2017 IRTG Retreat, August 14-19

Queen's University Biological Station

Contact: Queen's University Biological Station, 280 Queen's University Road, RR #1, Elgin, Ontario K0G 1E0
Telephone No.: 613-359-5629,
Fax No.: 613-533-6617 (Please be sure to indicate 'QUBS' in the message as this is a shared FAX line),
Website: https://qubs.ca/
Maps and Directions: https://qubs.ca/contact

INFORMATION IRTG Retreat August 14 – 19 2017

Venue

The retreat will take place at the Queen's University Biological Field Station (QUBS), about 45 min north of Kingston. QUBS is situated on Lake Opinicon which is part of the UNESCO World Heritage Rideau Waterway system. The Rideau system was build in the early 19th century to connect Ottawa with Kingston, thus providing a safe connection between the Atlantic Ocean and the Great Lakes even if the Americans were blocking the St Lawrence River between Montreal and Kingston, the only part of the St. Lawrence where the Canadian-American border is right in the river.
The area is part of the Frontenac Arch, an ancient granite connection between the Canadian Shield and the Adirondack Mountains. The Frontenac Arch is interesting for its geology, but also because of the wildlife that uses it for long range migration. In 2002 it became a UNESCO World Biosphere Reserve.
QUBS has first been set up in the 1940s and is unique in terms of its size and ecological diversity. Today it consists of 3400 hectares of woodland, 9 smaller lakes, and extensive shoreline along Lake Opinicon and Hart Lake. Find more info about QUBS on their website.

Transportation: Arrival

Getting here: German participants may fly to Toronto, Ottawa, or Montreal. There are also flights right into Kingston's Norman Roger airport, but only from Toronto. The connection is not very reliable and flights often get delayed.
The Default: We have arranged for a bus that will leave at Toronto's Pearson airport at noon (or a bit later) on Aug 19th. The bus is scheduled to pick up participants that arrive with a Lufthansa/AirCanada from Frankfurt that is scheduled to arrive at 11:40 at Pearson. The bus is big enough to accommodate Canadian participants who want to come out to the airport. Here are the instructions from McCoy, the company who provides the bus:

> *Have your group collect all their luggage, clear customs if necessary and have your group gather just inside the exterior doors of the arrivals level. Have a designated person from your group find any traffic Commissionaire and provide them with your bus company name (McCoy). The Commissionaire will then have the bus dispatched from the bus compound to your arrival post. Please note: the Commissionaire is not permitted to dispatch the coach from the compound until the entire group is ready to board the bus.*

From Toronto Pearson airport: If you are on a different flight, there are a few way s to get to Kingston. There are direct busses to Kingston. They leave three times a day and you can book them here: https://ca.megabus.com/. The bus ride to Kingston takes about 3.5 hours. You can also take the train from Pearson airport to Toronto downtown (https://www.upexpress.com/). There are more buses from the Toronto Bus Terminal and there are trains from Union Station to Kingston (http://www.viarail.ca/en). Altogether, it takes a bit longer and is a bit more expensive.
From Montreal airport: The airport in Montreal is very close to a train station named Dorval. Free shuttle buses take you from the terminal to the station in 5 min. Trains, however, are not very frequent. Check viarail for info.
From Ottawa: There are trains from Ottawa to Kingston (check viarail) but getting from the airport to the train station is a bit of a hassle. Ottawa is a great option if you want to take a rental car anyway. Driving from the airport to QUBS takes 1.5 hours.
From Kingston to QUBS: There is no public transportation. You need to coordinate with retreat participants who drive up from Kingston. Note, that most participants from York and Western come by car and they will drive through Kingston anyway. And then there are cars leaving directly from Kingston. It shouldn't be too hard to catch a ride. A taxi from Kingston to QUBS costs about $100.
Canadian participants have to organize transportation themselves. It seems that this will be mainly based on private cars or rental cars. Once we are getting close to the date, Dayna will try to function as an info centre that connects people with available car seats to people that require them. Our retreat starts with dinner on Monday, served at 5:30. It would be great if everybody has arrived by that time.

Transportation: Departure

Departure will be much less organized. Everybody seems to be on a different flight. Between private cars and shared taxis, we will be able to get everybody back to Kingston, but from there, you have to arrange transportation back to the airport yourself. The same links apply: viarail, UPexpress, megabus. Ask us for help if you need it.

Accommodation in Kingston
For those who registered for the canoe trip and/or for the Monday workshop, we booked double rooms in McNeil House at 40 Lower Albert Street in Kingston. McNeil House is one of Queen's student residencies and is located on the main campus.

What to bring
Bring swim suit, insect repellent, a swimming towel, and everything you need for your personal care. There are no shops around QUBS.

Lodging at QUBS
Lodging at QUBS is simple. Many of the smaller cabins have no washroom and showers. Those occupying them have to use the central facilities in the main building. Other cabins are more comfortable. Expect the comfort provided to you roughly proportional to the number and quality of the papers you list in your CV.
On the other hand, there are swimming opportunities all over the place. The water will still be reasonably warm and we expect good weather during the whole week. You cannot get cleaner than from swimming in our lakes.

Meals
QUBS has very good kitchen. Coffee is provided all day. Meals are at fixed times. Dinner is relatively early, at 5:30. If you have not yet done so, let us know about any food allergies and diet specifics. The kitchen is happy to accommodate them.

Meeting Schedule
Overview: Our main working days are Tuesday until Friday. Breakfast is always between 7:30 and 8:30, lunch will be served at 12:00 and dinner is relatively early, at 5:30. In the mornings, between 8:40 and 11:30 we have student presentations. In addition, we have shorter student presentation sessions either before dinner (Thursday) or after dinner (Tuesday, Friday). This gives us enough time for everybody to give a short presentation. Unlike in previous years, we will not have a poster session.
Student presentations: We schedule 20 min per student. Please prepare a presentation that is about 12 min long so that there is enough time left for discussions. Ideally you present data from your ongoing MSc or PhD project. If you are new to the program and don't have data yet, you can talk about the theoretical background, design, hypotheses etc. of your planned study. Please send your abstracts to Janice at jadsilva@yorku.ca. Submission deadline is July 28, 2017. The layout is as follows:

- Approximately half a page long or 300 words (format A4)
- Font should be Arial, 12 pt
- Title Bold
- Authors: first author name underlined
- Affiliation: Italic
- Line Spacing: single
- Save the abstract as Abstract IRTG_ first letter of first name followed by your last name Eg: Abstract IRTG_J Dsilva

Keynote talks: We have two keynote speakers. Roland Fleming is giving a seminar talk on Tuesday night, and Katja Fiehler is doing the same on Friday. Titles will be announced shortly.
Other evening program: On Monday night, the night of your arrival at QBS, Mary Ann Spencer from Queen's “Four Directions Aboriginal Student Centre” will talk about the history of this part of the world from a viewpoint of the people who lived here before European settlement. She told me that we should not expect a typical talk, but rather to become involved in old rituals designed to connect with the land and its life.
On Thursday night, we have a band over – just for us. Sheesham, Lotus and 'Son, “Mississippi Sheiks meet Doctor Seuss”. They will sure get you involved.
Wednesday night is the only night we have no plans yet. On Wednesdays, at 7:00, QUBS runs a regular seminar series which is attended by researchers working at the station, by the occasional students and faculty that drive out from Kingston, but also by locals who live in the area and are interested in activities at and around QUBS. I was asked if one of us wants to present that night. It doesn't have to be about conservation or biology, but it should be something that is a bit broader than your typical SFN presenstation, and accessible to a lay audience. If you have a good idea, please let me know.

Afternoon program: We kept most of the afternoons open. Use them to schedule meetings with your supervisors and plan your research. Go swimming. Or participate in a number of events:

- QUBS offers great nature, many birds and other animals, and we will have people from the station who will offer guided tours on Tuesday (and maybe Friday) afternoon.
- There are a few canoes on site. We can go for a paddle to Davis Lock at the southern end of Lake Opinicon. Those who signed up for the Saturday day trip might want to practice a little.
- I hope we can organize a tour to Johns Falls on Thursday afternoon, but it depends on whether we have enough cars and interested drivers on site. Johns Falls is the most impressive lock system of the whole Rideau Canal and worth a visit. There is wonderful swimming, too.

Optional canoeing trip on Sat. Aug 19.
There has been lots of interest in the canoe trip which I offered in the earlier info letter. Currently we have more than 20 registrations and I am not sure yet how to accommodate you all. Consider this trip to be booked-out. No more registrations! Note that we plan the paddle on Sat Aug 19, not Sun, the 20th which was my first suggestion. The trip takes us down a piece of the Gananoque River system. We get into our boats in Lyndhurst and then paddle through a couple a beautiful lakes and to a place called Black Rapids. Including stops for swimming, rock jumping, picknicking, etc. it will take us the whole day. We should leave in Lyndhust by 10:00 am which means that we have to leave QUBS at 9:30 the latest. Aaron, the site manager at QUBS will help us with transportation of the canoes. He has a truck that should fit them all. For ourselves, we yet have to work out how to get there. I hope that we have enough cars from local participants. If you come for the trip and you have a car, please let me (Niko) know. I estimate that we won't be back in Kingston before sunset.
If you participate in the canoe trip, make sure to bring sunscreen, a hat, a water bottle or two, a water proof container for your cell phone, camera etc. and some kind of backpack to put it all in. You might get wet on the way. Bring extra clothing – at least if the weather isn't warm. Avoid cotton, which doesn't dry on your skin. If you bring cell phone or camera, make sure you have a water tight container or bag for them. And don't forget your swim suit!

Before we leave in the morning, you have to get your main luggage ready. We will transport it back to Kingston that day and you can pick it up there in the evening.
There might be expenses. We get a few boats from QUBS, but we have to rent a few more externally. We also have to arrange for basic food for the day. Expect a contibution of $30 per person to cover these costs. ***Please bring some cash. We will collect it at the retreat.***

Optional workshop: motion capture and motion modelling
On Monday Aug. 21 we offer a full day workshop. Participants will learn about

- different motion capture technologies, incl. optical motion capture, IMU-based systems, and developments in marker-less motion capture
- post-processing, biomechanical modeling, and software (with a presentation by C-Motion)
- representations, classification, and semantic scaling

The workshop will happen in the facilities of Queen's Human Mobility Research Center at the Hotel Dieu hospital in Kingston. More info at the retreat.

	Monday Aug. 14
Morning	
Afternoon	Transportation from Western, York, and Pearson airport 5:30 Dinner
Evening	6:30 Opening address by VP Research John Fisher 7:00 Presentation by Mary Spencer from Queen's Four Directions Aboriginal Centre

	Tuesday Aug. 15
Morning	7:30 – 8:30 Breakfast 8:40 – 11:30 7 student presentations (20 min each) and coffee break (30 min) 12:00 – 1:00 Lunch
Afternoon	2:00 to 5:00 Afternoon program: Guided tour of QUBS: Birds and other wildlife (1.5 h) Or: Canoeing/boating to Davis Lock Committee meetings 5:30 Dinner 7:00 – 8:00 3 student presentations after dinner
Evening	8:15 Keynote 1: Roland Fleming

	Wednesday Aug. 16
Morning	8:40 – 11:30 7 student presentations
Afternoon	1:30 – 3:30 Allow for 2 hours after lunch to explore, go swimming 3:30 – 5:00 Committee meetings 5:30 Dinner 7:00 – 8:00 Public lecture (or, alternatively, three student presentations)
Evening	8:15 More times for committee meetings

	Thursday Aug 17
Morning	8:40 – 11:30 7 student presentations
Afternoon	1:00 – 3:00 Meeting of the IRTG steering committee For the others: Visit of Jones Falls 4:00 – 5:00 3 student presentations 5:30 Dinner
Evening	The Big Party! Special guests: Sheesham, Lotus & 'Son

	Friday Aug 18
Morning	8:40 – 11:30 7 student presentations
Afternoon	2:00 to 3:30 Guided tour of QUBS: Birds and other wildlife Or: Canoeing/boating to Davis Lock 4:00 – 5:00 3 student presentations 5:30 Dinner
Evening	7:00 Keynote 2: Katja Fiehler

	Saturday Aug 19
	Departure day. Canoe trip and return to Kingston for those who stay

	Monday Aug 21
	Motion capture workshop at the Human Mobility Research Center at Queen's University

Talk schedule IRTG Retreat Aug 14 – 19 2017

Tuesday morning		
08:40	Dmytro Velychko	**Model-free vs. model-based learning and error correction with temporal delays in sensory-motor control** Dmytro Velychko[1], Dr. Dominik Endres[1], Dr. Gunnar Blohm[2] *[1]University of Marburg, Germany, [2]Queen's University, Canada*
09:00	M. R. Watson	**Learning to exploit feature relevance: information sampling and object selection strategies** M. R. Watson[1], B. Voloh[1], M. Naghizadeh[1], S. Chen[2], T. Womelsdorf[1,3]; *[1]Dept. of Biol., [2]Cognitive Sci., York Univ., Toronto, ON, Canada; [3]Dept. of Psychology, Vanderbilt Univ., Nashville, TN*
09:20	Maria N Ayala	**Do movement sequences and consequences facilitate the retrieval of motor memories?** Maria N Ayala & Denise YP Henriques *Centre for Vision Research, York University*
09:40	Chad Vachon	**The Roles of Sensory Prediction and Explicit Strategies for Motor Learning in Older Adults** Chad Vachon, Shanaathanan Modchalingam, Bernard Marius 't Hart, Denise Y.P. Henriques *Centre for Vision Research, York University, Toronto, Canada*
Coffee Break		
10:30	Lukas Uhlmann	**The Role of the Distinction between Self and Other in Action-Feedback Monitoring** Lukas Uhlmann, Tilo Kircher, Benjamin Straube *Department of Psychiatry and Psychotherapy, Philipps University Marburg, Marburg, Germany*
10:50	Mareike Pazen	**Prediction of Indirect Action Consequences** Mareike Pazen[a], Benjamin Straube[a], Tilo Kircher[a] *[a]Philipps-University Marburg, Department for Psychiatry and Psychotherapy, Marburg, Germany*
11:10	Jonathan Coutinho	**A Bayes optimal decision model of the saccade trigger mechanism during smooth pursuit** Jonathan Coutinho[1], Philippe Lefèvre[2], Gunnar Blohm[1]

		1. Center for Neuroscience Studies (CNS), Queen's University, Kingston, Canada. *2. Institute of Information and Communication Technologies, Electronics and Applied Mathematics (ICTEAM) and Institute of Neuroscience (IoNS), Université catholique de Louvain, Louvain-la-Neuve, Belgium*
Tuesday evening		
07:00	Lina K. Klein	**Pick me up: How object shape, weight, and material properties determine precision grip** **Lina K. Klein, Guido Maiello, Vivian C. Paulun, Roland W. Fleming** *Department of Psychology, Justus-Liebig University Giessen*
07:20	B.-R. Baltaretu	**Transsaccadic updating of object orientation for grasp preparation: A neuroimaging study** *****B.-R. Baltaretu[1], *B.-R. Baltaretu[1,2], S. Monaco[2,3], J. Velji-Ibrahim[1,2], G. N. Luabeya[1,2], J. CRAWFORD[1,2]; *[1]York Univ., North York, ON, Canada; [2]Ctr. for Vision Res., [3]Univ. of Trento, Ctr. for Mind/Brain Sci., Trento, Italy*
07:40	Margarita V. Maltseva	**How is size perception of real objects modified by the congruency of the familiar size cue?** Margarita V. Maltseva[1,2], Melvyn A. Goodale[1,2], & Jody C. Culham[1,2] *Psychology Department of the University of Western Ontario, The Brain and Mind Institute*
Wednesday morning		
08:40	Tobias Moehler	**Effects of central and peripheral cueing on perceptual and saccade performance** *Tobias Moehler & Katja Fiehler* *Experimental Psychology, Justus-Liebig-University Giessen, Germany*
09:00	Tom Nissens	**Saccades and reaches curve away from the other effector's target in simultaneous eye and hand movements.** Tom Nissens & Katja Fiehler *Experimental Psychology, Justus-Liebig-University Giessen, Germany*
09:20	Jing Chen	**Tracking attention with reverse correlation EEG** Jing Chen, Matteo Valsecchi, Karl Gegenfurtner
09:40	Benjamin Cuthbert	**A whole-report approach to investigating visual working memory capacity limitations under high load** Benjamin Cuthbert[1], Dominic Standage[1], and Gunnar Blohm[1 1]*Centre for Neuroscience Studies,*

		Queen's University, Kingston, ON.
Coffee Break		
10:30	Parisa Abedi Khoozani	**Potential models of allocentric coding for reaching in naturalistic visual scenes** Parisa Abedi Khoozani [1], Mathias Klinghammer[2], Paul R. Schrater[3], Dominik Endres[4], Katja Fiehler[2], Gunnar Blohm[1]
10:50	Meaghan McManus	**Linear optic flow might be enhanced by conflict between visual and non-visual cues to orientation** Meaghan McManus and Laurence R. Harris *York University*
11:10	Constanze Schmitt	**TMS-induced disturbance of self-motion perception** Constanze Schmitt[1], Bianca R. Baltaretu[2], J. Douglas Crawford[2], Frank Bremmer[1] *[1] AG Neurophysik, Philipps-Universität Marburg, Marburg, Germany;* *[2] Centre for Vision Research, York University, Toronto, Ontario, Canada*
Thursday morning		
08:40	Adrian Schütz	**Decoding sensorimotor information from macaque area 7a** Adrian Schütz [1], John Douglas Crawford [2] and Frank Bremmer [1] [1]AG Neurophysik, Philipps-Universität Marburg, Marburg, Germany; [2]Center for Vision Research, York University, Toronto, Canada
09:00	Christian Wolf	**The necessity to choose causes the effects of reward on saccade preparation** Christian Wolf, Anna Heuer, Anna Schubö, & Alexander C. Schütz *Experimental and Biological Psychology, Philipps-University Marburg, Marburg, Germany*
09:20	Karén Wilhelm, Julia Morris	**Saccadic Eye Movements in Patients with REM Sleep Behavior Disorder – a Marker in Prodromal Parkinson's Disease?** Karén Wilhelm[1*], Julia Morris[2*], Annette Janzen[1], David Vadaz[1], Geert Mayer[1] Douglas Munoz[2] & Wolfgang H. Oertel[1] *[1]Department of Neurology, Philipps-University, Marburg, Germany and* *[2]Queens University, Kingston, ON, Canada* *equal contribution
09:40	Vishal Bharmauria	**Comparison of spatial coding schemes between the simultaneously recorded neurons from the frontal eye fields and supplementary eye fields during head-unrestraiend gaze shifts.**

		Vishal Bharmauria[1], Amirsaman Sajad[2], Harbandhan Arora[1], Xiaogang Yan[1], Hongying Wang[1], J. Douglas Crawford[1] *[1] Centre for Vision Research, York University, Canada; [2]* Vanderbilt Vision Research Center*, Vanderbilt University, Nashville*
Coffee Break		
10:30	Adam Zabicki	**Perceived vividness of imagined movements is associated with the variation of neural pattern within the human motor system** Adam Zabicki[1], Benjamin de Haas[2,3], Karen Zentgraf[4], Jörn Munzert[1] and Britta Krüger[1,5]
10:50	Julia Bachmann	**Multivariate Pattern Analysis in Alexithymia** J. Bachmann[1], A. Zabicki[1], B. Krueger[1], J. Munzert[1] *[1]Justus-Liebig-University Giessen, Germany*
11:10	Miriam Steines	Miriam Steines**The influence of group membership on the processing of emotional facial actions** Miriam Steines, Tilo Kircher & Benjamin Straube *Department of Psychiatry and Psychotherapy, Philipps-University Marburg, Germany*
Thursday afternoon		
04:00	Özlem Sensoy	**Perception and processing of familiar sizes in infancy** *Özlem Sensoy[1]; Jody C. Culham[2], Gudrun Schwarzer[1]* [1]Developmental Psychology, Justus-Liebig-University Giessen, Germany [2]Department of Psychology and Brain and Mind Institute, University of Western Ontario, London, Canada
04:20	Siavash Eftekharifar	**Dexterity analysis of surgeons and related parameters** Siavash Eftekharifar, Nikolaus F. Troje *Queens's University, Centre for neuroscience studies, Biomotion lab*
04:40	Friederike Seyfried	**Probing the metrics of representational geometry of face representation** Friederike Seyfried[1], Mathias Hegele[1], Niko Troje[2] [1]*Neuromotor Behavior Lab, Section Experimental Sensomotorics, Department of Psychology and Sport Science, Justus Liebig University Gießen, Deutschland*
Friday morning		
08:40	Fabian Helm	**Response Bias in Judging Disguised Movements** *Fabian Helm[1], Nikolaus F. Troje[2], & Jörn Munzert[1]*

		[1] *Department of Psychology and Sport Sciences, Justus-Liebig-University Giessen, Germany* [2] *Department of Psychology, Queen's University, Kingston, Canada*
09:00	Sophie Kenny	Perception of Human Animations With Inconsistent Body Shape and Motion Kenny, S. & Troje, N. F. *Queen's University*
09:20	Lindsey Fraser	**Do reach speed and reach consequences modulate tactile suppression?** Lindsey E. Fraser[1], Laurence R. Harris[1] & Katja Fiehler[2] [1]*York University, Toronto, Canada* [2]*Justus-Liebig Universität Giessen*
09:40	Zijian Lu	**The effect of gaze behavior and prior knowledge on the use of allocentric information in memory-guided reaching movements** Zijian Lu, Mathias Klinghammer, Katja Fiehler *Experimental Psychology, Justus-Liebig University Giessen, Giessen, Germany*
Coffee Break		
10:30	Janis Kan	**Visual saliency response in the superficial and intermediate superior colliculus.** Janis Y Kan[1], Brian J White[1], Laurent Itti[2], Douglas P Munoz[1] [1]*Centre for Neuroscience Studies, Queen's University, Kingston, Canada* [2]*Computer Science Department, University of Southern California, Los Angeles, USA*
10:50	Alexander Goettker	**Execution of saccadic eye movements affects speed perception** Alexander Goettker[1], Doris I. Braun[1], Alexander C. Schütz[1,2], & Karl R. Gegenfurtner[1] [1]*Justus-Liebig-University Gießen, Germany;* [2]*Philipps-Universität Marburg, Germany*
11:10	Benjamin Knopp	***Temporal Movement Primitive Perception under Naturalistic Conditions*** Benjamin Knopp, Moritz Schubert, Dominik Endres *University of Marburg*
Friday afternoon		
04:00	Brandon Caie	***Switching behaviour and the frontal eye field***

		Brandon Caie, Jerry Jeyachandra, Aarlenne Khan and Gunnar Blohm *Center for Neuroscience Studies, Queens's University*
04:20		
04:40		

KEYNOTE ABSTRACTS

Visual Perception of Materials and their Properties

Roland W. Fleming

University of Giessen

Under typical viewing conditions, human observers effortlessly recognize materials and infer their physical, functional and multisensory properties at a glance. Without touching materials, we can usually tell what they would feel like, and we enjoy vivid visual intuitions about how they are likely to respond to external forces, allowing us to predict their behaviour as we interact with them. These achievements are impressive because the retinal image of a material results from extremely complex physical processes (e.g. sub-surface light transport; visco-elastic fluid flow). Due to their extreme diversity, mutability and complexity, materials represent a particularly challenging class of visual stimuli, so understanding how we recognize materials, estimate their properties, predict their behaviour, and interact with them could give us more general insights into visual processing and internal models of the physical world. What is 'material appearance', and how do we measure it and model it? How are material properties estimated and represented? Discussing these questions causes us to scrutinize the basic assumptions of 'mid-level vision' that prevail in theories of human vision, and gives hints at how to build a machine vision system that could learn materials from passive and active observations.

Spatial coding of movement targets

Katja Fiehler

Department of Experimental Psychology, Justus-Liebig University Giessen, Germany

There is converging evidence that the human brain makes use of egocentric (relative to the observer) and allocentric (relative to objects in the environment) reference frames when coding targets for action. The relative weighting of both kinds of reference frames depend on multiple factors. In my talk, I will present a series of behavioral experiments in which we examined the contribution of egocentric, gaze-centered and allocentric reference frames in a reaching task. By varying the time delay between target encoding and reaching, we investigated the influence of memory on the use of both coding schemes. More recently, we strived to increase the ecological validity of our laboratory experiments by applying more complex, naturalistic scenes as well as virtual reality. This approach does not only allow to test whether allocentric information is used at all for coding targets for reaching, but also which information in particular does the brain use if multiple allocentric cues are available in the environment. By analyzing reach endpoints and eye movements, we have shown that both egocentric and allocentric reference frames contribute to immediate and memory-guided reaching movements. Moreover, the impact of environmental information to allocentric coding depends on the task relevancy and the reliability of allocentric cues as well as on the participant's gaze behavior and prior knowledge about the reach target. Overall, our results argue against the claim that spatial representations for action solely rely on egocentric reference frames.

TUES EARLY MORNING

Model-free vs. model-based learning and error correction with temporal delays in sensory-motor control

Dmytro Velychko[1], Dr. Dominik Endres[1], Dr. Gunnar Blohm[2]
[1]University of Marburg, Germany, [2]Queen's University, Canada

Information encoding, transmission, and processing by neural system is subject to temporal delays. How the brain performs sensory-motor control in presence of such delays it an open question. We investigate two hypothetical mechanisms for inferring corrective movements with delayed sensory feedback:

- Brain maintains a memory of past sensory-motor states and propagates the delayed feedback information, once it is received, through the Markov chain of state evolution, thereby adjusting the forward/inverse models according to the error. Such error propagation through time involves additional computations, thus the longer the feedback delay - the later the corrective movement will be performed. This is the correct Bayesian model-based learning and inference.
- New forward and inverse models matched to the specific temporal delay are learned. In this case the models could be updated immediately and the corrective movement onset should not scale with the feedback delay. We expect the corrective movements to have lower precision initially and the learning rate to be lower. This type of learning is model-free, but the brain is known to use a lot of shortcuts for computations.

To tackle this question, we have designed an experiment, when the sensory delay is being manipulated. Subjects control a point on a screen and are asked to perform reaching movements. Rotational and translational disturbances are randomly added to the visual feedback while performing the reaching. We record endpoint positions and EMG data to detect the corrective movement onset. As we are interested in low-level sensory-motor learning, to avoid cognitive strategies, the introduces delays are small, up to 200 ms. We are interested whether the correction onset delay scales linearly w.r.t. the feedback delay. With longer delays we expect the correction onset to saturate due to cognitive strategies (replanning).

Learning to exploit feature relevance: information sampling and object selection strategies

M. R. Watson[1], B. Voloh[1], M. Naghizadeh[1], S. Chen[2], T. Womelsdorf[1,3];
[1]Dept. of Biol., [2]Cognitive Sci., York Univ., Toronto, ON, Canada; [3]Dept. of Psychology, Vanderbilt Univ., Nashville, TN

Learning to succeed in goal-directed tasks often requires learning the relevance of specific objects and of specific features which define these objects. Here, we track this feature learning and identify shifts in behavior, attention and information sampling strategies that accompany it.
Human participants performed a context-dependent object selection task in a naturalistic 3D virtual environment. Their gaze was tracked as they navigated through an arena and learned to chose between pairs of multidimensional objects, only one of which was rewarded. Reward rules were based on object feature values and contexts: a value from one feature dimension was rewarded in one context, while a value from a different dimension was rewarded in another context.
We found that after exploratory periods of variable duration, learning of relevant features occurred abruptly. In a single trial, participants' choices changed from showing no evidence of rule-learning to near-perfect accuracy for the remainder of the block. On the same trial, choice times dropped and rewarded stimuli began to be preferentially fixated, consistent with a switch to a reward-driven exploitative strategy in both behavior and information-sampling.
The transition from exploratory behavior to the learned state was preceded by trials in which learners were more likely to have selected objects with non-rewarded values along the relevant feature dimension, as opposed to random selections across dimensions. Consistent with this finding, new rules were learned faster when they required intra-dimensional as opposed to extra-dimensional shifts.
These findings suggest that efficient learning of object relevance employs a hierarchically organized information sampling

strategy. Attention is first allocated to feature values within a single dimension, before switching to different dimensions of the object. This information sampling strategy is decoupled from immediate reward-driven strategies during learning. We speculate that a hierarchical information sampling strategy is computationally efficient for fast representational learning in complex multidimensional environments.

The Roles of Sensory Prediction and Explicit Strategies for Motor Learning in Older Adults

Chad Vachon, Shanaathanan Modchalingam, Bernard Marius 't Hart, Denise Y.P. Henriques
Centre for Vision Research, York University, Toronto, Canada

Our brains evolved to adapt our motor movements under changes in the sensory environment such as changed muscle strength or even trauma. This type of motor learning is thought to rely on sensory estimates of errors that can then use for adaptation. Some studies have shown intact motor learning in older adults compared to younger adults despite decreased sensory capacity. It is unclear how older adults maintain task performance on some motor tasks and not others. Two possible explanations are that older adults compensate for sensory decline by relying more on predicted sensory consequences as opposed to actual sensory feedback, or that they rely more on an explicit, cognitive strategy instead of implicit motor learning. We provided older and younger adults with a cognitive strategy to compensate for a visuomotor rotation and examined if these two groups made different use of that strategy. We also compared how much young and old adults rely on prediction and proprioception when estimating hand position, before and after visuomotor adaptation. In younger adults, the reach aftereffects were larger when participants were instructed to include their strategy, but only for the explicitly trained group. Older adults however, benefitted less from instructions, that is older adults did not make use of the strategy as well as younger adults. Our preliminary results suggest that rehabilitation for older adults should focus less on the explicit instructions, but rather allow for implicit learning that occurs with self-exploration through prolonged training.

Do movement sequences and consequences facilitate the retrieval of motor memories?

Maria N Ayala & Denise YP Henriques
Centre for Vision Research, York University

When planning movements, the human central nervous system (CNS) can actively compensate and adapt to two or more distinct perturbations simultaneously ("dual adaptation") but this is only possible when each visuomotor map is associated with a sufficient contextual cue. Because not all contextual cues are effective and only more "intrinsic" or motor-based cues tend to be useful to the CNS, we sought to investigate whether distinct movement sequences and consequences allow for dual adaptation of opposing visuomotor rotations. Using a virtual reality paradigm, participants manipulated a hand-cursor using a digitizing tablet in a semi-dark room with an opaque board occluding visual feedback of the hand. In the first experiment, we associated different movement sequences with opposing visuomotor rotations (e.g. a leftward sequence was associated with 30° counter-clockwise). Four "single" groups experienced a single perturbation and thus, only adapted their reaching to the specific sequence permutation. Two "dual" groups experienced opposing perturbations that were each associated with a distinct movement sequence (i.e. leftward or rightward sequence). In the second experiment, we explored whether movement consequence alone can assist the motor system in predicting the impending visuomotor rotation. Participants simply observe the consequence associated with the perturbation they just experienced. In this experiment, two "dual" groups experienced opposing perturbations; each rotation was associated with a distinct consequence (e.g. a leftward target consequence was associated with a 30° CCW rotation and vice-versa). In a final experiment, we will confirm that the static representation of the final target alone does not facilitate dual learning. Participants reach towards targets that are flanked by a secondary target which is predictive of the perturbation. Together these findings will show whether movement sequences and consequences are incorporated into motor planning and execution, and can thus facilitate dual learning of visuomotor rotations.

TUESDAY LATE MORNING

The Role of the Distinction between Self and Other in Action-Feedback Monitoring

16

Lukas Uhlmann, Tilo Kircher, Benjamin Straube
Department of Psychiatry and Psychotherapy, Philipps University Marburg, Marburg, Germany

In order to decide whether the sensory consequences of a self-generated action are in fact caused by the motor output itself and not by mere changes in the environment, the brain needs to compare the incoming sensory input with predictions about the sensory consequences of one's own action. Compared to externally generated stimuli, self-generated sensory events are attenuated in terms of their perceived intensity and their neural response. Interestingly, less sensory suppression is related to core symptoms in schizophrenia, such as passivity symptoms or hallucinations. Thus, dysfunctional action monitoring could be the basis of defective self-other discrimination, e.g. when patients with passivity symptoms have the sensation that their own actions or thoughts are induced or influenced by external sources. However, it still remains elusive how far the authorship of perceived sensory feedback influences feedback monitoring of self-generated and externally generated actions, and to what extent schizophrenia patients with and without passivity symptoms and/or hallucinations differ from healthy control subjects in tasks where the authorship of the sensory consequences of one's own action is manipulated. Therefore, the aim of this project is to examine the influence of the distinction between self and other on behavioral and neural levels regarding visual consequences of self-generated and externally generated actions. In several experiments, participants will be asked to detect delays between self-generated or externally generated right-leftward hand movements and the movements' visual feedback displayed on a computer screen. The visual feedback will either display the participant's own or someone else's hand. It is expected that neural suppression in cases where participants observe their own movement (in contrast to another person's movement) is reduced in schizophrenia patients with passivity symptoms and/or hallucinations compared with healthy subjects or schizophrenic patients without these symptoms.

Prediction of Indirect Action Consequences

Mareike Pazen[a], Benjamin Straube[a], Tilo Kircher[a]
[a]*Philipps-University Marburg, Department for Psychiatry and Psychotherapy, Marburg, Germany*

Background. The ability to attribute the sensory consequences of voluntary actions to oneself is based on internal prediction models: If the anticipated sensory input matches the actually incoming information, it can be classified as self-produced. The use of tools poses a challenge to these predictive mechanisms, as the attribution of agency requires that both direct (body) and indirect (tool) action consequences are incorporated into the prediction model. In order to achieve equally accurate predictions, we assume additional processes to be necessary for voluntary actions executed with a tool.
Methods. During fMRI data acquisition, participants grab a handle with their hand or with a tool. The handle is either moved by participants themselves (voluntary movement) or by a custom-made device (involuntary movement). A video of the movement is fed back to a screen in real time or with varying delays (0-417ms). Participants report the detection of such delays.
Expected Results. For both non-tool and tool use actions, we expect a suppression effect for voluntary compared to involuntary movements, i.e., worse behavioral detection performances as well as lower blood oxygen level dependent (BOLD) responses in primary sensory cortices. Additional BOLD activity in a fronto-parietal network is expected to be found for tool use actions.
Tentative Conclusion. Taken together, these findings would suggest that tools can be integrated into the internal prediction model, thereby serving as an elongation of the self. Predictions about the sensory consequences of tool use actions would be as accurate as those of actions without tools. However, the process of integration would demand some additional resources, reflected by the presumed recruitment of fronto-parietal areas during tool use actions.

A Bayes optimal decision model of the saccade trigger mechanism during smooth pursuit

Jonathan Coutinho[1], Philippe Lefèvre[2], Gunnar Blohm[1]
1. Center for Neuroscience Studies (CNS), Queen's University, Kingston, Canada.
2. Institute of Information and Communication Technologies, Electronics and Applied Mathematics (ICTEAM) and Institute of Neuroscience (IoNS), Université catholique de Louvain, Louvain-la-Neuve, Belgium

Accurate visual tracking depends on the synergistic control of smooth pursuit and saccadic eye movements. Pursuit eye movements are controlled primarily by retinal slip ('RS'), with intrinsic trial-by-trial variability that can be described through stochastic Bayesian modelling. Saccade trigger during pursuit is highly dynamic and contingent on both retinal position error

('PE') and RS. A related measure, the eye crossing time (which depends on PE and RS) has been shown to determine average saccade occurrence but fails to explain when a saccade will be triggered. Here we model the computational strategy underlying the decision mechanism triggering catch-up saccades during smooth pursuit initiation and maintenance in a closed-loop stochastic simulation within a Bayesian framework. In this model, sensory inputs (PE and RS, arising from the relative motion between the target and the eye) are delayed, corrupted by signal-dependent noise, and independently estimated through Kalman filtering. Each Kalman filter computes a Bayes optimal probabilistic estimate of its respective sensory signal (a mean value and its associated uncertainty). In line with observations that saccade amplitude accounts for RS during pursuit, our model utilizes estimated RS to extrapolate the current estimated PE into the future, compensating for sensory and motor delays. In our model, a saccade is triggered when estimated with certainty (in a statistical sense) that the future PE will be outside an allowable PE range (ie: foveal image positions). In agreement with the decision-making literature, the decision signal is accumulated through leaky integration and triggers saccades upon crossing a fixed threshold of certainty. The model reproduces the distributions of saccade occurrence observed in humans across a range of step-ramp target motions during pursuit initiation and maintenance. This provides a general framework for the predictive trigger of saccades during smooth pursuit constrained by noisy, delayed, and dynamically varying sensory and motor signals.

TUES EVENING

Pick me up: How object shape, weight, and material properties determine precision grip

Lina K. Klein, Guido Maiello, Vivian C. Paulun, Roland W. Fleming
Department of Psychology, Justus-Liebig University Giessen

Successfully handling objects requires selecting appropriate grasp locations. Of the many possible grasp points, only a small subset yield stable, comfortable grasps. To identify these, humans must take object shape, material properties, and the desired action into account. As previous experiments have generally investigated simple geometries, the computations underlying visually guided grasp point selection for three-dimensional objects of non-uniform materials remain unclear.
We tested how an object's visually perceived three-dimensional shape and material properties (mass distribution and surface friction) affect grasp locations. We created objects composed of 10 cubes (side length 2.5 cm) in various configurations. Individual cubes were made of either wood or brass. Objects were composed of either 10 cubes of wood or 5 cubes of each material. By reordering the locations of wood and brass cubes objects we shifted the location of each shape's center of mass (COM). Human participants were asked to pick up each object with only index finger and thumb and place it nearby on an elevated plate.
Movement trajectories and grip point locations were recorded with an Optotrak system. We find that grasp locations are affected by object orientation, the location of the object's COM, partial object occlusions by the subject's hand, and shape properties such as the presence of obvious handles. We used these findings as fundamental constraints for a generalized contact point selection model for three-dimensional objects. The correspondence between the model's predictions and human grasp locations is striking. In turn, such a model also has implications for the visual representation of 3D shape.

How is size perception of real objects modified by the congruency of the familiar size cue?

Margarita V. Maltseva[1,2], Melvyn A. Goodale[1,2], & Jody C. Culham[1,2]
Psychology Department of the University of Western Ontario, The Brain and Mind Institute

The visual system is able to use various cues to infer the true size of an object, which is important for both recognizing it and interacting with it. Yet a wealth of studies investigating size perception in pictures has found that the visual system is often fooled by illusions. For example, an object is often seen relative to the size of nearby objects in size-contrast illusions, such as the Ebbinghaus illusion, in which an object surrounded by larger objects is perceived smaller than it really is (and vice versa). However, objects in the real world offer additional cues, such as binocular disparity and familiar size, which are often absent or simply violated in 2D displays. Here we wondered whether size perception of real-world objects is as sensitive to the same illusions as images.

In a previous study, using 2D pictures we showed that a size-contrast (Ebbinghaus) illusion was eliminated when the relative physical sizes of the images were congruent with their familiar sizes, indicating the importance of the context's familiar size (irrelevant to the task) in the perception of a target. Specifically, a dog surrounded by small shoes and a dog

surrounded by large cars were estimated to be similar in size; whereas when the relative sizes were incongruent, as in the case with the dog surrounded by either large shoes or small cars, the targets were perceived to differ in the direction predicted by the illusion.

In the current study, we present a real neutral medium-sized object (i.e., 12.7-cm Styrofoam sphere) next to another Styrofoam sphere or a familiar object, namely a tennis ball or a basketball. The sizes of the flanker objects were either congruent with the familiar sizes of the object (e.g., 6.7-cm tennis ball and 24.2-cm basketball), incongruent (e.g., 6.7-cm basketball and 24.2-cm tennis ball) or identical to the target's size (i.e.,12.7-cm tennis ball, basketball or Styrofoam sphere). The first question is whether the size-contrast illusion occurs for the real objects when the binocular cues may facilitate veridical size perception. The second question, in case that the size-contrast illusion indeed occurs for the real objects, is the degree to which the familiar size of flanker objects contributes to size perception of the target. We expect to replicate the results of the previous study that congruently sized flankers will aid in veridical size perception; whereas the incongruent flankers will induce the illusion. Notably, when the physical size of the flankers matches that of the target but not their real-world size, the perceptual system will either ignore the familiar size cue resulting in a veridical perception or rely on it despite the incongruence. The results of this study will show which features of the real objects in the scene (i.e., physical size, physical depth and familiar size) influence size perception in the real world.

Transsaccadic updating of object orientation for grasp preparation: A neuroimaging study

*****B.-R. Baltaretu[1], *B.-R. Baltaretu[1,2], S. Monaco[2,3], J. Velji-Ibrahim[1,2], G. N. Luabeya[1,2], J. CRAWFORD[1,2];
[1]York Univ., North York, ON, Canada; [2]Ctr. for Vision Res., [3]Univ. of Trento, Ctr. for Mind/Brain Sci., Trento, Italy

It has been shown that intraparietal cortex is involved in the spatial updating of reach locations, and that extrastriate and inferior parietal cortex are involved in the transsaccadic perceptual integration object orientation. However, it is not known how object orientation is processed across saccades for planning grasping movements. Here, we used an fMRI-adaptation paradigm to investigate if saccades produce modulations in cortical areas involved in orientation-specific grasp preparation. In each trial, participants (n=13) were instructed to fixate an LED left or right of center, and prepare to grasp a central, elongated object (oriented 0° or 135°). The object was illuminated at center, then the subject either fixated or made a saccade to the opposite side, after which the object was re-presented at the same (Repeat) or different (Novel) orientation. After the second presentation, participants grasped the object. We analyzed the second illumination period to identify modulations of saccades on grasp plans are based on: 1) spatial/gaze parameters. The first two seconds of the motor execution period were analyzed for orientation sensitivity modulations. During grasp preparation, saccades recruited a broad swath of occipitotemporal and occipitoparietofrontal cortex. Orientation specificity was found in supramarginal gyrus (SMG). The orientation- and saccade-specific areas were in right superior and inferior parietal lobules and SMG. These data suggest that saccades and orientation changes may interact at an early stage to update grasp plans, but produce widespread modulations of activation through occipital, temporal, and parietal cortex.

Effects of central and peripheral cueing on perceptual and saccade performance

Tobias Moehler & Katja Fiehler
Experimental Psychology, Justus-Liebig-University Giessen, Germany

Previous research on the spatiotemporal dynamics of exogenous and endogenous attentional allocation during saccade preparation yielded conflicting results. We believe that this can be explained by the cueing type used to orient attention in a perceptual task. We investigated the time-course of attentional allocation as a function of cueing type (central vs peripheral), spatial congruency of a perceptual and a saccade task, and cue validity during saccade preparation in a dual-task paradigm. Participants performed a visual discrimination task during saccade preparation. We found that central and peripheral cues differentially affected the time-course of attentional allocation depending on spatial congruency and cue validity. Peripheral cues quickly and transiently oriented attention to the cued location. In the congruent condition, attention was maintained by the pre-saccadic attention shift, but declined in the spatially incongruent condition. Central cues slowly oriented attention to the cued location. In the congruent condition, attention was boosted by the pre-saccadic attention shift compared to a slower increase in the spatially incongruent condition. The pre-saccadic attention shift - the automatic and obligatory shift of attention to the saccade target - observed in the invalid and spatially incongruent condition was not differentially affected by the cueing type orienting attention away from the saccade target. In conclusion, exogenous and endogenous attention is dynamically and flexibly allocated to cued locations during saccade preparation while pre-saccadic attentional resources are progressively shifted to the saccade target locations irrespective of the type of cueing. We argue that attentional selection for perception represents a partially independent process than the action-specific pre-saccadic attention shift.

Saccades and reaches curve away from the other effector's target in simultaneous eye and hand movements.

Tom Nissens & Katja Fiehler
Experimental Psychology, Justus-Liebig-University Giessen, Germany

Simultaneous eye and hand movements are often coordinated and tightly coupled. This raises the question whether the selection of eye and hand targets relies on a shared attentional mechanism or separate attentional systems. Previous studies have revealed conflicting results by reporting evidence for both a shared as well as separate systems. Movement properties such as movement curvature can provide novel insights into this question as they provide a sensitive measure for attentional allocation during target selection. In the current study, participants performed simultaneous eye and hand movements to the same or different visual target locations. We show that both saccade and reaching movements curve away from the other effector's target location when simultaneously performed to spatially distinct locations. We argue that there is a shared attentional mechanism involved in selecting eye and hand targets which may be found on the level of effector independent priority maps.

Tracking attention with reverse correlation EEG

Jing Chen, Matteo Valsecchi, Karl Gegenfurtner
Department of Psychology, Justus-Liebig-University Giessen

We developed a method to track spatial attention continuously at a 0.1-second temporal resolution. The method is based on random luminance visual stimulation and EEG recordings. By reverse correlating EEG signals to the random luminance sequence (with a length as short as 100 ms), a peak correlation is observed at a delay of ~80 ms. The magnitude of this peak correlation in principle indexes the strength of early visual responses to the target visual stimulus. To test whether the peak correlation is modulated by spatial attention, we had participants monitor two independent random luminance patches, and presented a central attentional cue to direct their attention to one of the two patches. We did find that the correlation between EEG signals and the attended random luminance patch increased compared to the correlation between EEGs and the unattended patch, within 200 ms after the cue. In addition, instead of long-lasting enhancement on the attended side, we observed oscillations between the attended and the unattended side at 3-4 Hz such as has been observed behaviorally before. Overall, the technique of EEG reverse correlation provides high temporal resolution to track spatial attention, and could potentially be applied to various situations such as tracking attention during rapid eye movements.

A whole-report approach to investigating visual working memory capacity limitations under high load

Benjamin Cuthbert[1], Dominic Standage[1], and Gunnar Blohm[1 1]*Centre for Neuroscience Studies, Queen's University, Kingston, ON.*

The limited capacity of visual working memory imposes key constraints on cognitive function, and there is considerable variation in the robustness of individual maximum capacity to situations imposing high load on the working memory system. In addition, significant capacity deficits in high load conditions have been observed in clinical and aging populations, but the details of the working memory system's load- dependent performance remain poorly understood. Recently, a cortical network model of the working memory system has led to a hypothesized mechanism underlying this variation: at high loads, the working memory system may modulate competitive dynamics dictating information storage in the prefrontal cortex, inducing a "trade-off" between maximum storage capacity and robustness to overload.
To investigate this possibility, we have adapted a novel whole-report visual working memory task; this approach differs from the ubiquitous change-detection paradigm by allowing for trial-by-trial estimates of the number of items held in working memory. Preliminary experiments including 6 pilot participants have produced capacity estimates lower than the canonical limit of 3-4 stored items at all tested loads. Further analysis in combination with control experiments suggests that this performance decrease cannot be explained by the additional maintenance time required by the whole-report task, or by interference during the act of reporting the items. Interestingly, we have also failed to observe the expected decrease in estimated capacity at higher loads, suggesting that participants are implementing cognitive strategies during the whole-report task that involve fundamentally different processes from those active during a change-detection task. Further task manipulations will attempt to perturb these processes in ways that will give us insight into the mechanisms underlying whole-report task performance, with the ultimate goal of developing a framework for understanding the limitations of the working memory system.

Sensory attenuation modulated by predictive kinematics of dynamic objects induced by Earth's gravity

Benedict J. Chang[1], Dennis Koch[2], Anna Schubö[2], Jody C. Culham[1]
[1]*Brain and Mind Institute, Western University, London, Canada*
[2]*Fachbereich Psychologie, Phillipps-Universität Marburg, Marburg, Germany*

With any motor action such as moving a limb, or acting on objects, a prediction of the sensory consequences of the action is made. Previous work has shown that this prediction leads to an attenuation of sensory responses in the visual (Hughes & Waszack, 2011), somatosensory (Tsakiris & Haggard, 2003), and auditory (Weiss et al. 2011) domains. Humans have an innate knowledge of the kinematics of dynamic objects with passive motion in Earth's gravity ($1g = 9.81 m/s^2$), even to the point of estimating times-to-contact (TTCs) consistent with Earth's gravity when objects are not accelerating (Zago & Lacquaniti, 2005). The purpose of this study was to use sensory attenuation to determine whether sensory predictions can take Earth's gravity into account. We hypothesized that when a virtual ball is launched actively by a participant, the percept of a resultant bounce sound will be attenuated when the sound is congruent with TTC compared to earlier or later. We designed a task where participants had to rate the volume of the bounce sound when it was played at seven different timings either before or after the ball bounce. We found a significant attenuation of the perceived bounce sound when played at the TTC compared to when the sound was played 500 ms earlier, indicating sensory attenuation. Surprisingly, we found no signs of attenuation compared to when the bounce sound was played 500 ms after the ball had contacted the ground. We are currently testing an EEG version of this paradigm to examine a neural correlate of this attenuation. Further work will also determine if this effect is specific to gravitational acceleration or if it occurs in non-gravitational accelerations.

WEDNESDAY LATE MORNING

Potential models of allocentric coding for reaching in naturalistic visual scenes

Parisa Abedi Khoozani [1], Mathias Klinghammer[2], Paul R. Schrater[3], Dominik Endres[4], Katja Fiehler[2], Gunnar Blohm[1]
[1]Queen's Univ., Kingston, ON, Canada; [2]Justus-Liebig Univ. Giessen, Giessen, Germany; [3]Univ. Minnesota, Minneapolis, MN; [4]Philipps-University Marburg, Marburg, Germany

We use both allocentric and egocentric information for reaching to visual targets. Previous studies showed that contextual factors can modulate the integration of allocentric information, Klinghammer et al. 2015, 2016, 2017; e.g. random changes in scene configuration lead to less contribution of allocentric information and more variability in finding the position of the missing object in a memory task. However, the underlying principles of this integration are not clear; therefore, here, we propose three models to explain the reported data. At the encoding phase, the goal is to code and store the position of each object with respect to the others. The first two models create a cluster point and calculate the distance of objects from this cluster; logistic vs. generative Bayesian. The third model creates Barycentric coordinates and encodes the position of the target with respect to local clusters. At decoding, the aim is to infer the position of the missing object; in the first two models, this inference is done by combining the remembered egocentric cluster point and the new allocentric cluster point extracted from the new scene. The third model estimates the allocentric position of the missing object based on the new scene and then combines it with remembered egocentric position. All models reproduced the reported human data, but each one has different implications: in Bayesian models, the required computational and memory resources can be greatly decreased by creating a global cluster point, however, any misestimation in retrieving this cluster point can dramatically affect the final estimation (model#1 in more efficient computationally while model#2 is more robust since it makes fewer assumptions). In contrary, model#3 uses a more redundant coding strategy (requiring more resources) and therefore is more robust to changes in the scene. Future experiments should be carried out to examine which of these strategies, if any, the brain might use.

Linear optic flow might be enhanced by conflict between visual and non-visual cues to orientation

Meaghan McManus and Laurence R. Harris
York University

When the cues to gravity become unreliable or are removed, visual information is weighted more strongly. Therefore introducing a conflict between gravity and the body and visual cues to upright might reduce the reliability of the gravity cue and thus also enhance vision.

In two separate experiments we introduced a visual reorientation illusion using virtual reality so that participants felt upright while the head, or head and body were physically tilted relative to gravity. This created a conflict between the visual upright and the cues provided from vestibular system and the body. The conflict between visual and non-visual cues to upright was greater when both body and head were tilted compared to when only the head was tilted. We then measured the effectiveness of optic flow for use in traveling to a virtual target distance.

Optic flow was presented in a head-mounted display while participants were prone, upright or supine, or while standing with head tilted forwards, straight, or backwards. Participants saw a target at 10, 20, 40, 60 and 80m in a simulated hallway stretching away from their nose. The target was removed and the hallway accelerated past them. Participants pressed a button when they reached the remembered location of the target. Participants felt that they were standing upright and moving forwards horizontally in all conditions.

Participants undershot the target distances (thought they travelled further) when supine and prone, relative to when upright. This indicates an increased sensitivity to the visually-induced self-motion in those conditions. However, when the conflict is weaker (as when just bending the head), increased sensitivity was found only when the head was tilted forwards (not backwards). This difference indicates that increased visual sensitivity may depend not only on visual-vestibular conflict but may also be influenced by whether combinations of movement and posture are perceived as natural or purposeful, or due to the position of the otoliths.

TMS-induced disturbance of self-motion perception

Constanze Schmitt[1], Bianca R. Baltaretu[2], J. Douglas Crawford[2], Frank Bremmer[1]
[1] *AG Neurophysik, Philipps-Universität Marburg, Marburg, Germany;*
[2] *Centre for Vision Research, York University, Toronto, Ontario, Canada*

Accurate perception of one's direction of self-motion (heading) is of utmost importance during everyday life. Previous studies have emphasized the role of monkey and human medial superior temporal area (MST) in self-motion processing. In a recent study combining monkey neurophysiology, human psychophysics and computational modeling we could show that saccadic eye movements modulate heading representation. The computational part of our study predicted a direction

specific TMS-induced increase of response variance of heading perception. Here we wanted to investigate by means of neuronavigated transcranial magnetic stimulation (TMS) if (i) TMS can mimic the effects of saccades on heading perception and if (ii) TMS indeed induces a greater variance of heading perception for simulated self-motion contraversive to the TMS stimulation site.

We presented an optic flow stimulus (random dot pattern) on a large projection screen 54 cm in front of the participants. In a given trial, the stimulus first was stationary, then moved for 50 ms, simulating forward self-motion across a ground plane in one of three directions separated by 30°, and was stationary again. Participants fixated a central target throughout the trial. After each trial, participants had to indicate perceived heading direction. In 57% of the trials three TMS pulses were applied, separated by 100 ms each, centered on self-motion onset. TMS-stimulation site was either right-hemisphere MST, which we identified using an fMRI localizer, or a control area 1.5 cm posterior to human MST.

TMS over MST increased response variance of perceived heading. Remarkably, and as predicted by our model, this result was strongest for simulated self-motion to the left (contraversive). Different to saccades, which induce a compression of perceived heading, TMS pulses induced misperception towards both, more central and more peripheral, headings. Our results provide further evidence for a critical role of primate area MST for navigation.

Decoding sensorimotor information from macaque area 7a

Adrian Schütz [1], John Douglas Crawford [2] and Frank Bremmer [1]
[1]AG Neurophysik, Philipps-Universität Marburg, Marburg, Germany;
[2]Center for Vision Research, York University, Toronto, Canada

Area 7a is considered to be one of the higher stages of visual cortical processing of the macaque monkey. Over the years, a number of studies have revealed a plethora of response features of neurons in area 7a. In this project, we aim to better understand the role of macaque area 7a for visuomotor behavior.
Our lab has recently shown, that population activity from extrastriate and parietal areas (MT, MST, LIP and VIP) allows to decode **eye position** across eye movements, i.e. saccades and smooth pursuit (Morris et al., 2012; Dawiasch et al., 2016). All four areas project into area 7a. We hence expect that population activity from area 7a will allow to decode eye position during different oculomotor tasks. We will determine, if the decoding parameters as determined during these oculomotor tasks will also allow to decode eye position during head unrestrained gaze. Furthermore, we will investigate the reference frame of eye position signals by applying an approach that was developed in the Crawford lab (Keith et al., 2009).
Additionally we are interested in the self-motion responses of neurons in area 7a and the interaction of said tuning with eye movements. Our lab has previously shown that neurons in areas MST and VIP reveal an invariance for slow eye movements while responding to visually simulated **self-motion** (Bremmer, 2010; Kaminiarz et al., 2014). Both areas project directly into area 7a. Hence, we assume that neurons in area 7a are tuned to self-motion direction irrespective of smooth eye-movements. Most recently, our lab has shown that saccades induce a compression of heading as decoded from neural activity in areas MST and VIP (Bremmer et al., in press). We will determine if such an erroneous perisaccadic decoding is also observed from discharge in area 7a.

References

1. Morris, A.P., Kubischik, M., Hoffmann, K.P., Krekelberg, B., Bremmer, F., 2012. Dynamics of eye-position signals in the dorsal visual system. Curr. Biol. 22, 173–179. doi:10.1016/j.cub.2011.12.032
2. Dowiasch, S., Blohm, G., Bremmer, F., 2016. Neural correlate of spatial (mis-)localization during smooth eye movements. Eur. J. Neurosci. 44, 1846–1855. doi:10.1111/ejn.13276
3. Keith, G.P., DeSouza, J.F.X., Yan, X., Wang, H., Crawford, J.D., 2009. A method for mapping response fields and determining intrinsic reference frames of single-unit activity: Applied to 3D head-unrestrained gaze shifts. J. Neurosci. Methods 180, 171–184. doi:10.1016/j.jneumeth.2009.03.004
4. Bremmer, F., Kubischik, M., Pekel, M., Hoffmann, K.P., Lappe, M., 2010. Visual selectivity for heading in monkey area MST. Exp. Brain Res. 200, 51–60. doi:10.1007/s00221-009-1990-3
5. Kaminiarz, A., Schlack, A., Hoffmann, K.-P., Lappe, M., Bremmer, F., 2014. Visual selectivity for heading in the macaque ventral intraparietal area. J. Neurophysiol. 112, 2470–80. doi:10.1152/jn.00410.2014

The necessity to choose causes the effects of reward on saccade preparation

Christian Wolf, Anna Heuer, Anna Schubö, & Alexander C. Schütz
Experimental and Biological Psychology, Philipps-University Marburg, Marburg, Germany

When humans have to choose between different options, they can maximize their payoff by choosing the option that yields the highest reward. Information about reward is not only used to optimize decisions but also for movement preparation to minimize reaction times to rewarded targets. Here, we show that this is only true in contexts in which participants additionally have to choose between different options. We probed eye movement preparation by measuring saccade latencies to differently rewarded single targets (single-trial) appearing left or right from fixation. In choice-trials, both targets were displayed and participants were free to decide for one target to receive the corresponding reward. In blocks without choice-trials, single-trial latencies were mostly unaffected by reward. With choice-trials present, the influence of reward increased with the proportion and difficulty of choices and decreased when a cue indicated that no choice will be necessary. Choices caused a delay in subsequent single-trial responses to the non-chosen option. Taken together, our results suggest that reward affects saccade preparation mainly when the outcome is uncertain and depends on the participants' behavior, for instance when they have to choose between targets differing in reward.

24

Saccadic Eye Movements in Patients with REM Sleep Behavior Disorder – a Marker in Prodromal Parkinson's Disease?

Karén Wilhelm[1*], Julia Morris[2*], Annette Janzen[1], David Vadaz[1], Geert Mayer[1] Douglas Munoz[2] & Wolfgang H. Oertel[1]
[1]Department of Neurology, Philipps-University, Marburg, Germany and [2]Queens University, Kingston, ON, Canada
*equal contribution

Rapid eye-movement (REM) sleep behaviour disorder (RBD) is characterized by the loss of muscle atonia during the REM sleep cycle, leading to those affected to act out their typically violent dreams, resulting in kicking and punching. Importantly to note, approximately 10 to 20 years after diagnosis, more than 82% of patients with idiopathic RBD show a conversion to α-synucleinopathies, making this disease the most specific prodromal marker of Parkinson's disease (PD) and in rare cases, multiple system atrophy and dementia with Lewy bodies. Patients with PD have deficits in the pro- and anti- saccade task, specifically shorter latency saccadic reaction times (SRTs) during pro-saccades, more express saccades, longer SRTs during anti-saccades, and more direction errors. For pupil behaviour, patients with PD's pupils constrict and dilate less than healthy age-matched controls after the fixation point is presented. The goal of this study is to assess whether patients with RBD exhibit similar saccade and pupillary deficits as patients with PD in the pro- and anti- saccade task. Thus far, the pro- and anti- saccade task was completed with 21 RBD patients, 9 PD patients, and 8 controls. Patients with RBD exhibited more express saccades, as well as direction errors compared to healthy, age-matched controls. RBD patients also showed significantly less constriction and dilation during pro-saccades compared to healthy age-matched. Therefore, analysis of saccade and pupillary behaviour during pro- and anti- saccade has the potential to produce early behavioural biomarkers to determine which patients with RBD may go on to develop PD.

Comparison of spatial coding schemes between the simultaneously recorded neurons from the frontal eye fields and supplementary eye fields during head-unrestraiend gaze shifts.

Vishal Bharmauria[1], Amirsaman Sajad[2], Harbandhan Arora[1], Xiaogang Yan[1], Hongying Wang[1], J. Douglas Crawford[1]
[1] Centre for Vision Research, York University, Canada; [2] Vanderbilt Vision Research Center, Vanderbilt University, Nashville

The neural underpinnings of visual-motor transformations are yet not completely known. Here, in head-unrestrained monkeys, we investigated the visual-motor transformations by discriminating the spatial codes embedded in the visual (V) and motor (M) responses of the single- and multi-unit activities recorded simultaneously from the frontal eye fields (FEF) and supplementary eye fields (SEF). Animals performed a task involving the coordinated eye-head gaze shifts to the remembered visual targets, in presence/absence of an 'allocentric' landmark in the background. During the delay period, a visual mask was briefly presented in case of the allocentric cue. The cue was either displaced (by 8° in one of eight radial directions, on the majority of trials) or remained stationary. Employing similar spatial model-fitting approach as **Sajad et al. (2015, 2016),** the preliminary egocentric single-unit analysis revealed that the FEF visual (n=13) burst encodes the target in eye-centered coordinates (Te), whereas the motor (n=14) activity best describes the gaze relative to eye (Ge). On the other hand, the SEF visual (n=11) and motor (n=14) neurons do not exhibit spatially tuned activity (broad receptive fields) and show a slight bias toward Ts (Target in space). This suggests that FEF and SEF neurons exhibit different coding schemes. Further analysis is targeted on testing the allocentric models, analysis of gain fields, spatial transformations during memory delay **(Sajad et al. 2016)** and the comparison of single- and multi-unit visual-motor transformations between the FEF and SEF.

THURS LATE MORNING

Perceived vividness of imagined movements is associated with the variation of neural pattern within the human motor system

Adam Zabicki[1], Benjamin de Haas[2,3], Karen Zentgraf[4], Jörn Munzert[1] and Britta Krüger[1,5]

[1]Institute for Sports Science, Justus Liebig University Giessen, Germany; [2]Institute of Cognitive Neuroscience, University College London, UK; [3]Experimental Psychology, University College London, UK; [4]Institute of Sport and Exercise Sciences, University of Muenster, Germany; [5]Bender Institute of Neuroimaging, Justus Liebig University Giessen, Germany

Motor imagery refers to a process where subjects imagine doing a body movement by themselves from first-person-perspective with a strong kinesthetic component. Thus, the imager imagines "being inside his or her body" and

"experiencing those sensations" (Roberts et al., 2008). Therefore, it is argued that a motor image is a sort of conscious motor representation obtaining all functional and causal properties of the represented movement. Several studies have argued that the ability of creating such vivid motor images is an individual as well as a variable feature that can vary within and between subjects. On this background, the aim of the present work is to answer the question whether and how the perceived vividness is related to the functional geometry of the respective imagined movements.
During fMRI, after each of the 120 imagery trials, subjects were asked to rate the perceived vividness of the respective motor image. Based on the given ratings, all trials were divided into eight rating groups, representating trials from low to high vivid motor images. After first-level analysis, the obtained t-maps were then fed into a RSA in order to characterize the representational geometry of motor images with different vividness ratings in specific ROIs. Furthermore, the correlations between the similarity of neural pattern elicited by each rating group and the respective difference between the underlying rating behavior were analyzed.
The results split the regions into three groups: positive, negativ or no correlation between neural activity patterns of the different rating groups and the corresponding perceived vividness. Negative correlation (dPMC, SPL, IPS) means higher dissimilarities of activity patterns of similar rated groups, indicating more specific pattern within high vivid MI trials. Positive correlations (right M1, vPMC) indicate that the perceived vividness is reflected by the neuronal geometry. One possible conclusion might be that also the subjective impression of the underlying imagery quality is coupled to neuronal phenomena within motor and motor-related areas.

Multivariate Pattern Analysis in Alexithymia

J. Bachmann[1], A. Zabicki[1], B. Krueger[1], J. Munzert[1]
[1]*Justus-Liebig-University Giessen, Germany*

Recently, the evaluation of functional MRI signals with multivariate methods has become increasingly popular due to its utility in fundamental research. Multivariate techniques such as representational similarity analysis (RSA) and pattern classification approaches can help bridge the gap between neurophysiological and behavioral data. Being able to classify subjects based on neurophysiological data offers novel approaches regarding diagnostic guidelines for mental disorders. So far, this approach has been used extensively for clinical studies, however, multivariate analyses have rarely been used for the investigation of subclinical populations, such as alexithymic individuals. Alexithymia is a subclinical condition characterized by an impairment of the ability to identify and communicate one's emotional state. The goal of the current study is to investigate whether regional activity patterns are associated with emotional valence ratings. Furthermore, we aim to assess whether a classifier-based analysis can predict the clinical status of the participant. 20 individuals will be assigned to a group based on their scores on the 20-item Toronto Alexithymia Scale. Using functional magnetic resonance imaging (fMRI), a validated set of point-light stimuli displaying emotional scenes will be presented. Based on previous findings, we expect the representational dissimilarity analysis to show a clear separation of valence with positive and negative valence on opposite ends of the continuum. We further expect intra-group effects of item-specific representations that are highly predicted by other participant's representational maps in specific brain areas. Thus, a classifier-based analysis should reliably predict group membership of the participant. With this study we hope to shed light on the neurophysiological differences in emotion processing among alexithymic as well as healthy individuals and thus promote the integration of biological markers into diagnostic processes within clinical settings.

The influence of group membership on the processing of emotional facial actions

Miriam Steines, Tilo Kircher & Benjamin Straube
Department of Psychiatry and Psychotherapy, Philipps-University Marburg, Germany

Successful social interactions are based on both partners' ability to clearly communicate and understand meanings and intentions. This crucially depends on accurate recognition and interpretation of each other's emotional facial actions. We hypothesize that this is achieved by a mechanism in an extended mirror neuron system and that this process is further susceptible to social factors, such as group membership and identification with a respective interaction partner.
In order to compare group memberships that are established by different characteristics, we first employed a minimal group paradigm. Here, we had our 21 healthy, right-handed subjects (8 males, mean age 27.7 years, SD 7.4 years) of German descent complete a mock test. Based on their test results, we identified them as belonging to one out of two (fake) problem solving types (minimal ingroup/outgroup). During the acquisition of functional MRI data, subjects were then presented with

short videos of neutral or angry facial actions (emotion observation task). A colored frame around each video indicated if the actor belonged to the subject's minimal in- or outgroup. By having people of either German or Turkish descent display the emotions, we established a second group factor (ethnic ingroup/outgroup). In addition to observing videos, subjects also had to display angry or neutral expressions themselves (emotion execution task).
Results demonstrate that the perception and processing of emotional facial actions is modulated by the identity of our interaction partner, leading to differential activations when being confronted with members of in- or outgroups. Furthermore, groups established through different characteristics – e.g. ethnicity or artificial categorization – are processed similarly. Lastly, preliminary results indicate that social factors might influence potential motor simulation processes, supporting the hypothesis that mirror neuron mechanisms are involved in empathy and social cognition.

THURS AFTERNOON

Perception and processing of familiar sizes in infancy

Özlem Sensoy[1]; Jody C. Culham[2], Gudrun Schwarzer[1]
[1]Developmental Psychology, Justus-Liebig-University Giessen, Germany
[2]Department of Psychology and Brain and Mind Institute, University of Western Ontario, London, Canada

Much research in developmental psychology centers on the question of when and how infants acquire knowledge about the real world. However, Infants' real-world knowledge is often assessed by using models and replicas of real objects that do not correspond to the true size of the objects in the real world. So far, there have been almost no studies that have investigated explicitly when infants start to have a notion of the familiar size of an object and how this knowledge affects infants' actions.

In our project, we are presenting 7- and 12-month-old infants with familiar objects (such as pacifiers and sippy bottles) simultaneously in their familiar size and in unusual sizes (50% bigger or smaller) in out-of-reach and within-reach conditions. We are using a combination of preferential looking and reaching to investigate whether infants show visual and/or manual preferences for the familiar-sized object. We will also investigate whether infants show typical behavior as sucking or drinking more often towards the familiar sized object rather than towards the unusually-sized objects. Preliminary results show that 7 month-olds look and reach for the bigger objects more often in both conditions. The 12 month-olds however look more often towards the familiar sized objects in the within reach condition, while still reaching for the unusually-sized objects more often in both conditions. Whereas the 7 month-olds seem to prefer the bigger objects in general, the 12 month-olds show a visual preference for the familiar size, when the objects are within reach. Nevertheless, the 12 month-old infants seem to be more interested in manually exploring the unusually-sized objects.

Dexterity analysis of surgeons and related parameters

Siavash Eftekharifar, Nikolaus F. Troje
Queens's University, Centre for neuroscience studies, Biomotion lab

Surgery is a task that requires significant fine motor control (dexterity). Historically, performance assessment of medical students has been limited to subjective grading scales provided by the experts observing the novice's performance. This method of assessment is inefficient because of the need for the experts to be present during the task. Furthermore, this approach does not provide a quantitative and objective assessment of the dexterity. Thus, the need for providing quantitative methods and metric parameters has attracted a lot of attention. Different metrics and parameters have been studied to objectively assess surgeons' dexterity; such as maximum smoothness (minimum jerk), kinematic information of the upper limbs and other measurements derived from motion capture systems and signal processing techniques. One of the promising candidates is kinematic jerk. Although the jerk of surgical tools has been used as a measure of dexterity, this parameter has not been assessed for arm and hand movements while performing a surgical task. It is reasonable to consider the smoothness of arm and hand movements since the motion of the tool is the result of the movement of the body upper limbs. Thus, investigating the movement of the upper limbs and the surgical tool provide valuable information about surgical dexterity. Using the motion capture systems in our lab, I plan to capture the movement of the upper limb and the surgical tool simultaneously. Once this data is obtained, several parameters including principle components, frequency domain features and upper limb kinematic information, can be investigated. Exploiting signal processing techniques, it is my aim to identify the best parameters or a combination of them to assess performance. Furthermore, it has been shown that training novice surgeons in virtual reality (VR) offers several advantages and prepares them for real situations in operation room. Inspired by this fact, designing experiments

in VR and assessing dexterity in those environments is another significant component of my research.

Probing the metrics of representational geometry of face representation

Friederike Seyfried[1], Mathias Hegele[1], Niko Troje[2]
[1]*Neuromotor Behavior Lab, Section Experimental Sensomotorics, Department of Psychology and Sport Science, Justus Liebig University Gießen, Deutschland*
[2] *Biomotion Lab, Department of Psychology, Queen's University, Kingston, ON, Canada*

The representational geometry of perceptual objects in our visual environment can be explained by the distance of those objects in a conceptual space (see Gärdenfors, 2004). Here, we seek to probe the underlying metric of such a conceptual space for the presentation of faces in the human mind. Face perception is one of the most specialized perceptual tasks humans carry out in their daily lives. A lot of models of face perception are using pixel-based models in order to explain the representational geometry of face perception. However, representational geometry of faces has not been tested for correspondence based models that combined shape and texture. We collected similarity judgments of 20 human observers using a multi-arrangement method developed by Kriegeskorte and Mur (2012). We obtain similarity judgments for a large stimulus set containing 50 male, 50 female and 50 mixed faces from 20 participants in three separate sessions. We analyzed the data using representational similarity analysis (RSA) and compared the data to several models that represent different aspects of the face stimuli, such as shape, texture, orientation, illumination and pixels, as well as models that used a combination of shape and texture (correspondence-based models). For the mixed face stimuli, our results support the hypothesis that correspondence-based models best explain the representational geometry of faces in human face-similarity judgments. For the “pure” female and male faces, the results so far indicate that pixel-based models best explain human similarity judgments.

FRIDAY MORNING

Response Bias in Judging Disguised Movements

Fabian Helm[1], Nikolaus F. Troje[2], & Jörn Munzert[1]
[1] *Department of Psychology and Sport Sciences, Justus-Liebig-University Giessen, Germany*
[2] *Department of Psychology, Queen's University, Kingston, Canada*

As a topic that touches on many aspects of (anti-)social interaction, research on deception has attracted much attention during the last decades. A broad body of literature has focused on the investigation of movement deception based on postural cues (cf. Brault et al., 2010; Cañal-Bruland et al., 2010; Runeson & Frykholm, 1983). However, the current scientific debate is lacking a nuanced body of perceptual findings regarding the different strategies of manipulating an observer’s perceptual process. For example, it might be possible to deceive another by either (a) intentionally mislead an observer by providing (exaggerated) deceptive information or (b) keeping an observer in suspense about one’s own action intention by means of disguise. Although, both strategies aim to deceive another, recent kinematic findings indicate significant differences between the movement patterns of those strategies (cf. Brault et al., 2010; Helm et al., 2017). Consequently, it is expected that the different attempts would also provoke different perceptual effects. However, thus far, the effects of movement disguise have not been fully investigated.
Against this background, the current project aimed to investigate the perceptual effects of movement disguise in the context of a sports-related throwing task. We motion captured disguised and non-disguised throwing movements of novice and elite handball field players and used these to generate realistic 3D avatars. In a perceptual task, we asked novice and expert handball players to judge as quickly and accurately as possible whether observed throws were either disguised or non-disguised. The results show that both groups were highly sensitive to disguise, but were also biased to judge throws of the expert performers more frequently as non-disguised (genuine). This contrasts with previous perceptual findings on movement deception showing a response bias towards deception. It is suggested that the different kinematic characteristics of the observed throws (exaggeration vs. minimization) influence the participant’s response behavior. Elite performers produced disguised throws that were highly similar to genuine ones resulting in a response bias to judge throws more often as non-disguised.
References:
Brault S, Bideau B, Craig C, Kulpa R (2010) Balancing deceit and disguise: how to successfully fool the defender in a 1 vs. 1

situation in rugby. Hum Mov Sci, 29: 412–425.
Cañal-Bruland R, van der Kamp J, van Kesteren J (2010) An examination of motor and perceptual contributions to the recognition of deception from others' actions. Hum Mov Sci 29: 94–102.
Helm F, Munzert J, Troje NF (2017) Kinematic patterns underlying disguised movements: Spatial and temporal dissimilarity compared to genuine movement patterns. Hum Mov Sci 54: 308–319.
Runeson S, Frykholm, G (1983) Kinematic specification of dynamics as an informational basis for person–and–action perception: expectation, gender recognition, and deceptive intention. J Exp Psychol 112: 585–615.

Perception of Human Animations With Inconsistent Body Shape and Motion

Kenny, S. & Troje, N. F.
Queen's University

Animation retargeting is a method of producing human-like animations for use in research, video games, and movies. The procedure consists of capturing the motion of a performer and applying it to a computerized avatar. In practice, the body shape of the avatar can be very different from the body shape of the original performer. Such animations are called inconsistent, because they are generated from mismatching shape and motion components. However, the human actions seen in day-to-day life are typically composed of correlated and consistent information. As a result of this exposure it is believed that the visual system builds up expectations regarding the way a person should look and move. Here we asked whether the human visual system has a special sensitivity to shape-motion inconsistency that would modify the perception of realistic human animations. We recorded 10 male performers with either light or heavy body weight carrying out three actions: pushing, lifting, and throwing. We extracted the shape and motion estimates for each performer. Using these estimates we created consistent and inconsistent animations whose shape and motion components were either from the same performer or combined from performers in different body weight groups. We conducted three experiments in an immersive virtual reality environment, assessing discrimination between inconsistent and consistent animations, subjective perception of animations, and perception of action outcomes. We found an influence of shape-motion inconsistency only on the perception of action outcomes, and concluded that the visual system relies on its knowledge of shape and motion to perceive realistic human animations. Importantly, object manipulations may present an opportunity for the visual system to reinterpret inconsistency as a change in the dynamics of an object, rather than as an unexpected combination of body shape and body motion.

Do reach speed and reach consequences modulate tactile suppression?

Lindsey E. Fraser[1], Laurence R. Harris[1] & Katja Fiehler[2]
[1]*York University, Toronto, Canada*
[2]*Justus-Liebig Universität Giessen*

During movement our sense of touch is diminished. This effect, known as "tactile suppression," is believed to be a mechanism for discounting predicted sensory consequences of movement in favour of other, more relevant stimuli [1]. Movements can differ in speed, anticipated movement outcomes, saliency of movement outcomes and/or movement goals, and it is not clear how these factors modulate tactile suppression. We conducted a series of experiments in which we varied each of these characteristics of a reach movement individually, and measured tactile suppression of a 250Hz vibration on the back of the finger (detection threshold during reach – threshold at rest). In Experiment 1, we varied the velocity profile of a reach-to-target movement by taking advantage of Fitt's law, which states that the time to contact with a target is a function of both distance and target size. In Experiments 2 and 3, we added a tactile consequence (vibration) following contact with a target of a specific colour, with or without explicit instruction of the colour-consequence rule. In Experiment 4 we varied the saliency of the tactile consequence by making it either redundant or non-redundant feedback. Experiment 5 will repeat this manipulation but change the reach goal to pointing-in-space (i.e., no contact with target). Preliminary results suggest that the nature of the expected reach outcome may be the critical factor in modulation of tactile suppression.

[1] Williams & Chapman. *J Neurophysiol*. 2002, *88*(4), 1968.

The effect of gaze behavior and prior knowledge on the use of allocentric information in memory-guided reaching

29

movements

Zijian Lu, Mathias Klinghammer, Katja Fiehler
Experimental Psychology, Justus-Liebig University Giessen, Giessen, Germany

In this study we investigated the influence of gaze behavior and prior knowledge on the use of allocentric information for memory-guided reaching. Participants viewed a breakfast scene with five objects in the background and six objects on the table. Table objects served as potential reach targets. Participants first encoded the scene and after a short delay a test scene was presented with one table object missing and one, three or five table objects horizontally shifted in the same direction. Participants performed a memory-guided reaching movement toward the position of the missing object on a blank screen. In order to examine the influence of gaze behavior, participants either freely moved their gaze (*free-view*) or kept gaze at a fixation point (*fixation*). The effect of prior knowledge was investigated by informing participants about the reach target either before (*preview*) or after (*surprise*) scene encoding. Our results demonstrate that humans use allocentric information for reaching even if a stable retinal reference is available. However, allocentric coding of reach targets is stronger when gaze is free and prior knowledge about the reach target is missing. In sum, our findings contribute to the current debate questioning the role of allocentric reference frames in perception and action.

FRIDAY LATE MORNING

Visual saliency response in the superficial and intermediate superior colliculus.

Janis Y Kan[1], Brian J White[1], Laurent Itti[2], Douglas P Munoz[1]

[1]*Centre for Neuroscience Studies, Queen's University, Kingston, Canada*
[2]*Computer Science Department, University of Southern California, Los Angeles, USA*

Cognitive neuroscience postulates the existence of a visual saliency map, and a priority map that combines bottom-up saliency and top-down relevance to guide orienting behavior. We hypothesize that the superior colliculus (SC) embodies the role of a saliency map and a priority map compartmentalized in the superficial (SCs) and intermediate (SCi) layers, respectively. We compared monkey SCs and SCi firing rate and local field potential (LFP) in response to task-irrelevant but visually salient stimuli presented as a wide-field "pop-out" array. We randomly interleaved 0 to 4 pop-out items to examine how competition between items would affect saliency representation. We predicted that increasing the number of salient pop-out items from 1 to 4 would result in a systematic decrease in the saliency-evoked response at each pop-out location, because of increased competition. We found that 96% (21/22) of SCs neurons showed a reliable preference for the visually salient stimuli, but responded similarly in the presence of 1 to 4 pop-out items. A smaller percentage (75%; 24/32) of SCi neurons showed a preference for the salient but irrelevant stimuli, but their response was modulated by the number of pop-out items presented, possibly due to reflexive attentional mechanism. LFP responses of both layers displayed a biphasic response to presentation of an array stimulus that evolved to represent the pop-out item, with this difference emerging earlier in the SCs than in the SCi. This is consistent with a model of saliency in which saliency information is processed first in the SCs and refined in the SCi.

Execution of saccadic eye movements affects speed perception

Alexander Goettker[1], Doris I. Braun[1], Alexander C. Schütz[1,2], & Karl R. Gegenfurtner[1]
[1]*Justus-Liebig-University Gießen, Germany;* [2]*Philipps-Universität Marburg, Germany*

Due to the foveal organization of our visual system we constantly have to move our eyes to gain precise information about our environment. Doing so massively alters the retinal input. This is especially problematic for the perception of moving objects, because physical motion and retinal motion become decoupled and the brain has to compensate for this effect. We investigated whether different oculomotor responses to targets moving at the same physical speed lead to changes in the perceived speed of the movement. Two different eye movements, pursuit and saccades, are combined to track a moving target. While the pursuit system is tightly linked to the target speed and corrects for velocity errors within a limited range, saccades mainly correct for position errors.

Interestingly, we found that the execution of corrective saccades can affect the perceived speed of the tracked target. When participants executed forward (catch-up) saccades during tracking initiation, they perceived targets to move faster

compared to pure pursuit. Trials with backward saccades were perceived to move slower than trials with pure pursuit. Variations in eye speed during pursuit eye movements, caused by natural variability and also the position of the target relative to gaze, could be compensated and did not affect the perceived speed. The effect of corrective saccades on perceived speed could be mediated by an integration of the saccadic signal into the extraretinal signal used to account for retinal motion introduced by eye movements. This integration could serve a functional role as sensorimotor evidence for an update of an internal representation of target speed: Size and direction of the corrective saccades indicate an error signal for the pursuit system, which can be used to adjust the pursuit speed afterwards.

Temporal Movement Primitive Perception under Naturalistic Conditions

Benjamin Knopp, Moritz Schubert, Dominik Endres
University of Marburg

Movement primitives (MPs) have been proposed as compact representation for human movement. While MPs were originally proposed to facilitate control, they could as well be useful for perceiving movements. Therefore, we investigate the influence of perceptual motion segmentation on Movement Primitive extraction. To this end, we recorded an actor performing natural tasks in a fairly unconstrained manner. The actions consist of walking through an indoor environment, stair climbing, making/drinking coffee. The data were used for a psychophysical movement segment perception experiment, and for learning MP models. We showed 70 video-clips containing a random selection of the recorded movement to 12 participants. They were instructed to segment these clips into non-overlapping time intervals according to perceived boundaries. To determine whether the perceptual segments can be described compactly by temporal MP models, we decomposed the time series of joint angles into MPs and weights. We estimate the model complexity with the Bayesian Information Criterion (BIC). This decomposition/model selection procedure yields a compact MP representation: we estimated that 6 to 15 MPs are optimal for a given participant. We then performed k-means clustering on the weights to search for additional structure. The found cluster centers can now be transformed back to movements, and provide prototypes of the segments for each participant. We then repeated the MP complexity analysis within each cluster. The globally best number of MPs is less than the minimal number of MPs in each cluster multiplied with the number of clusters. This indicates that task-independent MPs combined with task-dependent weights is a good representation of human movement.

Switching behaviour and the frontal eye field

Brandon Caie, Jerry Jeyachandra, Aarlenne Khan and Gunnar Blohm
Center for Neuroscience Studies, Queens's University

It is well established that perceptual decisions are subject to biasing influences from the history of events that precede them. Previous trial effects in perceptual and decision-making tasks have been reported in opposing flavours, namely an repulsive bias from congruent stimuli (adaptation) or a tendency towards repetition (hysteresis). Recently, adaptation and hysteresis have been implicated in dissociable components of perceptual decision making, with the former representing shifts in perceptual availability, and the latter a post-perceptual phenomenon related to working memory content. Neuroimaging studies attempting to dissociate hysteresis and adaptation find a broadly distributed frontal network activated during choice repetition, while adaptation was found to be confined to lower-level perceptual cortices. The great cognitive flexibility that yields complex behaviour necessitates a malleable distinction between repetition and alternation, one that is likely shaped by the control policy specific to a given task. Striking a balance between negatively adaptive and hysteretic perceptual consequences may be essential for optimizing the trade-off between change detection and perceptual stability. Herein, we investigate the dynamics of competing motor goals on switching behaviour in a free choice saccade task, and report evidence for modulation of choice via HD-tDCS of human FEF that is contingent on previous choice identity. The absence of a direct relationship between choice modulation and reaction time is consistent with the putative role of FEF as a convergence site for RT-expensive perceptual information selecting motor goals separable from motor planning. We show a specificity for FEF stimulation in manipulating repeated choices, supporting the notion that hysteresis is broadly distributed in areas of the brain implicated in decision-making and working memory, and is separable from upstream adaptation that manifest in bias-to-switch behaviours. Further, stark differences in individual profiles of switching behaviour in free choice selection may suggest a novel avenue for exploring the interface between perceptual and decisional bias in populations healthy and aberrant.