsma (University of Groningen)

Abstract: Population receptive field (pRF) modelling determines response properties of neural populations by testing predictions of computational models describing how populations with different response functions would respond to sensory stimuli. Importantly, this can be applied to non-invasive fMRI data recoded simultaneously throughout the human brain. This allows researchers to show how visual receptive field properties change within and between visual field maps, between individuals, between species, and in visual disorders. These abilities have found broad applications in vision science, mapping the visual system and bridging gaps between neurophysiology, perception, computational neuroscience, and clinical vision research. This symposium will showcase recent studies that apply pRF modelling in new ways. Prof Dumoulin will first introduce the method he originated. Dr Klink will show that pRFs estimated from macaque fMRI closely follow invasive neurophysiological receptive field measurements from the same species and visual field maps. Ms. Halbertsma will show how object recognition affects visual spatial responses in early visual areas. Dr Ip will combine pRF methods with magnetic resonance spectroscopy to reveal how changes in synaptic transmission affect visual responses in amblyopia. Mr. Aqil will show how divisive normalization provides a computational basis for diverse extraclassical receptive field effects throughout the visual

hierarchy. Ms. Hendrikx will show how timing-selective neural responses ('temporal receptive fields') in higher visual areas can be derived from early visual response dynamics. Dr Harvey will moderate the talks and a general discussion to finish. Together, these speakers will show the ECVP community how pRF modelling can be applied in their research, and how recent findings shed light on diverse topics in vision sciences. Regarding diversity, our speakers include equal numbers of women and men, two PhD candidates, and two postdoctoral fellows. Speakers include Dutch, German, and Italian nationals with a British moderator.

Eyeballing the visual field: eye-tracking- and pupillometry-based alternatives for visual field assessment

Organizers: Minke de Boer & Anne Vrijling (UMC Groningen)

Contributors: Minke de Boer & Anne Vrijling (UMC Groningen), Rijul Soans (Indian Institute of Technology), Marnix Naber (Utrecht University), David Crabb (City University London), Birte Gestefeld (Bielefeld University), Johan Pel (Erasmus MC)

Abstract: One of the most frequently performed visual assessments in ophthalmology and neurology is perimetry, the assessment of the visual field (VF). In patients with suspected or confirmed VF defects, perimetry is performed to measure sensitivity throughout their VF. Perimetry often provides critical information for making a diagnosis and for rehabilitation. The current gold standard is standard automated perimetry (SAP), a form of threshold perimetry where participants are asked to fixate a central location and press a button any time they perceive a light stimulus in the surrounding area. Despite its common use, SAP is subjective and requires task comprehension, motor responses, and prolonged attention and fixation, limiting the use of SAP for many individuals. Alternatives to SAP are high on the wish list of patients. In recent years, various alternative methods have been proposed that use eye-tracking instead of manual responses to measure the visual field. These methods are intended to make perimetry more objective and more intuitive to perform, and thus better suited for a wide array of people of different age and cognitive ability. In this symposium, we will introduce such newly developed perimetric methods, which are at different stages of deployment. De Boer and Vrijling will introduce the topic, give a background on SAP and present the use of a continuous dot tracking task for the detection of glaucomatous VF defects. Soans will discuss the options provided by eye-movement assessment in virtual reality (VR) for perimetry. Naber will discuss recent developments in pupil perimetry and its application in children and using VR. Crabb and Gestefeld will show how it is possible to detect and reconstruct VF defects using movie viewing and analyzing natural eye movements. Finally, Pel will discuss how eye movement perimetry based on saccadic reaction time can be applied in a clinical setting.

What do inter-item biases in perception and visual working memory tell about vision?

Organizers: Andrey Chetverikov (Donders Institute), David Pascucci (Ecole Polytechnique Fédérale de Lausanne)

Contributors: Andrey Chetverikov (Donders Institute), David Pascucci (Ecole Polytechnique Fédérale de Lausanne), Cora Fischer (Goethe University), Rosanne L. Rademaker (Max Planck Institute for Neuroscience), Chaipat Chunharas (Chulalongkorn University)

Abstract: What we see and what we remember deviates from the truth, and deviates in a consistent manner. For a long time, biases in perception and visual working memory (VWM) were mostly neglected and considered noise. However, the last decade has seen a renewed interest in these phenomena spurred by the idea that they might be seen as adaptive behavior when other stimuli, shown in the present or recent past, are taken into account. For example, the serial dependence effect is believed to support continuity in perception, while repulsive biases in VWM help to avoid confusion between memory contents. Importantly, both memory and perception can show attractive and repulsive biases with similar patterns. But are there common mechanisms for biases observed in different experimental paradigms or are they just superficially similar? How can they be explained? And are they indeed adaptive? In this symposium, we aim to discuss theoretical models explaining inter-item biases in perception and visual working memory and the related empirical findings in brain and behavior to muse on these questions. David Pascucci and Cora Fischer will scrutinize the connections between visual working memory and serial dependence effect. Sabrina Hansmann-Roth will discuss her work on the role of uncertainty in sequential estimates in light of the Bayesian observer model. Raymundo Neto will talk about the commonalities and differences for sequential and simultaneous biases. Andrey Chetverikov will present a computational model of inter-item biases arguing that they are an inevitable part of information processing in the brain. And Rosanne Rademaker will discuss empirical findings arguing for the adaptive benefits of biases in memory reports. We hope that this symposium will prompt researchers from different fields of vision sciences to take a broader look at commonly observed biases and demonstrate their importance for understanding vision.

Individual differences in mental imagery and anomalous perception

Organizers: Reshanne Reeder (Edge Hill University), Tessa M. van Leeuwen (Tilburg University)

Contributors: Dr. Reshanne Reeder (Edge Hill University), Carla Dance (University of Sussex), Peter Lush (University of Sussex), Tessa M. van Leeuwen (Tilburg University)

Abstract: The recurrent theme of our symposium is “individual differences in mental imagery abilities and their relation to (anomalous) perception”. Visual perception research suggests much of our conscious experience of the world is influenced by top-down processes, some even claiming that perception is a controlled hallucination (Paolucci, 2021). With the recent discovery of aphantasia (a lack of visual mental imagery (VMI)) and hyperphantasia (realistically vivid VMI; Zeman et al., 2020), suddenly the question became a matter of individual differences: if perception is largely influenced by top-down factors, how is it different in people with and without VMI? And can these differences explain

anomalous perceptual phenomena that occur in conditions such as schizophrenia (e.g., hallucinations) or synaesthesia (e.g., persistent illusory colors)? In this symposium, speakers will present their research on individual differences in VMI and its influence on visual perception. Scientifically, individual differences in VMI is a very new topic, but it is a rapidly growing field with large potential for furthering our understanding of perceptual differences. First, Dr. Reshanne Reeder will introduce a new model of conscious visual experience rooted in predictive processing theory. The model predicts proneness to anomalous perceptual experiences depends on the extent to which individuals rely on prior information (higher in hyperphantasia, lower in aphantasia) and sensory input (higher in synaesthesia, lower in schizophrenia). Providing behavioral evidence for the model, Carla Dance will explore what aphantasia can tell us about the link between VMI and anomalous sensory perception, including insights on the relationship between aphantasia, synaesthesia, and autism. Next, Dr. Peter Lush will talk about individual differences in the ability to create subjective experience to meet expectancies arising from imaginative suggestion (phenomenological control). Finally, Dr. Tessa van Leeuwen will present perceptual studies on synaesthetes and schizophrenia patients and interpret these findings in the context of predictive processing.

Inhibition of Return and Visual Search

Organizer: Raymond M. Klein (Dalhousie University)

Contributors: Stefan van der Stigchel (Utrecht University), Margit Höfler (Danube University Krems), W. Joe MacInnes (HSE University), Iain D. Gilchrist (University of Bristol)

Abstract: In the early 1980's two separate research streams were launched by two of the 20th century's leading attention researchers Treisman distinguished empirically between serial and pop-out search and proposed feature integration theory (FIT) which was later supported via converging operations. Even if aspects of this theory have been discarded, the idea of an attentional operator, that sequentially inspects items or groups of items when search is difficult, has endured. Posner developed two model tasks for exploring the allocation of visual attention in space. Using the model task for exploring exogenous control of attention he discovered that an initial facilitation at a cued location was followed by inhibition there, an effect that has come to be known as inhibition of return (IOR). These two streams of research were linked in 1988 when Klein tested and verified Posner's proposal that this inhibition might be a novelty seeking mechanism that could improve search efficiency. The proposed symposium will feature contemporary research and thinking about when and how the inhibitory aftereffects of orienting might facilitate search. Klein will introduce the symposium with some history about search and attention and with converging evidence that there are two forms of IOR. Using an oculomotor task with targets, distractors and pre-cues, van deg Stigchel cleverly distinguishes two effects that seem related to the two forms identified by Klein. MacInnes and Höfler present research demonstrating that top-down goals and item relevance can affect the

manifestation of inhibition in search. Finally, Gilchrist reviews the variety of mechanisms, including IOR, that might operate to facilitate visual search.