International Symposium

Visual Search and Selective Attention (VSSA4)

Symposium Handbook

Munich/ Ammersee, July 13th-16th, 2018

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Editorial

Editorial by the Organizers

Dear participants,

As the organizers, we cordially welcome you to the fourth international symposium on “Visual Search and Selective Attention” (VSSA4). Since it is now six years since the last meeting, we thought it was high time to come together again and discuss current issues in visual search and selective attention. Attention is no doubt a central, ‘organizing’ function in perception, cognition, and action, controlling the selection of sensory information and mediating responses to achieve our behavioral aims. Work in the past decades/years has returned to a number of (by now) ‘classical’ issues, such as attentional capture and template-based search guidance, as well as opening up new issues, such as statistical (long-term) learning in search guidance and attentional control of visual working memory. In parallel with this, there has been a marked convergence of the methodologies for addressing these issues, with many studies combining standard behavioral approaches with electro- and neurophysiological recordings, functional brain imaging, lesion studies, and computational modeling.

So, in VSSA4, we intended to bring together a group of world-leading experts on these issues and approaches in order to take stock and to foster interdisciplinary dialogue, the aim being to identify important shared questions in the study of visual search and selective attention and discuss ways of how these can be resolved using neuro-scientific methodologies.

We divided the symposium into four *thematic sessions*. Although some thematic structuring was necessary to organize the presentations, the session themes are, of course, closely interrelated, so that issues focused on in the earlier sessions may be highlighted again, from some complementary perspective, in later sessions. Thus, the resulting whole will be more than the parts. There four sessions/themes are:

Session 1: "Template-based search guidance & attentional capture" (keynote: Steven Luck, UC Davis, USA)

Session 2: "Selective attention in visual working memory & search guidance by statistical long-term learning" (keynote: Kia Nobre, University of Oxford, UK)

Session 3: "Brain mechanisms of visual search" (keynote: Jeffrey Schall, Vanderbilt University, Nashville, USA)

Session 4: "New data and models of visual search" (keynote: Gregory Zelinsky, Stony Brook University, USA)

Each session will be opened by a 60 min keynote lecture and end with a 45-min general discussion that is meant to help us wrap up what we have learned and consider in more depth issues that cut across and bring together the contents of the individual talks.

In addition, there will be two poster sessions and, of note, a *Symposium Lecture*, which this time will be held by Jeremy Wolfe (Harvard University, Cambridge, MA, USA).

We wish to thank all speakers for accepting our invitation and agreeing to contribute to this symposium. Further, we thank the Munich Center for Neurosciences – Brain & Mind (MCN-LMU), the German Research Foundation ("Deutsche Forschungsgemeinschaft" – DFG), Ludwig-Maximilians-University Munich, and the Elite Network Bavaria ("Elitenetzwerk Bayern" – ENB) for their generous financial support. Last but not least: we would like to especially thank our scientific committee members – Jeremy Wolfe and Jeff Schall – for their enthusiastic help with the preparation of this meeting, as well all those who worked behind the scene to make VSSA4 possible, in particular: Birgitt Aßfalg and Gabriella Zopscak for assisting with the symposium organization and taking care of the attendees' creature comforts.

We wish you all a productive, intellectually exciting and enjoyable symposium.

Hermann Müller & Thomas Geyer.

Program

Program

Friday, July 13th

08.00-09.45	Arrival	
10.00-10.15	Welcome	

Session 1: Search guidance and attentional capture

10.15-11.15	S. Luck (keynote)	Mechanisms for the suppression of irrelevant objects during visual search
11.15-11.45	C. Folk	Semantic templates and attentional capture
11.45-12.15	J. Geng	The role of context in shaping dynamic attentional templates
12.15-12.45	C. Olivers	Proactive and reactive control over target selection in visual search
13.00-14.00	Lunch	
14.00-15.00	Check in	
15.00-15.30	D. Lamy	Attentional capture without attentional engagement: a camera metaphor of attention
15.30-16.00	A. Lleras	Search efficiency for targets defined by two feature dimensions can be predicted based on search efficiency measures for targets defined along a single dimension
16.00-16.45	Discussion	
16.45-17.00	Break	
17.00-18.30	Poster Session 1	
18.45-	Dinner	

Saturday, July 14th

Session 2: Selective attention in visual working memory & search guidance by statistical long-term learning

07.00-08.45	Breakfast	
09.00-10.00	K. Nobre (keynote)	Memory & Attention: the Back & Forth
10.00-10.30	G. Woodman	Context triggers the retrieval of targets stored in long-term memory
10.30-11.00	R. Luria	An object based pointer system underlying visual working memory ability to access its online representations
11.00-11.30	Break	
11.30-12.00	J. Theeuwes	Statistical learning drives visual selection
12.00-12.30	L. Chelazzi	Plasticity of priority maps of space
12.30-13.00	H. Müller	Learning to shield search from salient distractors: dimension-based mechanisms of distractor suppression
13.00-14.00	Lunch	
14.00-14.45	Discussion	

Session 3: Brain mechanisms of visual search

14.45-15.45	J. Schall (keynote)	Neural Control of Visual Search
15.45-16.15	J. Serences	Focal attention leads to warping of population codes in visual cortex
16.15-16.45	D. Baldauf	Functional connectivity mechanisms of attention
16.45-17.15	Break	
17.15-18.15	J. Wolfe (symposium lecture)	Anne Treisman's legacy and the future of visual search
18.30-	Dinner	

Sunday, July 15th

Session 3: Brain mechanisms of visual search (continued)

07.00-08.45	Breakfast	
09.00-09.30	D. Munoz	Neural circuits for saliency, priority and orienting
09.30-10.00	T. Konkle	Predicting visual search from the representational architecture of high-level visual cortex
10.00-10.30	J. Gottlieb	The economics of search and attention: which target should I be looking for?
10.30-11.15	Discussion	
11.15-11.30	Break	
11.30-13.00	Poster Session 2	
13.00-14.00	Lunch	

Session 4: New data and models of visual search

14.00-15.00	G. Zelinsky (keynote)	Predicting goal-directed attention control: A tale of two deep networks
15.00-15.30	R. Rosenholtz	Capacity limits and how the visual system copes with them
15.30-16.00	M. L.-H. Võ	The role of anchor objects in guiding real-world search
16.00-16.15	Break	
18.30-	Symposium Dinner (at Seehaus Riederau; meeting point for bus shuttle: BVS main entrance)	

Monday, July 16th

Session 4: New data and models of visual search (continued)

07.00-08.15	Breakfast	
08.30-09.30	Check out	
09.30-10.00	M. Castelhano	The Surface Guidance Framework: How Scene Surface can inform Search Strategies
10.00-10.30	A. Kristjánsson	New insights from visual foraging tasks into visual attention and visual working memory
10.30-11.00	M. Hout	Passive search strategies improve attentional guidance and object recognition during demanding visual search
11.00-11.45	Discussion	
12.00-13.00	Lunch	
13.00-	Departure	

Additional information (important notes)

Additional information

How to get to the venue

[Route 1] Airport—Herrsching. If you travel by plane, you will arrive at Munich Airport from where you have a direct S-Bahn connection to Herrsching. At the airport, follow the green “S-Bahn” signs (green circle with a white S). Before you enter the S-Bahn platform, please buy a ticket (i.e., the relevant ticket is “Tageskarte Gesamtnetz”; price: 13 Euro) – you can do this directly opposite to the S-Bahn platform entrance. Importantly, also stamp your ticket! The venue is located ca. 80 km southwest of Munich airport; thus, please calculate some additional 2 hours to reach the venue! We recommend you to use public transport (i.e., ‘S-Bahn’ = suburban railway; in particular: S-Bahn No. 8 – the destination is “Herrsching”; alternatively, you can also use S-Bahn No. 1 to “Laim”, where you change the train to S8), which is frequent (departures are every 10 min), inexpensive and convenient to use; transport by taxi would be prohibitively expensive; please note that we are unable to cover the additional expenses of taxi transport. In Herrsching we will set up a meeting point on Friday morning, 08:20 am, in front of the S-Bahn station and transfer you by bus to the venue (it is an additional 40 min bus drive around the south shore of Lake Ammersee to the venue). Participants who will stay the additional night 12th-13th in Herrsching: your hotel is “Seehof” at Seestraße 58 (82211 Herrsching). You can reach “Seehof” best by foot (400 m distance from the S-Bahn station): follow the direction from where the S-Bahn came (the street is: “Zum Landungssteg”) and then turn to the right (to “Seestraße”), where you immediately see the hotel. Please make sure to be back at Herrsching S-Bahn station on Friday morning at 08:20 for our jointed bus tour to the venue.

[Route 2] Airport—Munich—Herrsching. Those of you who will stay one additional night (12th – 13th of July) in Munich and arrive in Herrsching only on Friday morning: your ‘Munich’ hotel is “Carlton Astoria” at Fürstenstraße 12 (80333 München). From Munich Airport it is about 40-50 minutes to Marienplatz (the very heart of Munich; please take the S-Bahn No. 8 from Airport to Marienplatz). At Marienplatz you'd need to get the underground train U3 (Richtung=direction Olympiazentrum) or U6 (direction Garching-Hochbrueck). Your destination is “Odeonsplatz” – you can take any of the two trains (U3 or U6) to get there. Get off the train at Odeonsplatz and, leaving the train, turn right and take the (right-hand) exit in the direction from which the train came. Go up the stairs/escalator and walk in the direction of the University (at “Ludwigstraße”), then turn left to “Oskar-von-Miller Ring”, and then to the right, where you reach “Fürstenstraße”. From Odeonsplatz, it is only a 400 m foot walk to the hotel. On Friday morning, please make sure to arrive at Herrsching S-Bahn station at 08:20 in the morning (for the jointed bus tour to the venue). This would mean that you would have to leave the hotel ca. 07:00. (It is a ca. 1h 10 min travel from Carlton-Astoria to Herrsching). From Odeonsplatz please use either U-Bahn No. 3 or 6 to Marienplatz, where you enter S-Bahn No. 8 to reach Herrsching.

[Route 3] Munich—Holzhausen

Munich participants may also use the train (“Deutsche Bahn”): There is a train connection from Munich Central Railway Station to the town of Utting (the transfer is about 50 minutes; the distance between Utting and the venue is only 2 kilometers – you can walk directly at the lake). In case you will take S-Bahn No. 8 and arrive at Herrsching S-Bahn Station: Please make sure to be there on Friday morning at 08:20 in order to use our bus shuttle to the venue.

Football (Sunday, 16.15-18.30)

There is a break in the symposium program on Sunday afternoon, which may be used for watching ('public viewing' of) the final game of the soccer championship (at BVS' dining room). Alternatively, you may also want to actually play football at BVS' own soccer field. If so, please bring some sports equipment/ shoes with you to VSSA4.

Conference dinner (Sunday, 18.30-21.30; invited speakers / Munich Team)

The conference dinner will be at "Seehaus" at the town of Riederau, which is located approximately 10 km away from the venue. – There will be a joint bus tour to the restaurant. Seehaus is well-known for its original French and Italian meals and scenic location, directly at the Ammersee-shore. The bus tour will start at 18.30 in front of the venue (so please stop public viewing! – see point above). Note that the conference dinner is intended mainly for invited speakers / the Munich team, though a limited number of seats may be available for other participants too.

As an alternative to the conference dinner, you may stroll to the well-known „Alte Villa" in Utting (approx. 30-40 min walk) – a traditional Bavarian beer garden located directly at the Ammersee. There is a path /street starting directly at the venue (close to the railway track) towards the village of Utting and the Alte Villa.

Swim in the Ammersee lake

BVS is equipped with its own jetty/ bath house, which can be used/ entered with your individual room keys. The jetty is located directly on the left-hand side of the conference room. It is a great – and unique – BVS facility and you should thus ultimately consider having a shower in the Ammersee lake!

Check in at venue (Friday, 14.00-15.00; can be done already during lunchtime: 13.00-14.00)

Check in at this "late" hour is owing to the logistics of the BVS on this day (we apologize for this). When you arrive at the venue, please deposit your baggage at the back of the conference room or at our conference office/ desk (where we will take care of it).

Check out at venue (Monday, 08.30-09.30)

Check out at this "early" time is unavoidable, again due to the logistics of the BVS. Please deposit your baggage again at the back of the conference room for the remainder of the meeting.

Guidelines for Presenters

Presentations should be in PowerPoint format (4:3 or widescreen; the 'beamer' can project either screen format). A Mac, computer, and video projector will be provided. Please make sure to copy your presentation to the hard drive of the Mac (computer) in the conference room before the start of your session. Of course, you may also use your own Mac/ computer – in particular, if you use any other presentation software than PowerPoint. VGA adapters for various Mac generations will be provided.

Poster sessions (Friday 17.00-18.30; Sunday 11.30-13.00)

Each poster abstract contains information about whether a given poster will be presented on Friday or Sunday. Poster walls will be arranged on Friday afternoon (around 14.00-15.00). At this time, posters intended for the Friday session can already be put up. Posters intended for the Sunday session can be put up on Sunday morning. **This also means that Friday's posters should be removed on Saturday evening at the latest.**

Help Desk

Help is available permanently during the symposium. If you require help, please get in touch with BVS' Help Desk and/or the VSSA4 Assistance Team: Gabriella Zopcsak, Birgitt Aßfalg, Nadine Gögler, Thomas Geyer, Markus Conci, and Zhuanghua Shi. – You can quickly localize them by performing a real-world 'color' search: their name

tags will be in orange color while the name tags of the other participants will be in green color.

Internet/email

WLAN is available at the entire venue (i.e., in all seminar/ entrance/ guest rooms). The access parameters are the following: “bvs-hzh” (WLAN name) and “Holzhausen” (WLAN key).

Access to conference venue

Your individual room key will also allow late, i.e., evening/ night, access to the conference building (main entrance).

Payment (non-invited participants)

When you check out, payment can be made in cash (in Euro) or by credit card. The venue accepts two forms of credit cards: Visa and Master Card.

Abstracts

Session 1: Search guidance and attentional capture

Mechanisms for the suppression of irrelevant objects during visual search

Steven Luck, UC-Davis Center for Mind & Brain and Department of Psychology, USA; contact: sjluck@ucdavis.edu

Abstract

We have long known that attention can be directed toward items containing task-relevant feature values. But can attention also be directed away from irrelevant features (i.e., features indicating than an item is a nontarget)? In this presentation, I will review recent studies indicating that items containing distinctive nontarget feature values can be suppressed so that they attract attention less than “neutral” items. This mechanism can be used to suppress salient singletons, as assessed with psychophysics, eye tracking, and ERPs (with significant correlations among these measures, suggesting that they all reflect the same underlying mechanism). This mechanism can also be used to suppress nonsalient distractor items. However, the suppression mechanism does not appear to be under direct voluntary control. First, if observers are cued to avoid a specific color, the first eye movement tends to be directed to the to-be-avoided color. Second, the suppression appears to build up over trials. Third, if automatic priming from the previous trial is put into competition with explicit cuing of the to-be-avoided color, priming wins and suppression loses. The emerging picture is that explicit goals can direct attention toward but not away from specific feature values, but goal-driven experience with target and distractor features can lead to automatic suppression of to-be-avoided features.

Semantic templates and attentional capture

Charles Folk, Villanova University, USA; contact: charles.folk@villanova.edu

Abstract

Over the last 25 years, research on attentional guidance and capture has focused on the relative influence of bottom-up salience, top-down set, and more recently, selection history. An implicit assumption in much of this work has been that attentional guidance is limited to preattentively processed feature information (e.g., color, orientation, brightness, etc.). For example, a color singleton might capture attention based on a low level, salient, feature contrast, and that capture might be modulated by a top-down set for a particular color value. However, a growing number of studies looking at visual search in naturalistic scenes suggest that semantic/categorical information can have a dramatic impact on overt attention allocation as measured by eye movements. In addition, there is strong evidence that emotional content (independent of featural content) can produce evidence of attentional capture. Here we address whether attentional capture by semantic/categorical content is limited to emotional stimuli, or whether establishing a top-down set or template for semantic information can result in the contingent capture of attention by stimuli matching the semantic set. A series of behavioral and electrophysiological studies using an RSVP methodology will be reviewed that explore the degree to which natural images depicting exemplars from superordinate categories can elicit the capture of covert attention, and whether such capture is contingent on a top-down set for the relevant category.

The role of context in shaping dynamic attentional templates

Joy Geng, UC-Davis Center for Mind & Brain and Department of Psychology, USA; contact: jgeng@ucdavis.edu

Abstract

Theories of attention commonly refer to the “attentional template” as the collection of features in working memory that represent the target of visual search. Many models of attention assume that the template contains a veridical representation of target features, particularly when the target is defined by just one feature (e.g., a single color). However, recent studies have shown that the target representation can be “shifted” away from the true target value in order to optimize their distinctiveness from distractors and facilitate visual search (Navalpakkam and Itti, 2007; Becker, 2010; Geng et al., 2017). Despite these demonstrations, it remains unclear what conditions produce specific changes in the target representation. Here, I describe experiments in which we have investigated how the target template changes as a function of distractor context, stimulus complexity, and individual differences. Our data indicate that the "tuning" of the template is shaped by a number of factors, but its distance from distractors always predicts visual search performance.

Proactive and reactive control over target selection in visual search

Chris Olivers, VU Amsterdam, The Netherlands; contact: c.n.l.olivers@vu.nl

Abstract

Searching for more than one type of target often, but not always, results in switch costs. Using a gaze-contingent eye-tracking paradigm in which we instruct participants to simultaneously look for two target objects presented among distractors, we find that the occurrence of switch costs depends on target availability. When both targets are available in a display, thus giving the observer free choice on what to look for, little to no switch costs occur. In contrast, clear switch costs emerge when only one of the two targets is available, so that the target object is being imposed. This pattern occurs within and across various stimulus dimensions, and can be explained by assuming limited active attentional guidance in combination with a role for different types of cognitive control in visual search. While full target availability allows for proactive control over target selection, single target availability requires reactive control in response to unanticipated targets. I will furthermore present combined eye-tracking + fMRI and eye-tracking + EEG studies tracing both source and dynamics of these different control processes in visual search.

Attentional capture without attentional engagement: a camera metaphor of attention

Dominique Lamy, Tel Aviv University, Israel; contact: domi@tauex.tau.ac.il

Abstract

Most models of spatial attention assume that attention operates like a spotlight and that stimuli appearing in the focus of attention are mandatorily processed. Here, we show that when an irrelevant object captures attention, the shift of attention can be shallow and not followed by attentional engagement. In three sets of experiments, we measured spatial shifts of attention to an irrelevant distractor (or cue) as enhanced performance when the target appeared at the same vs. at a different location relative to the cue and attentional engagement as enhanced performance when the response-relevant feature at the cued location was compatible vs. incompatible with the target's response feature. We found that (1) attentional shifts to irrelevant onsets were followed by attentional engagement at the cued location only with relevant-color and not with irrelevant-color onsets (contingent attentional engagement); (2) Attentional shifts to relevant-color cues were independent of conscious perception of the cue, whereas attentional engagement was contingent on it; (3) Attentional shifts to relevant-color cues were unaffected by the attentional blink, whereas attentional engagement was reduced and the N2pc component of the ERP suppressed. We discuss the implications of these findings for the distinction between stimulus-driven and goal-dependent attentional capture, the mechanisms indexed by the N2pc and more broadly, models of spatial attention. In particular, we suggest that attention operates like a camera, which requires both aligning the zoom lens and pushing the shutter button, rather than like a spotlight.

Search efficiency for targets defined by two feature dimensions can be predicted based on search efficiency measures for targets defined along a single dimension

Alejandro Lleras, University of Illinois at Urbana-Champaign; contact: alejandrolleras@gmail.com

Abstract

A new model for efficient visual search (Contrast Signal Theory - CST) is proposed whereby the goal of early parallel processing is to compute a contrast signal between the target template in memory and each item in the display. This architecture allows the visual system to compute fast and confident decisions about items in the display that are sufficiently different from the target such that parallel, peripheral evaluation of these items is sufficient to discard them as non-targets. In this model, the logarithmic search observed when a target is sufficiently different from lures is proposed to be inversely proportional to that [lure-target] contrast signal, such that evidence accumulation will accrue faster at locations where contrast is larger (i.e., the lure-target similarity is low) than where contrast is smaller (lure-target similarity is high). The Contrast Signal Theory has shown some early successes: it allows one to predict RTs for heterogeneous displays based on performance observed in homogeneous displays. Here, we ask: can search efficiency for targets that differ from distractors along two dimensions (color and shape) be predicted by the search efficiency observed for targets that differ from distractors along a single dimension (only differ in color or only differ in shape)? Predictions from various models are compared. Results from ten experiments show that there is a simple equation to derive the combined ([color x shape]) search efficiency based on the search efficiency observed along individual dimensions ([color] & [shape]).

Session 2: Selective attention in visual working memory & search guidance by statistical long-term learning

Memory and attention: the back and forth

Kia Nobre, University of Oxford, UK; contact: kia.nobre@psy.ox.ac.uk

Abstract

Intuition tells us that memory is about moving back, to retrieve the past, whereas attention is about moving forth, to anticipate the future. In my talk I will argue that these arrows of time are misleading, and suggest instead that memory and attention work together in tightly knit complementary ways to link past and future in the service of guiding adaptive behaviour.

Context triggers the retrieval of targets stored in long-term memory

Geoff Woodman, Vanderbilt University, Nashville, USA; contact: geoffrey.f.woodman@vanderbilt.edu

Abstract

How do we know what we are looking for in familiar scenes and surroundings? One proposal from theories of human memory is that visual working memory buffers mnemonic contents retrieved from long-term memory. The retrieved contents can then form an online mental representation (i.e., an attentional template) to control and guide attention. In the present study, we tested the hypothesis that context triggers the retrieval from long-term memory of the possible targets given that context. For example, being in the drivers seat of a car triggers the retrieval of road hazards. Here we recorded human subjects electroencephalogram (EEG) while they searched for objects on different colored backgrounds. Subjects searched for different sets of 1, 2, 4, and 6 unique real-world objects with each target set size paired with a different search context color. While learning, they also had to hold the search set of objects in mind during a blank delay to perform a visual search task at the end of each trial. After learning, subjects performed the visual search tasks in the different color contexts. During this final phase, we found that the colored backgrounds elicited EEG and event-related potentials of visual working memory maintenance that recapitulated the set size of the objects that people were to look for on that background. These results support the idea that contextual retrieval cues are sufficient for people to pull information out of long-term memory and into working memory to guide attention.

An object based pointer system underlying visual working memory ability to access its online representation

Roy Luria, Tel Aviv University, Israel; contact: royluria@tauex.tau.ac.il

Abstract

The world around us constantly changes, posing a difficult challenge for our visual system that needs to constantly modify the information it represents accordingly. This process is done by Visual working memory (VWM) that is able to access a specific representation and modify it according to changes in the environment.
We argue that in order to access and modify the corresponding information, each representation within the VWM workspace must be stably mapped to the relevant stimuli. The idea of such a “pointer system” has been theoretically proposed in the past (e.g., FINST, Pylyshyn, 2000), but empirical support for it was largely limited to a tracking task, in which the only relevant information was spatial.
First, we provide evidence that VWM relies on such a pointer system in a shape change detection task, in which spatial information is task-irrelevant. By manipulating the pointer’s stability, we demonstrated that the loss of a pointer was accompanied by stable electrophysiological and behavioral markers, allowing us to use them as signatures of the pointer system. Next, we examined how the pointer system operates. Specifically, we asked whether pointers are allocated based on a spatial, featural, or object-based code. The results indicate that the pointer system relies on objecthood information to map and access each VWM representation.

Statistical learning drives visual selection

Jan Theeuwes, VU Amsterdam, The Netherlands; contact: j.theeuwes@vu.nl

Abstract

Lingering biases of attentional selection affect the deployment of attention above and beyond top-down and bottom-up control. In this talk I will present an overview of recent studies investigating how statistical learning regarding the distractor determines attentional control. In all these experiments we used the classic additional singleton task in which participants searched for a salient shape singleton while ignoring a color distractor singleton. The distractor singleton was presented more often in one location than in all other locations. Even though observers were not aware of the statistical regularities, we show that the location of the distractor was suppressed relative to all other locations. Moreover, we show that this learning in highly flexible and adaptive. We argue that selection history modulates the topographical landscape of spatial ‘priority’ maps, such that attention is biased towards locations having a high activation and biased away from locations that are suppressed.

Plasticity of priority maps of space

Leonardo Chelazzi - University of Verona, Italy, contact:
leonardo.chelazzi@univr.it

Abstract

In the past we have pioneered research with human participants exploring the impact of reward on visual selective attention. For example, in a recent study using visual search, we have demonstrated that reward can alter the "landscape" of spatial priority maps, increasing priority for locations associated with greater reward during a learning phase and reducing it for locations associated with smaller reward. Importantly, we could also demonstrate that the effects persisted for several days after the end of the learning episode, during an extinction phase, and generalized to new tasks and stimuli. With an ongoing program of research, we are now assessing whether similar effects can be induced via statistical learning. In a series of experiments using variants of a visual search task, unbeknownst to the participants, we manipulate the probability of occurrence of the sought target and/or of a salient distractor across locations. The evidence indicates that, similar to the influence of reward, uneven probabilities of the critical items alter deployment of attention in a way that can optimize performance under certain conditions but can hinder it under other conditions. We argue that these effects reflect durable changes in priority maps of space. Importantly, in all cases above, changes in attentional performance were obtained even though participants had no clue as to the adopted manipulation. Future studies will try to understand whether reward-based learning and statistical learning operate via shared or independent mechanisms. In summary, reward and statistical learning appear to be strong (and implicit) determinants of attentional deployment.

Learning to shield search from salient distractors: dimension-based mechanisms of distractor suppression

Hermann J. Müller, Fredrik Allenmark, Heinrich R. Liesefeld, Mariam Sauter, Zhuanghua Shi, & Bei Zhang, LMU Munich, Germany; contact: hmueller@psy.lmu.de

Abstract

Recently, there has been a growing interest in the mechanisms that permit observers to mitigate the interference effects of salient, additional-singleton distractors in visual search, including (statistical) learning to suppress distractors that consistently appear at likely, as compared to unlikely, distractor locations in the display. We will report a set of experiments which collectively indicate that mechanisms of dimension-based shielding of search from distraction play a role in these phenomena. First, we show that distractors defined in a different dimension to the target (e.g., orientation-defined target, luminance-defined distractor) cause less interference than distractors defined in the same dimension as the target (orientation-defined target, orientation-defined distractor), even though the defining distractor feature is perfectly predictable and clearly separable from the target feature in both cases. Second, we show that observers can learn to down-modulate a whole display region (rather than just a specific, single location) where a distractor is likely (vs. unlikely) to occur, both with different-dimension and with same-dimension distractors. Third, we present evidence suggesting that the signal down-modulation may operate at a different level with distractors defined in a different vs. the same dimension to the target: a dimension-based (spatial) level vs. a supra-dimensional (priority-map) level. In particular: spatial suppression also affects target processing, but only with same-dimension distractors – indicating that different-dimension distractors are suppressed on the dimensional level. This appears to be at variance with other studies that found such a target-location effect even for different-dimension distractors. We will discuss possible factors responsible for these discrepant findings, including the probabilistic 'cueing' of a single distractor location vs. a whole distractor region as well as the role of practice on the task. Together, our evidence suggests that, while the shielding of search from salient distractors ultimately works via the priority map, suppression at the dimension-based level (prior to signal integration by the priority map) offers a ready strategy when distractors are defined in a non-target dimension.

Session 3: Brain mechanisms of visual search

Neural Control of Visual Search

Jeff Schall, Vanderbilt University, Nashville, USA; contact: jeffrey.d.schall@vanderbilt.edu

Abstract

This presentation will survey performance, neural and computational findings demonstrating that gaze is guided during visual search through the operation of distinct stages of visual selection and saccade preparation. These stages can be selectively manipulated though target-distractor similarity, stimulus-response mapping rules, and unexpected perturbation of the visual array. Such manipulations indicate that they are instantiated in different neural populations with distinct connectivity and functional properties. Race and accumulator models provide a comprehensive account of the saccade preparation stage and of the conversion of salience evidence into saccade commands.

Focal attention leads to warping of population codes in visual cortex

John Serences, UC San Diego, USA; contact: jserences@ucsd.edu

Abstract

Visual search is often likened to shining a spotlight of attention at different positions in the visual field. Yet even convert attention to a single position, without search across the visual field, induces widespread modulations of neural populations with receptive fields (RFs) across the entire visual field. To investigate this 'warping' of spatial RFs, we used fMRI to examine changes in single voxel receptive fields (vRFs) and corresponding changes in the precision of representations based on larger populations of voxels arrayed across entire visual areas. We find that attention leads to large-scale modulations of vRF gain, size, and position, with position shifts contributing more to population-level enhancements of visual information than changes in vRF size or gain. These findings demonstrate that attending to even a single position leads to spatially widespread modulations in visual cortex, and that shifts in the position of RFs are a principal mechanism by which spatial attention enhances population codes for relevant visual information. This poses particular challenges for labeled line theories of information processing, suggesting that downstream regions likely rely on distributed inputs rather than single neuron-to-neuron mappings.

Functional connectivity mechanisms of attention

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Abstract

The neural mechanisms of spatial attention, via feedback signals from spatially-mapped control areas in frontal / parietal cortex, have been described in much detail. For non-spatial attention to different sensory modalities, complex objects, and so on, the control mechanisms seem much more complex and experimental work has just begun to identify possible sources of top-down control in the inferior part of frontal cortex. Obviously, however, spatial and non-spatial attention is often combined in everyday tasks. How these different control networks work together is a major question in cognitive neuroscience. To answer these remaining questions, we combined MEG and fMRI data in human subjects to identify not only the sources for spatial and non-spatial feedback signals, but also the mechanisms by which these different networks interact with sensory areas in attention. We identified two separable networks in the superior- and inferior-frontal cortex, mediating spatial versus non-spatial attention, respectively. Using multi-voxel pattern analysis, we found spatial and non-spatial information are represented in different subpopulations of frontal cortex. Most importantly, our analyses of temporally high-resolving MEG data also show that both control structures engage selectively in coherent interactions with sensory areas that represent the attended stimulus. Rather than a zero-phase lag connection, which would indicate common input, the interactions between frontal cortex and sensory areas are phase-shifted to allow for a 20ms transmission time. This seems to be just the right time for signals in one area to arrive at a time of maximum depolarization in the connected area, increasing their impact. Further, we were able to identify top-down directionality of these oscillatory interactions, establishing the superior- versus inferior-frontal cortex as key sources of spatial versus non-spatial attentional inputs, respectively.

Neural Circuits for Saliency, Priority and Orienting

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Abstract

Since its introduction almost 30 years ago, saliency-map theory has attracted wide spread attention. The concept of a priority map arose as an extension of this idea to include top-down, goal-dependent input in a combined representation of visual saliency and behavioral relevancy, which is thought to determine attention and gaze. Models of visual attention postulate that a bottom-up saliency map is formed early in the visual processing stream. Although studies have reported evidence of a saliency map in various cortical brain areas, determining the contribution of phylogenetically older pathways is crucial to understanding its origin. We compared saliency coding from neurons in two early gateways into the visual system, the primary visual cortex (V1) and the evolutionarily older superior colliculus (SC). We found that, while visual signals reached V1 sooner than the SC superficial visual layers (SCs), the saliency representation emerged earlier in SCs than in V1. Because the dominant input to the SCs arises from V1, these relative timings are consistent with the hypothesis that SCs neurons pool the inputs from multiple V1 neurons to form a feature-agnostic saliency map, which may then be relayed to other brain areas. If the salient stimulus or stimuli become the target for a future saccade then neurons in the intermediate layers of the SC (SCi) develop a robust code of priority. How saliency and priority are coded in the brain has largely been restricted to simple laboratory stimuli presented to subjects performing stereotypical tasks. I will also highlight recent evidence contrasting neural processing of saliency and priority in the SC during natural free viewing of videos. The take home message is that the SCs robustly codes saliency, while the SCi robustly codes priority.

Predicting visual search from the representational architecture of high-level visual cortex

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Abstract

While many prominent models of visual search focus on characterizing how attention is deployed, it is also clear that representational factors contribute to visual search speeds, such as target-distractor similarity (Duncan and Humphreys, 1989). In this line of work, we examined the extent to which performance on a visual search task can be predicted from the stable representational architecture of the visual system, independent of attentional dynamics. Overall, we found strong brain/behavior correlations across most of the higher-level visual system, including both the ventral and dorsal pathways when considering both macro-scale sectors as well as smaller meso-scale regions. These results suggest that visual search for real-world object categories is well predicted by the stable, task-independent architecture of the visual system.

The economics of search and attention: which target should I be looking for?

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Abstract

Studies of attention and visual search have focused on how we find targets given that we have been instructed to what to attend. But in natural behavior we do not have an instructor. Instead, our brains autonomously decide which sensory stimulus is most useful in a situation. Behavioral studies suggest that the brain makes these decisions based on cost-benefit analyses that consider the information gains, reward associations and costs (difficulty) related to finding and discriminating sensory cues. I will describe findings from our laboratory that begin to unravel how these quantities are represented in individual cells. While our studies have focused on the lateral intraparietal area (LIP), they suggests that many of the relevant processes depend on structures beyond the classical priority maps, thus linking the study of attention with traditionally separate topics of motivation, decision making and cognitive control.

Session 4: New data and models of visual search

Predicting goal-directed attention control: A tale of two deep networks

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Abstract

The ability to control the allocation of attention underlies all goal-directed behavior. Here two recent efforts are summarized that apply deep learning methods to model this core perceptual-cognitive ability.

The first of these is Deep-BCN, the first deep neural network implementation of the widely-accepted biased-competition theory (BCT) of attention control. Deep-BCN is an 8-layer deep network pre-trained for object classification, one whose layers and their functional connectivity are mapped to early-visual (V1, V2/V3, V4), ventral (PIT, AIT), and frontal (PFC) brain areas as informed by BCT. Deep-BCN also has a superior colliculus and a frontal-eye field, and can therefore make eye movements. We compared Deep-BCN's eye movements to those made by 15 people performing a categorical search for one of 25 target categories of common objects and found that it predicted both the number of fixations during search and the saccade-distance travelled before search termination. With Deep-BCN, a DNN implementation of BCT now exists that can be used to predict the neural and behavioral responses of an attention control mechanism as it mediates a goal-directed behavior—in our study the eye movements made in search of a target goal.

The second model of attention control is ATTNet, a deep network model of the ATTention Network. ATTNet is similar to Deep-BCN in that both have layers mapped to early-visual and ventral brain structures in the attention network and are aligned with BCT. However, they differ in two key respects. ATTNet includes layers mapped to dorsal structures, enabling it to learn how to prioritize the selection of visual inputs for the purpose of directing a high-resolution attention window. But a more fundamental difference is that ATTNet learns to shift its attention as it greedily seeks out reward. Using deep reinforcement learning, an attention shift to a target object elicits reward that makes all the network's states leading up to that covert action more likely to occur in the future. ATTNet also learns to prioritize the visual input so as to efficiently control the direction of its focal routing window—the colloquial spotlight of attention. It does this, not only to find reward faster, but also to restrict its visual inputs to potentially rewarding patterns for the purpose of improving classification success. This selective routing behavior was quantified as a "priority map" and used to predict the gaze fixations made by 30 subjects searching 240 images from Microsoft COCO (the dataset used to train ATTNet) for a target from one of three object categories. Both subjects and ATTNet showed evidence for attention being preferentially directed to target goals, behaviorally measured as oculomotor guidance to the targets. Other well-established findings in the search literature were observed.

In summary, ATTNet is the first behaviorally-validated model of attention control that uses deep reinforcement to learn to shift a focal routing window to select image patterns. This is theoretically important in that it shows how a reward-based mechanism might be used by the brain to learn how to shift attention. Deep-BCN is also theoretically important in being the first deep network designed to capture the core tenant of BCT: that a top-down goal state biases a competition among object representations for the selective routing of a visual input, with the purpose of this selective routing being greater classification success. Together, Deep-BCN and ATTNet begin to explore the space of ways that cognitive neuroscience and machine learning can blend to form a new computational neuroscience, one harnessing the power and promise of deep learning.

Capacity limits and how the visual system copes with them

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Abstract

Our visual system cannot process everything with full fidelity, nor, in a given moment, perform all possible visual tasks. Rather, it must lose some information, and prioritize some tasks over others. A number of strategies have developed for dealing with this limited capacity. A popular proposal posits limited access to higher-level processing; that a mechanism known as selective attention serially gates access to that resource; and that the gate operates early in visual processing. However, since this account was originally proposed, we as a field have learned a great deal about capacity limits in vision. I will discuss the implications for selective attention theory. Furthermore, I will examine what we have learned from studying an alternative mechanism for dealing with limited capacity: efficient coding, particularly in the visual periphery. In this scheme, visual processing has limited bandwidth rather than limited access to higher-level processing. Finally, evidence suggests that we should look for additional capacity limits late in processing, taking the form of general-purpose limits on the complexity of the tasks one can perform at a given moment. A general-purpose decision process may deal with such limits by "cutting corners" when the task becomes too complicated.

The role of anchor objects in guiding real-world search

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Abstract

General scene knowledge (our “scene grammar”) plays an important role in both identifying and locating objects in the real world. This knowledge reflects co-occurrences of scene elements and their structural regularities. When trying to locate an object, predicting the spatial relationship between various objects within a single scene is key for efficient search performance. We propose that the arrangement of objects is not only rule-governed, but hierarchical in its structure. In particular, we believe that some objects within each scene category function as anchors, carrying strong spatial predictions regarding other objects within the scene (e.g. the stove anchors the position of the pot). Therefore, these “anchors” constitute key elements in the hierarchy of objects in scenes and allow to efficiently guide search in real-world scenes. To test this hypothesis and to quantify the spatial relationship between objects in different scene categories, we extracted the spatial locations of objects from an image database. Inspired by graph theory, we captured the relationship of objects as a set of nodes connected by edges of varying weights. Based on these weights and combined with cluster analyses, we identified “anchor” objects. We tested the behavioral relevance of the weight parameters by correlating them with search performance in a different set of scenes. Results show that reaction time decreases as weights increase and that swapping anchors impeded search. We take this as first evidence that anchors play an important role in guiding search through naturalistic scenes.

The Surface Guidance Framework: How Scene Surface can inform search strategies

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Abstract

The spatial relationship between objects and scenes and its effects on visual search performance has been well-established. In previous studies, we have shown that the spatial relationship can be exploited to explain eye movement patterns, to explain how initial scene representations affect subsequent search performance, and to distinguish the contribution of spatial vs. semantic information.

Using the newly proposed Surface Guidance Framework, we operationalize target relevant and irrelevant scene regions. We divide scenes into three regions (upper, mid, lower) that correspond with possible relevant surfaces (wall, countertop, floor). Target relevant regions are defined as the region a target object is expected (e.g., painting, toaster, rug). Here, we explore how relevant and irrelevant regions of a scene are processed in two classic visual search paradigms (set size and sudden onset) to further explore mechanisms of attention during search in scenes.

In Study 1, we explored how spatial associations affect search by manipulating search size in both target relevant or target irrelevant regions. We found that only set size increases in target relevant regions adversely affected search performance. In Study 2, we manipulated whether a suddenly-onsetting distractor object appeared in a target relevant or target irrelevant region. We found that fixations to the distractor were significantly more likely to occur in the target relevant condition and negatively affected search performance.

The Surface Guidance Framework allows us further explore how spatial associations can narrow processing to specific areas of the scene relevant to the task. Viewing effects of scene context through the lens of target relevancy allows us to develop new understanding of how the spatial relationship between objects and scenes can affect performance and processing.

New insights from visual foraging tasks into visual attention and visual working memory

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Abstract

The assessment of the functional properties of visual attention and visual working memory has in past decades been dominated by single-target visual searches. But our goals from one moment to the next are unlikely to involve only a single target, and more recently, paradigms involving visual foraging for multiple targets have been used to investigate visual attention and working memory. Set-size effects in single-target visual search tasks partly form the foundation of many theories of visual search. We therefore manipulated set-size in a visual foraging task, involving both “feature” and “conjunction” foraging. The target selection times during foraging revealed specific components of the foraging pattern indicating that single-target search tasks only provide a snapshot of visual attention. Foraging tasks can also provide insights into the operational principles of visual working memory, and our results indicate that participants are able to change their foraging patterns according to task demands suggests that visual working representations used for attentional guidance are flexible, but not restricted to a single value as some current theories suggest. Our results show how single-target visual search tasks vastly undersample the operation of visual attention and visual working memory, providing only a snap-shot of the function of visual attention and visual working memory and this limited information is bound to be reflected in theoretical accounts based on such tasks.

Passive search strategies improve attentional guidance and object recognition during demanding visual search

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Abstract

Hybrid visual memory search (i.e., search for more items than can be maintained in working memory) requires observers to search both through a visual display and through the contents of memory in order to find designated “target” items (e.g., walking through the grocery store looking for items on your grocery list, airport baggage screeners looking for many prohibited items in travelers’ luggage). A substantial body of research on this task has shown that observers are able to search for a very large number of items with relative ease. However, the attentional mechanisms that drive hybrid search remain somewhat unclear. In our first two experiments, we investigated the role that cognitive strategies play in facilitating hybrid search for categorically-defined targets. We hypothesized that observers in a hybrid search task would naturally adopt a strategy in which they remain somewhat passive, allowing targets to “pop out,” rather than actively directing their attention around the visual display. Experiment 1 compared behavioral responses in passive, active, and uninstructed hybrid search. Contrary to our expectations, we found that uninstructed search tended to be active in nature, but we also found that adopting a passive strategy led to more efficient performance. In Experiment 2, we replicated these findings, and tracked the eye movements of observers. We found that oculomotor behavior in passive hybrid search was characterized by faster, larger saccades, a tendency to fixate fewer non-target items, and an improved ability to classify items as either targets or distractors. In Experiment 3, we explored whether the benefits of passive search were limited only to particularly demanding search tasks (i.e., those that require observers to search for many items at once), or if performance benefits also appear when people are asked to find a single, categorically-defined target. Once again, we tracked the eye movements of participants and found strikingly similar results to our hybrid search task. Namely, that passive searchers were faster and less accurate, but more efficient overall. Additionally, passive search led to improved attentional guidance, better object recognition, and fewer target recognition failures. Together, our results indicate two surprising findings. First, that hybrid visual search is more active in nature than expected, and second, that adopting a passive search strategy leads to performance and oculomotor improvements during hybrid and single-target search. These findings fill a gap in the literature regarding the nature of strategy use during visual search, and the potential benefits of strategy adoption during challenging search tasks.

Symposium lecture

Anne Treisman's legacy and the future of visual search

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Abstract

For most researchers in the visual search trade, Anne Treisman's work was foundational. Whether you agreed or disagreed with her, you could not ignore the body of data and theory that she created. In this talk, I will review some of my agreements and disagreements with Treisman's Feature Integration Theory. My Guided Search theory, in its various incarnations, was the product of my fruitful interaction with Anne. For the most part, our arguments dealt with tasks where observers looked for one target amongst a set of items randomly distributed on an otherwise blank background. In the second part of the talk, I will consider whether the rules that govern those tasks are relevant when we search in real scenes, when we might be searching for more than one type of target, and when we don't know how many instances of targets might be present in the search stimulus. The answer will be a qualified "yes". In the third section, if I have not exhausted the allotted time and the patience of the audience, I will discuss some of the problems posed by socially important search tasks like cancer screening and consider whether basic behavioral research has solutions to offer.

Participants presenting posters (alphabetic order)

Bayesian updating models of inter-trial effects in visual search: a factorial model comparison

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Abstract

Many previous studies on visual search have reported inter-trial effects: observers respond faster when some target property repeats versus changes across trials. However, the processes driving these effects remains a controversial topic. Here, we investigated this question by combining Bayesian modeling of belief updating and evidence accumulation modeling of perceptual decision-making. In three visual search experiments, we explored how the probability of the response-critical states of the search display and the repetition/switch of the target-defining dimension influence reaction time distributions. The results replicated previous findings of inter-trial effects. To uncover the underlying mechanisms, we used the Drift-Diffusion Model and the Linear Approach to Threshold with Ergodic Rate model to explain the RT distributions in terms of decision bias and information processing speed. We further investigated how these different aspects of the decision-making process are affected by different properties of stimulus history, by considering different rules for updating of the starting point and the rate. We compared all combinations of updating mechanisms and perceptual decision model in a factorial model comparison. We found that the history of the response-critical property influences the decision bias, while repetition/switch of the target-defining dimension affects the accumulation rate, likely reflecting an implicit 'top-down' modulation process.

Poster session: Friday

Statistical context learning within and across the modalities of vision and touch

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Abstract

In everyday scenes, searched-for targets do not appear in isolation, but are embedded within configurations of non-target or distractor items. If the position of the target relative to the distractors is invariant, such spatial contingencies are learned and come to guide environmental scanning ("contextual cueing" effect; i.e., Chun & Jiang, 1998). Importantly, such context learning is not limited to the visual modality: using a novel tactile search task, here we show that repeated tactile contexts aid tactile search as well. We further show that the coordinate system underlying tactile context cueing is an anatomical one (i.e., tactile search items are learned relative to where they occur on the body surface/ fingers). Finally, we present new work on statistical context learning across the sensory modalities of vision and touch. The new finding is that of context-based facilitation of visual search even if spatial arrays are held constant in the other (tactile) modality. This demonstrates that observers can form spatial context memory between the constant visual target position and the constant tactile distractor configuration. These findings make the context cueing paradigm are promising avenue for future research on crossmodal learning.

Poster session: Sunday

Phase coupling between posterior EEG theta and gamma as a signature of memory matching

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Abstract

Our visual perception is strongly influenced by our expectancies about incoming sensory information. It is assumed that mental templates of expected sensory input are created that are compared to actual sensory input, which can be matching or not. In cases where such mental templates have to be held in short-term memory, such as in visual attention or search tasks, cross-frequency synchronization between theta and gamma band EEG oscillations has been proposed to serve matching processes between prediction and sensation. In this study, we investigated how matching between sensory input and mental templates from working memory is affected by the certainty about which activated template must be matched. In a visual search paradigm, we compared cross-frequency phase coupling for conditions where participants had to keep either one or multiple templates in mind for successful search. We find that memory matching appeared as a transient posterior phase-synchronization between EEG theta and gamma oscillations in an early time window after search display presentation, around 100-150 ms. Our results suggest a stronger transient phase-synchronization of theta and gamma over posterior sites contralateral to target presentation for conditions where one mental template was required than for multiple templates. This is understood in line with previous theoretical accounts, lending promising support for such transient phase coupling between posterior theta and gamma as a neuronal correlate of matching of incoming sensory information with memory contents from working memory.

Poster session: Sunday

The role of the pre-supplementary motor area on verticality perception in subjective visual vertical in visual search tasks: a transcranial magnetic stimulation (TMS) study

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Abstract

Successful spatial orientation and navigation are highly related to precise and stable perception of verticality. Researchers are able to measure verticality perception with the Subjective Visual Vertical (SVV) task which estimates the deviation between an individual's subjective vertical perception and the veridical vertical. In the present study, we aim to investigate the role of pre-Supplementary Motor Area (pre-SMA) in the neuronal implementation of verticality judgements. To probe the role of pre-SMA, we conducted an offline TMS study using SVV and visual search task. As a result, we demonstrated that after TMS, in the visual search task, participants were significantly more precise (less variation in bias) than pre-TMS. These results suggest that pre-SMA might have an effect on precision. However, we could not find any significant result in SVV task which may indicate that pre-SMA is more related to visual search than verticality perception per se.

Poster session: Friday

Kanizsa-figure object completion gates attentional selection in time

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Abstract

Previous work has demonstrated that perceptual grouping modulates the selectivity of attention across space. However, how grouping influences the allocation of attention over time is much less clear. The current study investigated this issue, using an attentional blink (AB) paradigm with Kanizsa figure configurations that systematically varied the strength of grouping, thus permitting the effects of object integration upon initial selection and subsequent short-term memory consolidation of a target to be determined. On a given trial, two red Kanizsa-type targets (T1, T2) were embedded in a rapid serial visual presentation stream of irrelevant distractors. We observed the typical AB phenomenon: impaired identification of T2 when presented close in time after T1. Moreover, the AB was modulated by T2 grouping, with stronger grouping resulting in a reduced AB and higher performance overall. This influence of grouping was independent of the perceptual organization of T1 (grouped or ungrouped). By contrast, an opposite pattern – of an increased AB with increasing grouping strength – was obtained when the Kanizsa figure was not task-relevant. Together, these findings suggest that the grouping benefit emerges at early perceptual stages, automatically drawing attentional resources, thereby leading to either sustained benefits or transient costs – depending on the task-relevance of the grouped object. This indicates that grouping modulates processing of objects in time.

Poster session: Friday

Search task difficulty mediates distractor template utilization

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Abstract

There is an ongoing debate as to whether prior knowledge about the upcoming distractor identity can facilitate visual search performance. Part of this controversy is due to the failure of several studies to replicate the “distractor cueing effect” (DCE). Some authors have reported this effect using a trial-by-trial cueing task (e.g., Reeder, Olivers, & Pollmann, 2017), while others have merely interpreted this effect in terms of a “spatial recoding” from the cued distractor set to the actual target set (Beck & Hollingworth, 2015).
One observation evident in studies that have reported the DCE is the employment of rather difficult serial search tasks alongside relatively slow reaction times (RTs). Consequently, the present study aimed to determine whether search task difficulty may be a prerequisite for the occurrence of the DCE. To investigate this question, participants received cues prior to the search array indicating the (i) target color, (ii) distractor color, or (iii) a task-irrelevant color. In the easy search task, participants searched for a “T” amongst “Ls”, while in the difficult search task, the similarity between the distractor and target items was increased by altering the perpendicular line of the letter “L” by 30 % towards the center.
Our findings revealed no DCE in the easy variant. In the difficult search task, by contrast, each cue produced different RTs: target cues triggered fastest responses, followed by distractor and neutral cues. Accordingly, the higher the difficulty the more beneficial it is to utilize prior distractor-related knowledge, indicating that top-down distractor templates are activated only when the search is difficult. However, given that the distractor cues remained less efficient than the target cues, the present study cannot determine whether the DCE can simply be explained in terms of spatial recoding.

Poster session: Sunday

On the efficacy of computerized cognitive remediation in improving cognitive, functional and clinical outcomes in patients with schizophrenia. A meta-analysis

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Abstract

Objective: The effects of computerized cognitive remediation (a behavioral training for the improvement of cognitive functions) on diverse cognitive, clinical and functional outcomes in patients with schizophrenia was assessed. The potential moderator effects of age and gender on these outcomes were furthermore analyzed. Method: A meta-analysis was conducted with 50 reports of 50 independent studies, including a total of 2830 patients with schizophrenia or schizoaffective disorder. The patients had a mean age of 36.1 years. The male ratio was 66,8 %. Results: There were significant and small effects of cognitive remediation on improving cognitive ($g = 0.2851$), clinical ($g = 0.1848$) and functional outcomes ($g = 0.2273$). We found evidence for a publication bias in studies reporting effects of CR on clinical outcomes. There was a moderator effect of age on various subgroups of the main outcome measures, including “Depression + Anxiety”, “Total Symptoms”, “Health” and “Executive Functions” and a moderator effect of gender on “Executive Functions” and “Health”. Older age and higher male ratio was associated with a smaller effect of CR on improving these outcomes. Conclusion: The results indicate, that computerized cognitive remediation is effective in improving cognitive functions in patients with schizophrenia. We furthermore found evidence for a similar effect of computerized cognitive remediation on functional and clinical outcomes, suggesting, that other types of outcomes similarly benefit.

Poster session: Friday

All beginnings are difficult: repeated search through virtual reality environments

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Abstract

Understanding how repeated exposure to an increasingly familiar environment guides exploration behavior is crucial for understanding the role of episodic memory in visual search. This question has been investigated predominantly in studies using 2D stimuli on a computer screen. In our study, participants searched through 3D virtual environments that were either arranged syntactically consistent (Exp. 1: soap on a sink) or inconsistent (Exp. 2: soap on a mirror). Replicating previous work, we show that the usage of episodic memory was stronger within inconsistent environments compared to consistent ones. Critically, we find the strongest improvement in search times directly after the first trial in both experiments. This effect has remained unreported in previous studies, as it is easily masked by averaging. Our results indicate that while a first glimpse of a 3D scene initially takes time, it then guides search even more efficiently than subsequently repeated exposure to the scene

Poster session: Sunday

Statistical regularities induce spatial as well as feature-specific suppression in visual search

Michel Failing[1], Tobias Feldmann-Wüstefeld[2], Benchi Wang[1], Chris Olivers[1], Jan Theeuwes[1], [1]VU Amsterdam, The Netherlands, [2]University of Chicago, USA, contact: michel.failing@vu.nl

Abstract

Previous research has highlighted the impact of statistical regularities on how we search the environment. For example, a salient distractor is efficiently suppressed if it appears more often at a specific location in space even if one is completely oblivious to the regularity. Here we show that this suppression is not only spatially- but also feature-specific. In the context of the additional singleton task, participants had to search for a particularly oriented Gabor while ignoring either a color or a shape singleton distractor each of which appeared more often at a specific location. Consistent with spatial suppression of high likelihood distractor locations, we found that target search was slowed in the absence of the salient distractor for when the target appeared at either of the two high likelihood distractor locations (color or shape). Interestingly however, we only observed reduced interference by the singleton distractor when the color singleton distractor appeared at its high likelihood location, but not when it appeared at the high likelihood location of the shape singleton distractor (and vice versa). These differential effects were observed even though the vast majority of participants were completely unaware of the regularities in the search display. We conclude that initial suppression due to statistical regularities is purely spatial. However, when initial suppression is followed by mandatory feature-specific processing, e.g. due to attentional capture of a salient feature singleton, suppression can be released in a feature-specific manner.

Poster session: Friday

Posterior alpha oscillations are not predictive of prioritized working memory load in a modified change detection task

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Abstract

Since Luck and Vogel's hallmark "change detection" task a growing number of studies have provided behavioral evidence that the accessibility of working memory (WM) content can be altered dynamically after stimulus encoding within capacity limits. Recently it has been shown that WM can be influenced by temporal expectations and it can prioritize a subset of its stored elements accordingly. Whilst the neural mechanism by which this occurs is unclear, attenuation in alpha oscillations appears to negatively scale with WM load and be a reliable indicator of attentional prioritization in visual cognition. In order to better understand the relationship between temporal prioritization and alpha oscillations a behavioral paradigm is necessary that can flexibly control both non-prioritized and prioritized WM load and lateralization. In the current study we introduce a novel paradigm based a modified change detection task and provide EEG evidence of alpha oscillation patterns under increased prioritized load that challenge their role as neural substrates of dynamics WM activity.

Poster session: Sunday

Independent effects of eye and hand movements on visual working memory

Nina M. Hanning & Heiner Deubel, LMU Munich, Germany; contact: hanning.nina@gmail.com

Abstract

Saccades and reaches have been shown to selectively interfere with visual working memory, presumably due to the deployment of spatial attention to their action goals. Given the assumption of independent attentional mechanisms for the selection of eye and hand targets, the question arises whether the two effector systems also separately interact with visual working memory. To approach this issue, we investigated memory performance in combined eye-hand movements.
Participants memorized several items and performed eye, hand, or combined eye-hand movements during the maintenance interval. Subsequently, we tested working memory performance at motor goals and action-irrelevant locations. We found that for single eye and single hand movements, working memory performance was increased at the motor target compared to the action-irrelevant locations. Remarkably, the same amount of bene t was found at both the eye and the hand target for combined eye-hand movements – with no memory tradeoff between the two targets.
We conclude that both effector systems independently enhance visual working memory at their goal location. This is in line with the assumption that eye and hand targets are selected by separate attentional mechanisms.

Poster session: Friday

Predictability of salient distractor increases top-down control in healthy younger and older adults

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Abstract

In healthy younger adults, visual attention functions can be altered by preparation effects, such as prior expectancy about upcoming distractor locations induced by spatial cues. To date, it is controversial if such preparation effects also affect visual attention functions in normal aging. The present study addresses preparation effects on top-down control of visual attention in healthy younger and older adults. The individual degree of top-down control can be parametrically assessed based on the performance in a psychophysical partial report of briefly presented letter arrays and fitted based on the computational Theory of Visual Attention (TVA). In our study, we combine a partial report with rapid-onset cues that enhance the saliency of upcoming information at the indicated position and measure the ability to prioritize target letters over such highly salient distractor letters. The probability that the cue indicates a distractor (and not the target) varies in different experimental blocks (33.3 vs. 66.6 %). We assess whether predictability affects the degree of top-down control and whether this effect is modulated by normal aging. The results show that the ability to predict an upcoming salient distractor leads to decreased distractor weighting and that this ability is preserved in normal aging. Hence, the results suggest that healthy younger and older adults can use prior expectancies to shield against irrelevant information.

Poster session: Sunday

The role of alpha oscillations in action video game players in a discrimination task

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Abstract

A great body of research demonstrated impacts of action video game play on improvements of cognitive performance, especially, attention. However, little is known about the neural mechanism behind those improvements. This study aimed to relate the attentional improvements by action video game play with alpha band activity because alpha band activity is known to play a considerable role as an electrophysiological framework in attentional functioning. For this, the EEGs of 11 action video game players (AVGPs) and 11 non-AVGPs (Controls) were recorded during the discrimination of the rotation of 100% Michelson contrast Gabor patches in two conditions asking participants either to focus or to divide attention. It was hypothesized that (i) AVGPs would demonstrate a larger alpha band activity lateralization compared to the Controls in the Focused Attention Condition and that (ii) AVGPs would exhibit increased alpha synchronization compared to the Controls in the Divided Attention Condition. None of those hypotheses were confirmed by the data. Unexpectedly, there was a marginal significant difference between the two task paradigms indicating that participants required a larger alpha synchronization to handle the Focused Attention Condition relative to the Divided Attention Condition. This effect was assumed to be related with the task difficulty. Implications for further research were discussed.

Poster session: Sunday

Drifting perceptual patterns suggest prediction errors fusion rather than hypothesis selection: replicating the rubber-hand illusion on a robot

1 Nina-Alisa Hinz, 2 Gordon Cheng, & 3 Pablo Lanillos, 1 LMU Munich, Germany, 2 TU Munich, Germany; contact: nina-alisa.hinz@rub.de

Abstract

Humans can experience fake body parts as theirs just by simple visuo-tactile synchronous stimulation. This body-illusion is accompanied by a drift in the perception of the real limb towards the fake limb, suggesting an update of body estimation resulting from stimulation. This work compares body limb drifting patterns of human participants, in a rubber hand illusion experiment, with the end-effector estimation displacement of a multisensory robotic arm enabled with predictive
processing perception. Results show similar drifting patterns in both human and robot experiments, and they also suggest that the perceptual drift is due to prediction error fusion, rather than hypothesis selection. We present body inference through prediction error minimization as one single process that unites predictive coding and causal inference and that it is responsible for the effects in perception when we are subjected to intermodal sensory perturbations.

Poster session: Sunday

Luminance contrast dependency of trans-saccadic integration of orientation and shape

Dorontina Ismajli, Heiner Deubel, & Lukasz Grzeczkowski, LMU Munich, Germany; contact: tinaismajlii@gmail.com

Abstract

Humans make frequent eye movements, as a result of which the visual system receives pre- saccadic peripheral information and post-saccadic foveal information about objects in the visual world. Although less evidence is found about integration of this pre-post saccadic information, only under the blanking paradigm, blanking the target temporary after a saccade improves performance on detection of displacement in visual targets. However, the strength of the blanking effect can vary depending on luminance contrast of the target. Here, we show benefits of blanking effect in discrimination of orientation change only in stimuli with pre and post saccadic luminance contrast. Blanking the display between pre-post saccadic stimulus didn't improve the performance in detection of shape change in any condition for both stimuli with and without luminance contrast. In contrast, blanking worsened the performance in fixation condition for both stimuli with luminance contrast and without luminance contrast, leading to better detection of changes in shape in the no blank condition. These findings further strengthen the evidence for blanking benefit and importance of luminance contrast of stimuli in visual stability during eye movements, but this benefit accounts only for orientation feature.

Poster session: Friday

A computer-based paradigm for shared experiences and identity fusion

Yingqian Jiang, Markus Paulus, & Antonia Misch, LMU Munich, Germany; contact: Y.Jiang.Psy@gmail.com

Abstract

Identify fusion refers to a visceral feeling of “oneness” with a group that can predict the endorsement of extreme pro-group behaviors. To examine the role of shared experiences in identity fusion, the present study developed a computer-based paradigm that participants were told to play a computer game in a group with “other participants”. We manipulated the difficulty and stimuli of the game to trigger negative or positive emotions. The results showed that our paradigm successfully manipulated participants’ emotional valence, and we found a greater identity fusion by shared positive experiences.

Poster session: Friday

Object completion enhances working memory for grouped features, not whole objects

Anna Kocsis, Thomas Töllner, Hermann J. Müller, & Markus Conci, LMU Munich, Germany; contact: anna.kocsis1@gmail.com

Abstract

The aim of the present study was to examine how the completion of parts into a coherent whole-object affects the representation of items in visual working memory. To this end, a change detection paradigm was used that required observers to memorize both the orientation and the color of six 'pacman' inducer items. After a short delay period, a probe was presented, and observers indicated whether the probe was the same or different (in terms of color or orientation) than the item shown previously at the same location in the memory display. Moreover, by systematically varying the orientation of the pacman inducers, the strength of grouping was varied, presenting either an ungrouped configuration, a partially grouped arrangement, or a whole-object (Kanizsa-type) grouping. Our results showed that overall grouping enhanced working memory performance. However, this benefit was particularly strong when the to-be-detected change occurred for orientation features, that were directly associated with the grouping structure. By contrast, an influence of grouping on the memorized colors was much weaker. This suggests that object completion does not enhance the representation of a whole object, but it is specifically associated with the grouped features that generate an integrated object representation.

Poster session: Sunday

Visual attention models in robotics

Pablo Lanillos, TU Munich, Germany; contact: p.lanillos@tum.de

Abstract

Visual attention has been continuously underestimated in robotics. We hypothesise that enabling artificial cognitive systems with middleware implementing these mechanisms will empower robots to perform adaptively and with a higher degree of autonomy in complex and social environments. Moreover, it will give insights about visual attention in animals by means of systematic experimentation. First, we designed an artificial attention system to fulfil the requirements of social interaction (i.e., reciprocity, and awareness), with strong inspiration on current theories in functional neuroscience. We demonstrated the potential of our framework, by showing how a robotic head exhibits coherent joint attention behaviours without any inbuilt prior expectations regarding the experimental scenario. Secondly, we developed an active visual search model for allowing mobile robots to find objects in unknown environments. The proposed top-down and stimulus driven attention algorithm guided the robot towards the sought object using the relevant stimuli provided by the visual sensors. Finally, we addressed visual self-detection by means of probabilistic reasoning and a protoobject attention system, which combined visual, proprioceptive and tactile cues. This enabled a humanoid robot to discern between inbody and outbody sources in the scene, and planted the seed of SELFCEPTION project.

Poster session: Sunday

Dimension weighting and salient-signal suppression work in concert to prevent misallocations of attention

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Abstract

How does the visual system cope with distraction? It has been suggested that it cannot avoid distraction (involuntary-capture hypothesis), or that it does avoid it via searching for a particular feature (feature-search mode), up-weighting a particular target dimension (dimension-weighting account), or suppressing distracting signals (salient-signal suppression). In a series of studies, we use electrophysiological markers of attention allocation (N2pc) and distractor suppression (PD) to show that the visual system can avoid distraction via a combination of dimension weighting and salient-signal suppression: A distractor defined in the same dimension as the target, but featurally clearly separable, reliably captures attention, whereas a distractor defined in a different dimension does not. In the latter case, the distractor still produces substantial, though heavily reduced, interference and elicits a PD component indicating attentional suppression. These, as well as previous findings, can be explained by a combination of dimension weighting and salient-signal suppression: When a different-dimension distractor is sufficiently down-weighted by dimension-weighting mechanisms taking effect before the onset of the display, salient-signal suppression is strong enough to suppress the residual activation when the display comes up. In contrast, when the distractor signal cannot be sufficiently attenuated in advance, because the distractor is defined in the same dimension as the target, salient-signal suppression is too weak to avoid attentional capture by the distractor.

Poster session: Friday

Uni- versus crossmodal redundancy gains in pop-out search: Insights from event-related EEG lateralizations

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Abstract

Processing information that contains multiple response-relevant target features yields speeded reaction time (RT) performance. This redundant signals effect (RSE) is evident both within and across different sensory modalities. To gain deeper insights into the mechanisms that give rise to redundancy gains in pop-out search scenarios, we developed a novel multimodal search interface that allowed us to generate feature-contrast signals simultaneously in vision (via a beamer) and touch (via solenoids). In particular, participants were instructed to detect the presence (versus the absence) of a feature singleton target, which could be defined by a single feature (color, shape, frequency), redundantly by a combination of two features (color-shape, color-frequency, shape-frequency), or simultaneously by all three features (color-shape-frequency). Behaviorally, we replicated the classical RSE, with faster RTs for redundant targets relative to single-signal targets. Noteworthy, we found additional RT modulations between the redundant targets depending on whether the response-relevant features originated from the same or different sensory modality: color-shape targets were significantly slower than color-frequency and shape-frequency targets, whereas the triple redundant target condition produced the fastest RTs. The overall RT pattern was mirrored by the timing of the Posterior Contralateral Negativity (PCN) wave, indicating a pre-attentive locus of these RT differences. Overall, these findings provide new evidence in favor of the modality-weighting account (MWA; Töllner, Gramann, Müller, & Eimer, 2009), according to which a separate “pool” of modality-specific processing resources modulates the computation and integration of feature-contrast signals at the attention guiding, supra-modal master (i.e., saliency or priority) map level.

Poster session: Sunday

Where am eye? Subjective gaze moves continuously in space before saccade onset

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Abstract

People have a strong intuitive sense of where they are looking at, or where their gaze is directed. In contrast, previous reports found evidence for large deviations between subjective and objective gaze, in particular before saccadic eye movements. In the present study we asked how subjective gaze shifts when we make a saccade. Participants were asked to make a saccade towards an endogenously cued target 6° from fixation. A flash was presented for 25ms at any time between cue onset and 200 ms after their average saccade onset. This flash served as a temporal marker: After the saccade, participants indicated with a mouse pointer the location where they thought they were looking at when the flash occurred. If the flash occurred long before saccade onset or after the saccade, participants correctly reported their objective gaze. However, if the flash occurred between 250 and 0 ms before saccade onset, participants reported their gaze to be at locations intermediate between fixation and saccade target. In particular, subjective gaze was perceived closer to the saccade target the later the flash was presented. This demonstrates that people have the perception that their eyes are moving continuously from fixation to the saccade goal long before the actual start of the eye movement. It shows that people have very little knowledge about their actual eye position at any given moment in the vicinity of a saccade. They are unaware of the time when they make a saccade, and they cannot make use of the retinal position of objects to correctly indicate their objective gaze.

Poster session: Friday

Isolating versus combining temporal and spatial expectancies in visual search: A PCN study

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Abstract

In visual search, there is a reaction time (RT) speed up when participants can reliably predict the location and/or the onset time of a target stimulus relative to when space and timing are non-predictive. Here we aimed at investigating whether the knowledge about the spatio-temporal structure of stimuli exposure leads to facilitated target processing at a pre-attentive processing stage, a postselective processing stage, or both? To dissociate pre-attentive from postselective levels of target processing, we combined mental chronometry with the Posterior Contralateral Negativity (PCN)—a well-established EEG marker of attentional selection in visual space.
To further examine whether these effects may vary as a function of task, we employed two different task sets: localization and compound. In the localizations task, participants had to localize the target (left vs. right), whereas in the compound task, they were asked to discriminate—independently of the target-defining feature (e.g., shape)—the orientation of the target (horizontal vs. vertical). Each task comprised four blocks performed at random order: three predictable blocks, in which either the target's (1) location, (2) onset time, or (3) location & onset time were made predictive, and one block of random target expositions (serving as a control condition).
In both tasks, RTs were fastest for targets that were predictable in both space and time. Spatial predictability allowed for faster reactions only in the localisation task, while no differences were evident between temporally predictable and randomly exposed targets. This pattern of effects was mirrored by the timing of the PCN, indicating that these RT effects are primarily generated during pre-attentive vision. Overall, our results suggest that space and time can be regarded as top-down biases that might be attentionally weighted, thereby enabling faster target selection in a specific place and time-interval..

Poster session: Sunday

Seeing what your heart tells you to – modulation of neuronal heartbeat processing facilitates visual perception

Sebastian Schneider, Simone Schütz-Bosbach, & Amanda Marshall, LMU Munich, Germany; contact: s.c.schneider@gmx.net

Abstract

With a steady increase of research in interoception over the past years, classical concepts such as visual perception are looked at again from a new perspective. Among such examination some results have revealed that detection of visual stimuli might be dependent on interoceptive processing of cardiac signals. A definitive causal role could however not be demonstrated due to methodological shortcomings. We therefore wanted to explore if visual detection is causally dependent on prestimulus neuronal processing of cardiac activity. In line with previous reports we hypothesized that detection of a target stimuli should be facilitated following an increased prestimulus heartbeat evoked potential (HEP) amplitude, an event related potential associated with neuronal cardiac signal processing. By presenting participants both neutral and angry face stimuli either in rapid succession either repeated or alternated we were able to systematically manipulate the HEP amplitude and thereby observe methodical changes in behavioral parameters related to visual detection. We recorded (EEG) amplified HEP amplitudes to repeated neutral faces and attenuated ones for alternated neutral faces, as well as the opposite pattern for angry faces. Reaction time and correct detection rate were however significantly faster for trials including either repeated angry or neutral faces as compared to alternated faces, contradicting the initial HEP amplitude-based hypothesis. Considering the reasoning behind an increased HEP amplitude and interoceptive approaches to subjective self-consciousness however lead us to the conclusion that enhanced prestimulus integration of cardiac activity, which HEP amplitude can be an indicator of, facilitates visual detection.

Poster session: Sunday

Top-down matching pop-out cues have no edge over top-down matching non-pop-outs in spatial cueing

Tobias Schoeberl, Florian Goller, & Ulrich Ansorge, University of Vienna, Austria; contact: tobias.schoeberl@univie.ac.at

Abstract

We investigated if object salience influences attentional selection at early stages of visual processing in a novel condition of the peripheral cueing paradigm. In each trial, participants searched for two target colors so that they had to maintain search settings for two colors at the same time. Prior to a target display, cueing displays were presented with one pop-out cue presented amidst three non-pop-out distractors. In one condition, cueing displays consisted of a pop-out cue having one target color and three additional non pop-outs of another target color. Hence, all objects in these all-relevant cueing displays had a target color. If pop-outs initially captured attention in a stimulus-driven way, regular cueing effects (faster responses to targets at the cued location compared to targets away from the cue) should be found in these conditions. However, results showed that compared to a control condition (a condition with a pop-out cue of a target color among non-pop-outs of a non-target color) cueing effects with all-relevant cueing displays were strongly reduced, as if relevant pop-out and non-pop out cues captured attention to equal extents. This is evidence for top-down contingent capture of attention even at early stages of processing and against stimulus-driven attentional capture by pop-out cues.

Poster session: Friday

Selection history effects withstand top-down control

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Recent work has shown that selection history can have a substantial impact on attentional selection. The present study examined to what extent goal-oriented top-down control prevents selection history effects in guiding attention. Selection history was induced by a categorization learning task in which either color or shape was the response-relevant dimension. This task alternated with an additional singleton task in which participants had to search for a shape target and ignore an irrelevant color distractor. Both tasks alternated in a consistent, entirely predictable trial sequence to allow observers optimal volitional task preparation. Results showed that selective attention was still biased toward the dimension predictive in categorization learning despite the possibility to prepare for an upcoming trial. The bias also persisted when both tasks were performed in separate experimental sessions and observers could fully adjust their attentional control settings to the task. Selection history seems to considerably shape attentional selection beyond top-down control even when detrimental to task performance.

Poster session: Friday

Cortical mechanisms of difficult – and interrupted – letter search

Connor Spiech, Artyom Zinchenko, Hermann J. Müller, & Thomas Geyer, LMU Munich, Germany; contact: connorspiech@gmail.com

Abstract

Visual search can be thought of as perceptual hypothesis testing. One paradigm that has been particularly useful for investigating this is the interrupted visual search task where the same visual search display is presented shortly a number of times. The classic reaction time effect in this task is a rapid resumption of visual search – that is, reaction times are longer in response to the first presentation and significantly faster in subsequent presentations, implying that there is an initial process to load the perceptual hypothesis of the visual scene (Lleras et al., 2005). Previous research with this task has shown that the right temporal parietal junction (rTPJ) and the superior frontal gyrus (SFG) may be involved in target detection and predictive attention allocation, respectively (Spaak et al., 2016). To investigate this, we stimulated both areas in a between-subjects design with 10 minutes of 1 Hz offline TMS and compared the resulting reaction time changes at both stimulation sites against each other and a no-rTMS baseline group. Preliminary results show that the total number of correct (and rapidly resumed) responses after the first presentation is massively increased when the rTPJ is stimulated, while response accuracy is massively lowered following SFG stimulation relative to both the rTPJ and no-rTMS groups. These results suggest that the rTPJ may indeed play a role in early target detection whereas the SFG may be responsible for directing attention to the predicted target location.

Poster session: Sunday

The role of differently weighted objects on infants' neural correlates: an ERP study

Ebru Ecem Tavacıoğlu, Carolina Pletti, & Markus Paulus, LMU Munich, Germany; contact: ebrueecem@gmail.com

Abstract

Infants from young age are able to notice and learn about the properties of the physical environment. The physical information is more useful when it combines with the experiential information as cross-modal system. The current study was designed to examine how infants process the heavy and light cubes, which are weighted differently. To this end, we presented the pictures of heavy and light cubes, which were previously explored by infants with their hands. Simultaneously, we assessed event-related potentials (ERPs) of P3 component between 300 - 600 ms over parietal and occipital sites. The results revealed that there is no significant difference between perception of heavy and light cubes for parietal and for occipital electrode sites. Hemisphere was included as a factor to control. There is close to significant difference in the left hemisphere for heavy object and light object, but no significant difference in the right hemisphere for heavy object and light object. When we look at the interaction of two factors there is significant interaction. Interaction of left hemisphere is processing heavy and light object in differently. According to the literature and our results, heavy and light objects could be processed in the left hemisphere differently.

Poster session: Friday

Is attention necessary in order to process vocal prosody in congenitally blind individuals?

[1] Pavlos Topalidis, [1] Thomas Schenk, [2] Brigitte Röder & [1] Julia Föcker, [1] LMU Munich, Germany, [2] University of Hamburg, Germany; contact: topalidis.paulos@gmail.com

Abstract

The question whether spatial selective attention is necessary in order to process vocal prosody has been controversially discussed when testing sighted individuals. Whereas some studies argue that spatial attention is necessary in order to process emotional human voices, other studies point to the fact that emotional human voices (e.g. anger) can be processed even outside the focus of spatial attention (e.g. Grandjean et al., 2005). Here, we asked if longterm visual deprivation starting from birth requires attention in order to process emotional information in human voices.Therefore, eight congenitally blind individuals and thirteen sighted controls had to detect rare deviant syllables spoken in neutral, angry, happy, and fearful prosody by two different actors and to orient their attention either to the left or to the right loudspeaker while the EEG was recorded. In contrast to sighted controls, who showed early attention effects in the time range of the N1 in the fearful prosody but not in the neutral, happy, and threatening vocal prosody (manifested in an interaction between emotion and attention), blind individuals do not show enhanced capture effect in the fearful compared to the other emotions (main effect of emotion, main effect of attention). Moreover, blind individuals show enhanced N1 amplitudes irrespectively of the presented emotion or the attention conditions. We discuss our results in line with a brain imaging study (Klinge, Roeder, & Buechel, 2010) which did not find a difference in amygdala activation as a function of whether or not the emotional prosody of voices had to be attended in blind individuals. – Moreover, we discuss enhanced excitability of unimodal sensory areas as one underlying neural mechanism in congenitally blind individuals.

Poster session: Friday

Neural correlates of infants' learning of physical properties of objects

Yiu Yuk Hoi, Carolina Pletti, & Markus Paulus, LMU Munich, Germany; contact: yyhhoi@gmail.com

Abstract

Human learn to understand an action by mapping between the observation and their own motor repertoire, resulting in activities in sensorimotor cortical regions. The involved neurological modules are referred as Mirror-Neuron System (MNS) and its activity can be measured by the decrease of Electroencephalography (EEG) oscillation power in mu frequency range. While studies found that MNS activity in adults also encode the understanding of manipulable objects by its associated sensorimotor experience, it is still unclear whether infants, whose motor repertoire is still developing, can do the same. Therefore, the present study aims to investigate when infants view a manipulable object, whether their MNS activity differs with respect to the prior associated sensorimotor experience. To examine the issue, infants were recruited to join our 32-channels EEG experiment. Firstly, they played with a light and a heavy cube and familiarise themselves with the cubes' weight properties. Afterward, the infants would be presented with the pictures of heavy and light cubes, and their EEG power in mu frequency range (6-9 Hz) would be compared between the heavy and light trials. In the results, infants who viewed the pictures of cube in heavy trials exhibited greater mu power suppression in channel FC5 than the light trials, suggesting a higher activity in the ventral premotor region which is part of the MNS. It demonstrates that infants can encode the understanding of manipulable objects into MNS differentially by the prior associated sensorimotor experience (heavy and light), in a way that higher physical demand with the objects is coupled with higher cortical activation.

Poster session: Friday

ERP-lateralizations of context learning and adaptation in difficult letter search

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Abstract

In visual search if a searched-for target object is consistently encountered within a stable spatial arrangement of distractor objects, detecting the target becomes more efficient over time, because learnt target-distractor spatial associations (stored in LTM) come to guide the search, cueing attention to – or predicting – the target location. However, changes of the target location in a nevertheless constant distractor array completely abolish the cueing effect and the gains derived from repeated contexts recover only relatively slowly with relatively massive amount of training on the relocated displays. In this work we investigated one nature of this limitation by combining mental chronometry with electrophysiological recordings. Specifically, we tested the hypothesis that the matching of the search display with a given context memory trace is a relatively automatic process (e.g., Schneider & Shiffrin, 1977) and as a result of this LT context templates are relatively long-lasting and persist even after target position changes and thus weaken context adaptation.
The learning phase showed a typical build-up of the contextual cueing effect. The electrophysiological results revealed three consecutive, lateralized ERP waveforms: N1pc, PCN, and CDA. All three components showed increased amplitudes in repeated as compared to non-repeated displays. While the PCN and CDA modulations suggest that context-based memories, once activated, facilitate target selection and target discrimination, the early N1pc may index the automatic, i.e., pre-attentive, detection of the target in a repeated sensory array. In the subsequent adaptation phase, in which the target in a contextual-cueing array swapped its location from one hemifield of the display to the other one, the cueing effect completely vanished. Moreover, the ERP pattern showed that in the adaptation phase (after the swap of the target location), the N1pc was reversed, now eliciting a positive-going deflection (thus, still showing a lateralization contralateral to the old, previously learned target location). Moreover, the amplitude differences between repeated and non-repeated displays vanished in both the PCN and CDA components. These findings suggest that following cross-hemifield changes of the target location in learned distractor arrangements, template matching persists towards the initial target location and therefore contextual cueing (in behavioral measures and corresponding ERP components) vanishes.

Poster session: Sunday

Poster sessions

Poster sessions and presenters

Presenter		Affiliation	Session
Fredrik	Allenmark	LMU Munich, Germany	Friday
Beril Nisa	Can	LMU Munich, Germany	Friday
Siyi	Chen	LMU Munich, Germany	Friday
Clara	Dominke	LMU Munich, Germany	Friday
Michel	Failing	VU Amsterdam, The Netherlands	Friday
Nina	Hanning	LMU Munich, Germany	Friday
Dorontina	Ismajili	LMU Munich, Germany	Friday
Yingqian	Jiang	LMU Munich, Germany	Friday
Heinrich Renè	Liesefeld	LMU Munich, Germany	Friday
Meng Fei	Ngan	LMU Munich, Germany	Friday
Tobias	Schoberl	University of Vienna, Austria	Friday
Anna	Schubö	University of Marburg, Germany	Friday
Ebru Ecem	Tavacıoğlu	LMU Munich, Germany	Friday
Pavlos	Topalidis	LMU Munich, Germany	Friday
Yiu	Yuk Hoi	LMU Munich, Germany	Friday
Leonardo	Assumção	LMU Munich, Germany	Sunday
Anna-Lena	Biel	LMU Munich, Germany	Sunday
Casandra	Cook	LMU Munich, Germany	Sunday
Dejan	Draschkow	Goethe University Frankfurt, Germany	Sunday
Tamas	Foldes	LMU Munich, Germany	Sunday
Marleen	Haupt	LMU Munich, Germany	Sunday
Yannik	Hilla	LMU Munich, Germany	Sunday
Nina-Alisa	Hinz	LMU Munich, Germany	Sunday
Anna	Kocsis	LMU Munich, Germany	Sunday
Pablo	Lanillos	TU Munich, Germany	Sunday
Jan	Nasemann	LMU Munich, Germany	Sunday
Marta	Ratomska	Catholic University of Lublin, Poland	Sunday
Sebastian	Schneider	LMU Munich, Germany	Sunday
Connor	Spiech	LMU Munich, Germany	Sunday
Artyom	Zinchenko	LMU Munich, Germany	Sunday