2019 CREATE-IRTG Retreat, June 17-21, 2019 & VISTA-BrainsCAN VR Forum (June 17)

Oakwood Resort, Grand Bend, Ontario

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OAKWOOD RESORT

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70674 Bluewater Highway,
Grand Bend, Ontario N0M 1T0

The 2019 IRTG Retreat will take place at the Oakwood Resort in beautiful Grand Bend, Ontario. The resort is nestled within a natural setting featuring large mature trees and plenty of green space all just steps away from the beautiful white sand beaches of Lake Huron.

Oakwood Resort is a family owned and operated. Dave & Valorie Scatcherd can trace their family roots in Grand Bend all the way back to the early 1900s when the Scatcherd family cottage was built. Originally a vacation spot, it is a cottage that has remained in the family to this day and is now their year-round home, so when the opportunity to purchase the Oakwood Resort presented itself, Dave Scatcherd knew it was the perfect fit.

The Resort was purchased in 1981 and since that time Dave has strived to make Oakwood a premiere destination for both leisure and business travelers. Together with his wife and their three kids who all work at the Resort, the Scatcherd Family has taken the Oakwood Resort from a modest sixteen room inn to the full family resort it is today.

With a wide range of things to do on site including private beach access, indoor pool, indoor and outdoor hot tubs, sauna, fitness centre, tennis courts, games room, an eighteen-hole golf course*, relaxing spa*, dining room and pub*, , driving range*, children's play area, and ten thousand square feet of banquet and conference space, it will be a perfect setting for the CREATE-IRTG Retreat and VISTA-BrainsCAN VR Forum 2019. (* Additional charge for some activities above). The resort has free wifi.

OAKWOOD
RESORT
SINCE 1922
GRAND BEND, ON

BEACH ACCESS – KEY CARD REQUIRED

Located at the black gate on the road to the beach.
Insert key card to unlock gate.

WASHROOMS

Lower Pine
Main – family washroom behind Front Desk
Lower Main – stairs at Front Desk Registration
Lower Main – outside Huron Room
Lower Main – stairs at Entrance to Oak Dining Room
Dave's Pub & Grill
Loft – above Dave's Pub & Grill
Lower Dave's Pub & Grill – Games Room
Pool – Pine Lodge, Lower Change Rooms

CHANGE ROOMS

Lower Pine
Lower Main
Lower Dave's Pub & Grill – Games Room

ATM MACHINE

Front Desk Registration/Lobby

ICE MACHINES

Lower Pine Lodge
Lower Oak Lodge
Front Desk

POP MACHINES

Lower Pine Lodge
Lower Oak Lodge
Lower Main Building

VENDING MACHINES

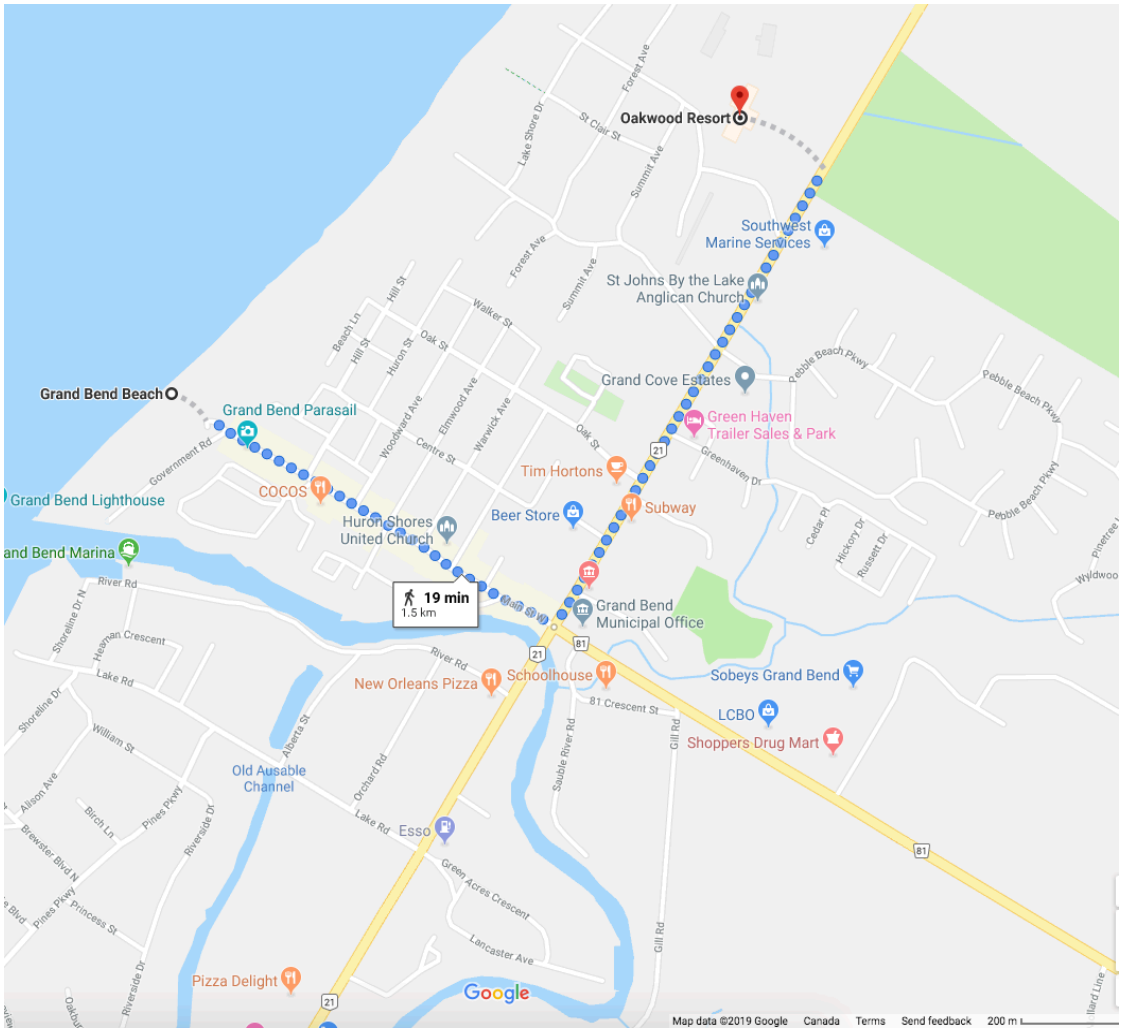
Front Desk Registration/Lobby

GRAND BEND

Located on the shores of Lake Huron in Southwestern Ontario, Canada, Grand Bend has carved a niche for itself as **one of the best beach towns of Canada**! Boasting one of the best sunsets in the world, Grand Bend's Main Beach is among a few beaches in Canada to have earned official Blue Flag status for its commitment to strict safety and water quality criteria. The 40-kilometer (25-mile) wide sandy beach lures people for swimming and enjoying the nightlife at the beach. Grand Bend offers excellent shopping, art galleries, golfing, skydiving, parasailing, water craft rentals, fantastic food, live music and more.
https://www.grandbendtourism.com/

Oakwood to Grand Bend Route

It's a 19-minute walk or 3-minute car ride from Oakwood to Main Street in Grand Bend.



If you have break time to spare and access to a vehicle, Bayfield, 30 km (20 min) north of Grand Bend is a lovely village with nice stores (more upscale than Grand Bend).
https://www.villageofbayfield.com/

OUTING TO THE PINERY PROVINCIAL PARK

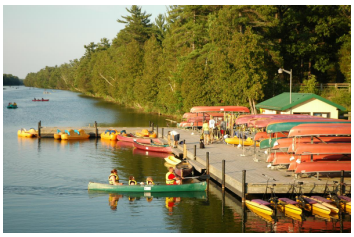
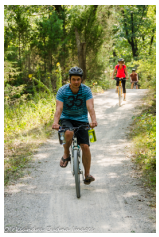
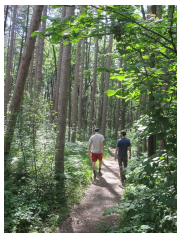
Wednesday June 19 or Thursday June 20 (based on weather forecast)

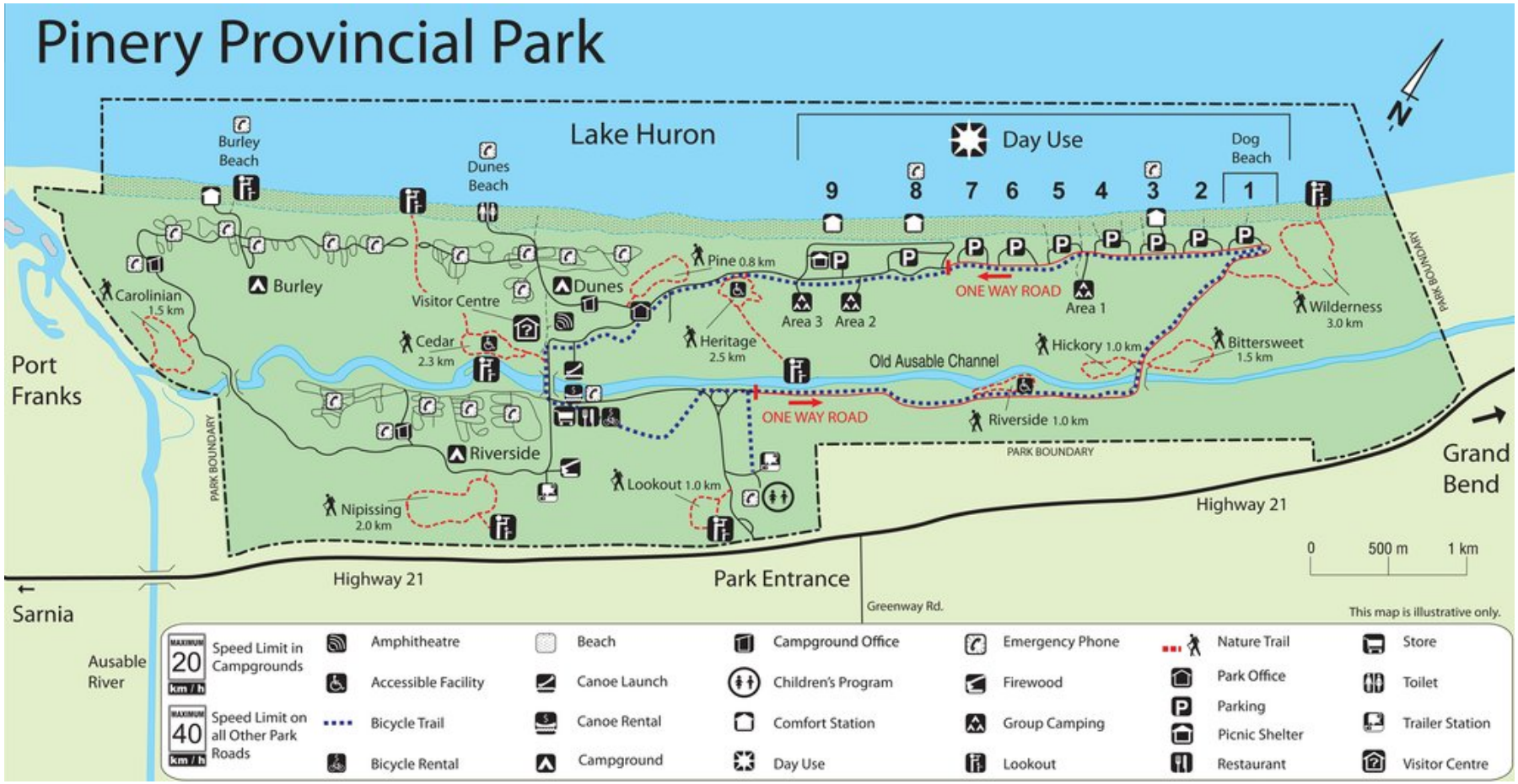
This year's outing will be to the Pinery, an Ontario Provincial Park that is a 10-minute drive from Oakwood. The park is huge with 10 kilometers (6 miles) of sandy beach on the shores of Lake Huron near Grand Bend beach. The park has a unique ecosystem with the largest oak savannah in Ontario, Carolinian forest, and coastal sand dunes. The park features over 300 bird species, 60 butterfly species and over 700 plant species. The beach is quite rocky but the water is beautiful and very clean. In late June, it may or may not be warm enough to swim (or may be warm enough for Canadians only!). The sunset on Lake Huron is ranked among the 'Top 10 Best in the World' by National Geographic.

Research Western will cover the costs of park entry plus canoe, paddleboat, and bicycle rentals. Canoes and paddleboats can be taken down the Old Ausable Channel, a calm, slow-moving body of water. We'll also bring some games for the beach (frisbee etc.) and there are many nice hiking trails. There's a visitor centre open from 1-4 pm. We'll arrange carpooling with groups interested in similar activities. You may wish to bring a swimsuit and flip flops or water shoes. We'll supply drinking water, sunscreen and insect repellent. Further details will be provided at the Retreat. You can download an app called "Explore Pinery" and you can find further information at the websites below:
https://www.ontarioparks.com/park/pinery
http://pinerypark.on.ca/

See map on next page.

Western
UNIVERSITY · CANADA


Pinery Provincial Park
Lake Huron
Day Use
Dog Beach
9 8 7 6 5 4 3 2 1
Burley Beach
Dunes Beach
Burley
Dunes
Visitor Centre
Carolinian 1.5 km
Cedar 2.3 km
Pine 0.8 km
Heritage 2.5 km
Area 3
Area 2
Area 1
ONE WAY ROAD
Wilderness 3.0 km
Hickory 1.0 km
Bittersweet 1.5 km
Old Ausable Channel
ONE WAY ROAD
Riverside 1.0 km
Riverside
Lookout 1.0 km
Nipissing 2.0 km
PARK BOUNDARY
PARK BOUNDARY
PARK BOUNDARY
Port Franks
Grand Bend
Highway 21
Highway 21
Park Entrance
Greenway Rd.
Sarnia
Ausable River
0 500 m 1 km
This map is illustrative only.
Speed Limit in Campgrounds
Speed Limit on all Other Park Roads
Amphitheatre
Accessible Facility
Bicycle Trail
Bicycle Rental
Beach
Canoe Launch
Canoe Rental
Campground
Campground Office
Children's Program
Comfort Station
Day Use
Emergency Phone
Firewood
Group Camping
Lookout
Nature Trail
Park Office
Parking
Picnic Shelter
Restaurant
Store
Toilet
Trailer Station
Visitor Centre

BUS TRANSPORTATION

Transportation: Arrival

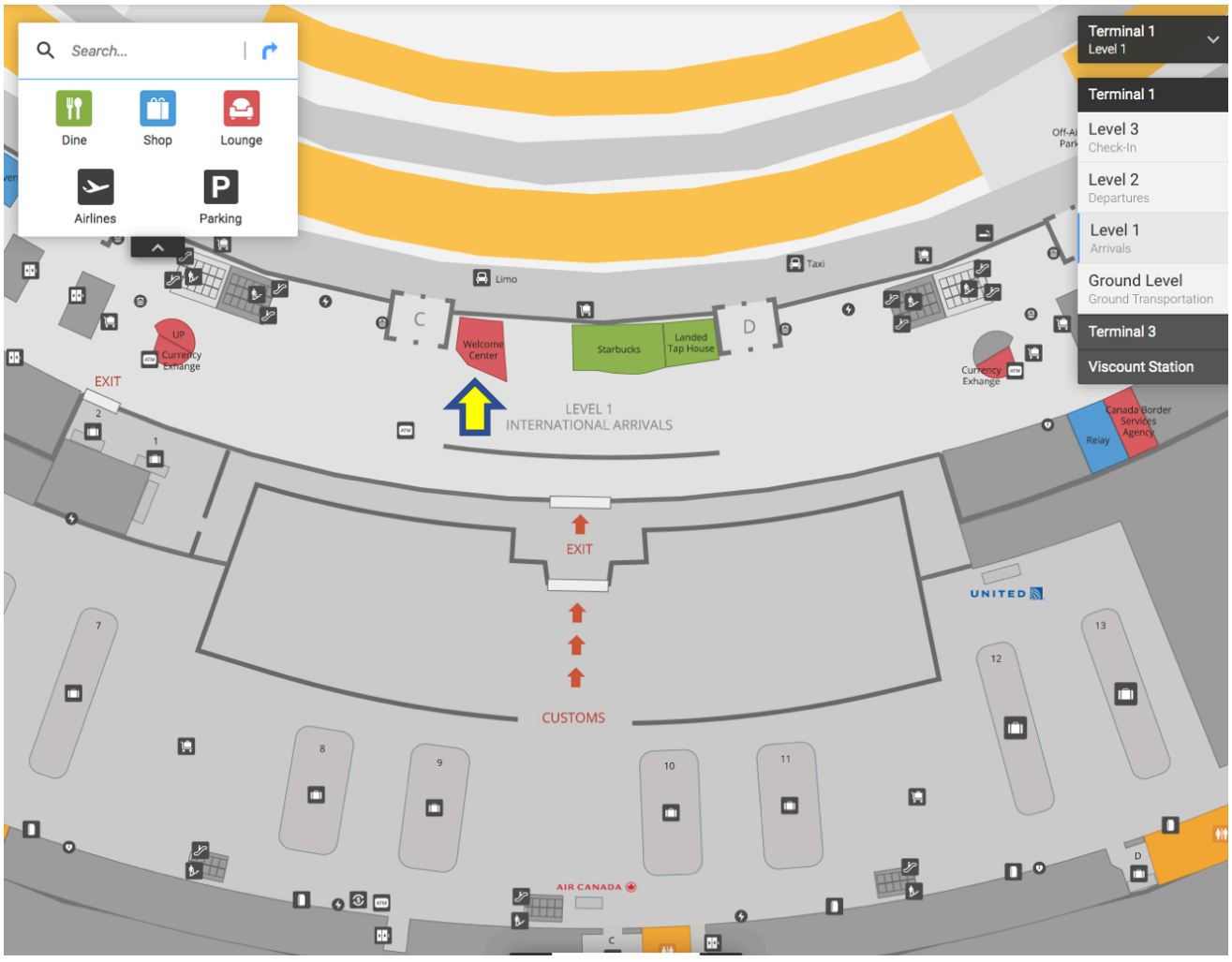
Shuttle buses (through provider bus.com) have been arranged for passengers arriving at Pearson International Airport in Toronto on both Sunday, June 16 and Monday, June 17. The shuttles will make a secondary stop to pick up passengers at York University on both days.

Sunday, June 16 Shuttle:

~ 1:30 pm (time may vary depending on arrival times of AC873/LH6676. Shuttle driver will monitor flight arrival)

Please proceed to the Welcome Centre on Level 1 of International Arrivals near Door C (See yellow arrow below), after you have picked up your luggage and exited the Customs area. Once the entire group has congregated near the Welcome Center, a staff member will be able to direct you to the bus pick-up location on the lower level.

For any issues or concerns regarding the shuttle, please contact:
Bus.com Emergency Line at 1-855-428-7266 #1



~ 1:55 pm (time may vary depending on Pearson Airport pick-up)
The shuttle will make a stop at York University at 4700 Keele St. Pick up location will be at the Vari Hall bus loop.

~ 4:45 pm – Arrive at Oakwood Resort
Expected travel time from York University to Oakwood Resort is 2.5 hours.

Monday, June 17 Shuttle:
~ 1:30 pm (time may vary depending on arrival times of AC873/LH6676. Shuttle driver will monitor flight arrival)
See information and map on Page 6 for meeting place and shuttle emergency line.

~ 2:10 pm (time may vary depending on Pearson Airport pick-up)
The shuttle will make a stop at York University at 4700 Keele St. Pick up location will be at the Vari Hall bus loop.

~ 5:00 pm – Arrive at Oakwood Resort
Expected travel time from York University to Oakwood Resort is 2 hours, 40 minutes.

Transportation: Departure

A shuttle has been arranged for passengers flying out of Pearson International Airport on AC876/LH6779 on June 21 at 9:35 pm. The bus will make a secondary stop at York University. There will be plenty of seats for all passengers.

Friday, June 21 Shuttle Estimated Times:
3:00 pm – Depart Oakwood Resort

6:00 pm – Arrive at Pearson International Airport

6:55 pm – Arrive at York University, 4700 Keele St

INFORMATION FOR PRESENTERS

All trainees at the CREATE-IRTG workshop (including affiliates) have been scheduled to give a talk. We have allocated 20 minutes each, of which a maximum of 15 minutes should be for the talk itself, with 5 minutes for questions. Question periods are an important component so trainees should strive to keep their talks within the 15-minute limit.

We have assigned trainees to 9 talk sessions, each a mix of topics and universities. Taking jetlag into account, there are more German talks later in the week.

Because the trip to the Pinery is an outdoor event that depends on the weather, we have scheduled the timing to be flexible between Wednesday June 19 (default) and Thursday June 20 (backup date). As such, the trainees assigned to speak Thursday afternoon will instead be asked to speak Wednesday afternoon if the social event gets moved to Thursday.

A projector, screen, remote control, laser pointer and laptop will be provided. Speakers are encouraged to use the laptop where possible to avoid wasted time switching computers between presentations. The default aspect ratio of the projector is the old standard (4:3), not widescreen (16:9).

Sunday, June 16

5:00 pm	Estimated arrival time for bus from Pearson airport and York University
6:00 pm	Pizza dinner for trainees and others in gazebo of Oak Lodge, Oakwood Resort
7:00 pm	Dinner for speakers and Lake Ontario Virtual Reality members who are available (Culham, Harris, Troje, Wilcox, and maybe MacKenzie). F.I.N.E. A Restaurant, 42 Ontario St., Grand Bend.

Monday, June 17: VISTA-BrainsCAN Forum: "How Virtual Reality technologies can benefit cognitive neuroscience and vice versa"

Co-organizers: Jody Culham, Niko Troje & Laurie Wilcox

Monday, June 17

7:00 - 9:00 am	Breakfast
9:00 am	Niko Troje "The state of VR"
9:45 am	Michael Barnett-Cowan (University of Waterloo) "What can VR do for researchers?: Basic Research"
10:30 am	VISTA-sponsored Coffee Break
11:00 am	Jennifer Campos (Toronto Rehabilitation Institute): "What can VR do for researchers?: Clinical Research"
11:45 am	Dan Tinkham (Head of Sales, WorldViz) "VR in the Enterprise - Current Business Use Cases of VR and Future Trends"
12:00 pm	Lunch
1:00 pm	Kevin MacKenzie (Research Scientist Lead, Facebook Reality Lab) "Vision Science Challenges for VR/AR"
1:45 pm	Laurie Wilcox and Rob Allison (York University) "What can researchers do for VR Development and Applications?"
2:30 pm	BrainsCAN-sponsored Coffee Break
3:00 pm	Introduction to Daniel Kharlas (General manager and co-founder, VRcadia, London ON) and Ben Switzer (Founder, True Focus and Motiv8 Studios, London ON)
3:30 pm-4:30 pm	Discussion panel and question period (Industry partners, speakers and audience) "What next: How can VR researchers and developers work together to address current challenges and opportunities?" (Moderator: Jody Culham)
6:00 pm	Dinner (with separate Discussion table for speakers, industrial partners, and programmers: Culham, Harris, Troje, Allison, Campos, Wilcox, Barnett-Cowan, Martinez-Trujillo, Mackenzie, Tinkham, Switzer, Kharlas, Watson, Bebko)

Tuesday, June 18

7:00 – 9:00 am	Breakfast
9:00 am	Professional Development: "How to talk to non-academics (media and industry)" Michael Barnett-Cowan, Associate Professor, University of Waterloo Kevin MacKenzie, Research Science Lead, Facebook Reality Labs Jeff Renaud, Senior Media Relations Officer, Western University David Twedell, Director, Research Development, Western University
10:00 am	Coffee Break
10:30 am	Talk Session 1 (4 presentations @ 20 min; 1.5 h)
12:30 pm	Lunch
2:00 pm	Advisory Meetings
3:30 pm	Talk Session 2 (4 presentations @ 20 min; 1.5 h)
5:00 pm-5:30 pm	Lina Klein – Tutorial on Adobe Connect
6:00 pm	Dinner
7:30 pm	Keynote Lecture: Gudrun Schwarzer "The relationship between infants' visual-spatial processing of objects and their motor development"

Wednesday, June 19

7:00 – 9:00 am	Breakfast
9:00 am	Talk Session 3 (4 presentations @ 20 min; 1.5 h)
10:30 am	Coffee Break
11:00 am	Talk Session 4 (4 presentations @ 20 min; 1.5 h)
12:30 pm	Lunch
2:00 pm	FLEX Advisory meetings OR afternoon at Pinery Provincial Park

3:30 pm	FLEX Talk Session 5 (4 presentations @ 20 min; 1.5 h) OR afternoon at the Pinery
6:00 pm	Dinner
7:30 pm-8:30 pm	Meeting of Joint Directorate (Birch South Meeting Room)

Thursday, June 20

7:00 – 9:00 am	Breakfast
9:00 am	Talk Session 6 (4 presentations @ 20 min; 1.5 h)
10:30 am	Coffee Break
11:00 am	Talk Session 7 (4 presentations @ 20 min; 1.5 h)
12:30 pm	Lunch
2:00 pm	FLEX Advisory meetings OR afternoon at Pinery Provincial Park
3:30 pm	FLEX Talk Session 5 (4 presentations @ 20 min; 1.5 h) OR afternoon at the Pinery
6:00 pm	Dinner – Outdoor Barbecue – Weather Permitting

Friday, June 21

7:00 – 9:00 am	Breakfast
9:00 am	Talk Session 8 (4 presentations @ 20 min; 1.5 h)
10:30 am	Coffee Break
11:00 am	Talk Session 9 (2 presentations @ 20 min)
11:45 am	Keynote Lecture: Anna Schubö “Motor coordination in joint action”
1:00 pm	Lunch
3:00 pm	Shuttle Bus departs Oakwood for Toronto Pearson Int’l Airport and York University

Tuesday, June 18		
9:00 am		**Professional Development Workshop** **"How to talk to non-academics (media and industry)"** Michael Barnett-Cowan, Associate Professor, University of Waterloo Kevin MacKenzie, Research Science Lead, Facebook Reality Labs Jeff Renaud, Senior Media Relations Officer, Western University David Twedell, Director, Research Development, Western University
10:00 am		**Coffee Break**
10:30 am	Jonathan Coutinho	**Re-evaluation of luminance evoked pupil response dynamics** Jonathan D Coutinho, Jeff Huang, Philippe Lefèvre, Gunnar Blohm, Douglas P Munoz *Center for Neuroscience Studies (CNS), Queen's University, Kingston, Canada.*
10:50 am	Benjamin Knopp	**Estimating pose from images using a deep shared latent variable model** Benjamin Knopp, Matt Laporte, Gunnar Blohm & Dominik Endres *Philipps-University Marburg, Marburg, Germany*
11:20 am	Zijian "Fabio" Lu	**SWITCH WITH SOMEBODY THURS MORNING** **Allocentric information influences real-time reaching movements** Zijian Lu, Katja Fiehler *Justus-Liebig University Giessen, Giessen, Germany*
11:50 am	Maria Mosebach	**How does previous trial information modulate predictive tactile suppression?** Marie C. Mosebach, Dimitris Voudouris, Katja Fiehler *Justus-Liebig University Giessen, Giessen, Germany*
12:30 pm		**Lunch**
2:00 pm		**Advisory Committee Meetings**
3:30 pm	Johannes Kurz	**Gaze behavior in natural environments with different task demands** Johannes Kurz and Jörn Munzert *Justus-Liebig University Giessen, Giessen, Germany*
3:50 pm	John Jong-Jin Kim	**Keeping track of an object during self-motion** John J.-J. Kim and Laurence R. Harris *York University, Toronto, Canada*

4:10 pm	Hossein Abbasi	**Individual selection history biases visual attention depending on the task preparation** Hossein Abbasi, Hanna Kadel, Anna Schubö *Philipps-University Marburg, Marburg, Germany*
4:30 pm	Raphael Gastrock	**It wasn't me: External source attribution dampens shifts in predicted sensory consequences but not proprioception** Raphael Q. Gastrock, Shanaathanan Modchalingam, Chad Vachon, Bernard Marius 't Hart, Denise Y. P. Henriques *York University, Toronto, Canada*
5:00 pm-5:30 pm	Lina Klein	Tutorial on Adobe Connect
6:00 pm		**Dinner**
7:30 pm	Gudrun Schwarzer	**Keynote Lecture: The relationship between infants' visual-spatial processing of objects and their motor development**

Wednesday, June 19		
9:00 am	Alexander Goettker	**The effect of corrective saccades on subsequent oculomotor behavior** Alexander Goettker & Karl R. Gegenfurtner *Justus-Liebig University Giessen, Giessen, Germany*
9:20 am	Janis Kan	**Laminar organization of reward signal in the superior colliculus priority map** Janis Y Kan, Brian J White, Laurent Itti, Douglas P Munoz *Centre for Neuroscience Studies, Queen's University, Kingston, Canada*
9:40 am	Mareike Pazen	**Neural correlates of preparing hand movements during object use** Mareike Pazen, Benjamin Straube, Tilo Kircher, and Jody C. Culham *Philipps-University Marburg, Marburg, Germany*
10:00 am	Lindsey Fraser	**Increased tactile suppression for reaches with goal-relevant tactile consequences** Lindsey E Fraser, Marie C Mosebach & Katja Fiehler *Center for Vision Research, York University, Toronto, Canada*
10:30 am		**Coffee Break**
11:00 am	Özlem Sensoy	**The influence of real objects and visual-manual exploration on infants' understanding of the familiar size of objects**

		Sensoy, Ö.; Culham, J.C. & Schwarzer, G. *Justus-Liebig-University Giessen, Giessen, Germany*
11:20 am	Matt Laporte	**Assessment of ataxia by analysis of poses estimated from single-camera video** Matt L. Laporte, Paul Schrater, Juan Fernandez-Ruiz, Konrad Kording, Gunnar Blohm *Centre for Neuroscience Studies, Queen's University, Kingston, Canada*
11:40 am	Lisa Rosenblum	**Processing of multisensory self-motion information: path-integration and heading** Elisabeth Rosenblum & Frank Bremmer *Philipps-University Marburg, Marburg, Germany*
12:00 pm	Aaron Cecala	**Investigating the Neural Substrate underlying a Fast Orienting Response** Aaron Cecala, Brian Corneil *Brain and Mind Institute, Western University, London, Canada*
12:30 pm		**Lunch**
2:00 pm		**FLEXIBLE: Advisory meetings or Pinery** Decision will be announced based on weather forecast
3:30 pm- 5:00 pm		**FLEXIBLE: Talk Session or Pinery** Decision will be announced based on weather forecast
3:30 pm	Lina Klein	**Which brain areas are responsible for which aspects of grasping?** Lina K Klein, Kevin Stubbs, Guido Maiello, Daria Proklova, Vivian C Paulun, Jody C Culham, Roland W Fleming *Justus-Liebig University Giessen, Giessen, Germany*
3:50 pm	Miriam Steines	**The role of semantic abstractness and speech-gesture relatedness – An fMRI study on language and action** Miriam Steines, Arne Nagels, Tilo Kircher & Benjamin Straube *Philipps-University Marburg, Marburg, Germany*
4:10 pm	Siavash Eftekharifar	**The effect of motion parallax and stereopsis on the sense of presence in the pit room environment** Siavash Eftekharifar, Nikolaus Troje *Centre for Neuroscience Studies, Queen's University, Kingston, Canada*
4:30 pm	Adrian Schütz	**Influence of allocentric cues on visual and predictive responses in monkey FEF** Adrian Schütz, Vishal Bharmauria, Xiaogang Yan, Hongying Wang, Frank Bremmer, John Douglas Crawford

		Philipps-University Marburg, Marburg, Germany
6:00 pm		**Dinner**
7:30 pm		Meeting of the Joint Directorate (Birch South Meeting Room)

Thursday, June 20		
9:00 am	Harun Karimpur	**How mid-level visual object properties affect spatial coding within and outside of peripersonal space** Harun Karimpur, Filipp Schmidt, Katja Fiehler *Justus-Liebig University Giessen, Giessen, Germany*
9:20 am	Benjamin Cuthbert	**Stimulus dependencies in visual working memory** Ben Cuthbert, Dominic Standage, Martin Paré, Gunnar Blohm *Queen's University, Kingston, Canada*
9:40 am	Julia Bachmann	**Perceiving affect from human motion - modality (in)dependence and gender differences** Julia Bachmann, Britta Krueger, Adam Zabicki, Stefan Gradl, Johannes Kurz, Niko Troje & Joern Munzert *Justus-Liebig-University Giessen, Germany*
10:00 am	Julia Morris	**Saccadic Eye Movements, Pupillary Responses, and Eye-Blink Rate as a Possible Markers in Prodromal Parkinson's Disease** Julia E. Morris, Felix P. Bernhard, Karén Wilhelm, Donald C. Brien, Jeff Huang, Brian C. Coe, Annette Janzen, David Vadaz, Geert Mayer, Jana Huang, Naomi Visanji, Anthony E. Lang, Connie Marras Wolfgang H. Oertel2, & Douglas P. Munoz *Center for Neuroscience Studies (CNS), Queens University, Kingston, Canada*
10:30 am		**Coffee Break**
11:00 am	Paulina Cuevas	**Influence of gestures on the neural processing of semantic complexity** Paulina Cuevas, Miriam Steines, Yifei He, Arne Nagels, Jody Culham and Benjamin Straube *Philipps-University Marburg, Marburg, Germany*
11:20 am	Tom Nissens	**The effects of distractor salience on goal-directed action under different task instructions** Tom Nissens & Katja Fiehler *Justus-Liebig-University Giessen, Giessen, Germany*

11:40 am	Bianca Baltaretu	**Cortical networks for updating of grasp orientation across saccades: an fMRIa / functional connectivity study** Bianca R. Baltaretu, Simona Monaco, Jena Velji-Ibrahim, Gaelle N. Luabeya, & J. Douglas Crawford *Centre for Vision Research, York University, Toronto, Canada*
12:00 pm	Ilja Wagner	**Saccadic adaptation to temporarily delayed stimuli** Ilja Wagner, Christian Wolf, & Alexander C. Schütz *Philipps-University Marburg, Marburg, Germany*
12:30 pm		**Lunch**
2:00 pm		**FLEXIBLE: Advisory meetings or Pinery** Decision will be announced based on weather forecast
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6:00 pm		**Dinner – Outdoor Barbecue**

Friday, June 21		
9:00 am	Gloria Gehb	**The relationship between infants' motor skills and their visual spatial abilities**

		Gloria Gehb, Bianca Jovanovic, Claudia Kubicek, Amanda Kelch, & Gudrun Schwarzer *Justus-Liebig University Giessen, Giessen, Germany*
9:20 am	Lukas Uhlmann	**Predicting the sensory consequences of one's own actions: Neural suppression effects in healthy subjects and patients with schizophrenia** Lukas Uhlmann, Mareike Pazen, Bianca van Kemenade, Olaf Steinsträter, Laurence R. Harris, Tilo Kircher, Benjamin Straube *Philipps University Marburg, Marburg, Germany*
9:40 am	Shanaathanan Modchalingam	**Attribution of error: adapting in virtual reality** Shanaathanan Modchalingam, Denise Henriques *York University, Toronto, Canada*
10:00 am	Margarita Maltseva	**Familiar size preference for real objects by 7-months-old infants in the absence of manual interaction** Margarita Maltseva, Özlem Sensoy, Gudrun Schwarzer, Jody Culham *Brain and Mind Institute, Western University, London, Canada*
10:30 am		**Coffee Break**
11:00 am	Brandon Caie	**EEG Correlates of Homeostatic Expectation following Electrical Brain Stimulation** Brandon Caie, Paul Schrater, Aarlenne Khan, Gunnar Blohm *Centre for Neuroscience Studies, Queen's University, Kingston, Canada*
11:20 am	Mahboubeh Habibi	**Saccadic and pupillometric eyemovement-perception under target-driven and free-viewing condition in RBD, PD and neurodegenerative diseases as a prodromal and longitudinal biomarker** Mahboubeh Habibi, Felix Bernhard, Julia Morris, Douglas Munoz, Wolfgang H. Oertel *Philipps University Marburg, Marburg, Germany*
11:45 am	Anna Schubö	**Keynote Lecture: Motor coordination in joint action**
1:00 pm		**Lunch**
3:00 pm		**Shuttle Bus Departs Oakwood**

Tuesday, June 18, 2019

The relationship between infants' visual-spatial processing of objects and their motor development
Gudrun Schwarzer

It is essential that infants learn to understand the visual-spatial characteristics of objects in their environment. This enables them to recognize objects despite changes in the viewing angles, and to visually anticipate and grasp them at the right moment when they move. That in turn allows infants to interact safely with objects and perform successful actions with them in everyday life. In this talk, I will provide empirical evidence that infants' development of visual-spatial abilities is deeply interwoven with their motor development. First, I will demonstrate that infants' mental rotation ability of objects and their predictive visual-spatial ability are clearly linked to their locomotion and manual object exploration skills. Then, I will present experiments in which we investigated visual and visual-manual mediators through which locomotion and manual object exploration most likely bring about improvements in infants' visual-spatial abilities. Finally, I will introduce studies that examined the implications of this close coupling of visual-spatial development with motor development for young children with motor or visual impairment.

Friday, June 21, 2019

Motor coordination in joint action
Anna Schubö

Joint action has been defined as "any form of social interaction whereby two or more individuals coordinate their actions in space and time to bring about a change in the environment" (Sebanz, Bekkering, & Knoblich, 2006). Humans usually do not act in isolation and examples of people coordinating their actions to perform a task together are manifold. Although humans do astonishingly well in coordinating their actions with others, our understanding of the underlying mechanisms of this ability is far from complete.
My talk will highlight some of the central mechanisms needed for successful joint action. I will present studies that examine how humans coordinate their actions in space and time, how they share relevant task information, and how their motor behavior is modulated in different social contexts. In these studies, humans perform simple motor tasks in naturalistic environments, and the tasks allow for varying degrees of social cooperation. Results indicate that participants spontaneously adapt their movement parameters to the joint action situation: movement paths, movement time, and movement speed were adjusted automatically when working with a partner. Personality traits and the social context in which the task was performed were shown to modulate the extent to which a partner's task and common action goal were represented and integrated into action planning. These results show that many mechanisms contribute to joint action performance. Joint action tasks thus provide an interesting framework to study motor coordination, action planning, and other aspects of motor behavior in naturalistic task settings.

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Tuesday, June 18, 2019

Re-evaluation of luminance evoked pupil response dynamics
Jonathan D Coutinho, Jeff Huang, Philippe Lefèvre, Gunnar Blohm, Douglas P Munoz

Pupil responses are commonly used in clinical assessments and as a proxy for cognitive processes in psychological research. Making accurate inferences from these measures requires precise knowledge of the underlying system dynamics. However, the precise system dynamics of pupillary responses are poorly quantified. As a result, there is a lack of consistency in the selection of pupil metrics and the preprocessing and analysis of pupil response data across the literature. Meanwhile, existing pupil models rely on simplistic assumptions of underlying control signals, resulting in poor generalizability. Thus, better quantification of the control system and neuromuscular properties of pupil response dynamics would substantially advance the utility of pupillometry in cognitive and clinical neuroscience research. Here we quantify pupil responses in healthy young adults to the simplest possible sensory stimulus, i.e. large-field changes in luminance, randomly selected between 1 and 43 cd/m2. We found large variability in baseline pupil sizes within and between subjects. Nevertheless, we found a linear relationship between average changes in pupil size and the difference in log-luminance during a luminance transition. Furthermore, we found covariance between the amplitude and peak velocity of pupil responses suggestive of a "main sequence" in the pupil control. We quantified aspects of dynamic pupil responses, including saturating non-linearities and asymmetries between constriction and dilation dynamics. These results provide a better foundation to link pupil dynamics with cognitive processes and clinical biomarkers.

Estimating pose from images using a deep shared latent variable model
Benjamin Knopp, Matt Laporte, Gunnar Blohm & Dominik Endres

Pose tracking is the estimation of skeletal poses from video frames. We investigate pose tracking as a component of biological movement perception. For this purpose, it is important to incorporate temporal and physical constraints of biological movement. Most state-of-the-art pose tracking algorithms predict 2D keypoint locations from single frames instead, and are thus not suitable for this purpose.
We assume that movement represented as skeletal joint angles share a latent representation with its video representation. We implement this assumption as deep latent variable model (also known as variational autoencoder). The latent space can be constrained by dynamical systems. Pose tracking in this framework is done via conditioning the video frames.
We demonstrate the feasibility of the approach using toy data. This is an important step towards a robust and principled probabilistic pose tracking algorithm for real world data. The model additionally allows for the generation of videos given poses. It is thus an ideal test bed for hypotheses about the perception of biological movement.

Familiar size preference for real objects by 7-months-old infants in the absence of manual interaction
Margarita Maltseva, Özlem Sensoy, Gudrun Schwarzer, Jody Culham

Visual and motor systems develop in parallel, with one enabling the other for more complex outputs. Sitting up right, the developmental stage that occurs around 6 months of age, frees up the hands of a proficient crawler letting them to explore the visual world now using hands. The visuo-spatial information, such as object distance and physical size, previously available only visually, can now be tested by an infant through reaching and grasping. Active manual manipulation of objects also enriches learning of object features, including familiar size. In the current study, we tested whether 7-months-old infants can distinguish between familiar and novel physical sizes of objects from their

daily environment (i.e., pacifier and sippy cup) when manual interaction with objects was restrained, with a plexiglass glass barrier. In a preferential looking paradigm, infants were presented with a pair of objects with the same identity (e.g., pacifier), in which one object was of a familiar size and the other was either half or twice the size of a regular (familiar) size. Each pair was presented either within reach (~20 cm) or out of reach (~40 cm) from the infants. Importantly, the object pairs were separated by a transparent barrier, so that even when objects were technically within reach, the infants could not manipulate the objects. We found a three-way interaction of distance, object identity and familiar size. Specifically, the looking duration was the longest fo the familiar pacifier that was within reach. The results suggest that the absence of manual interaction with objects direct visual perception towards highly familiar objects instead of the novel ones, in contrast with a consistently observed preference towards novel objects when manual interaction is available. Manual interaction with objects, therefore, seems to be a crucial stage for initial curiosity and subsequent learning of novel object features.

How does previous trial information modulate predictive tactile suppression?
Marie C. Mosebach, Dimitris Voudouris, Katja Fiehler

Tactile stimuli on a moving limb are rated as less intense compared to rest. This phenomenon, known as tactile suppression, is discussed in the context of an internal feed-forward model: While planning a movement an efference copy of the motor command is used to predict, and eventually, cancel the predicted sensory outcome of that movement. The strength of suppression can vary according to the accuracy of the predictable aspects of somatosensory information relevant for the movement. Humans can establish accurate predictions, but when uncertainty increases the most recently obtained information may be used to plan the movement. For instance, when asked to grasp an object with uncertain task-relevant properties (e.g. center of mass), humans grasp as if it had the properties experienced in the previous trial. We here sought to determine whether predictions under uncertainty are established on the basis of the most recently obtained information, and if so, whether and how tactile suppression is modulated by such predictions. To test this, we asked participants to perform lifting movements with their right index finger, during which they would encounter a barrier set at two different heights, or no barrier. Movements were performed in three predictable blocks, and in an unpredictable block, in which all three barrier configurations were presented in a pseudo-randomized order. Participants were to respond if they felt a vibro-tactile stimulus presented either shortly before movement onset or at the moment of collision with the barrier, and in a separate resting state block. We expect tactile suppression when moving compared to rest, and stronger suppression in the predictable than unpredictable blocks. If people establish predictions based on previous trial information, we expect stronger suppression of stimuli presented at the moment when a barrier collision was experienced in the previous trial.

Gaze behavior in natural environments with different task demands
Johannes Kurz and Jörn Munzert

In the last 20 years, investigating gaze behavior in natural environments has become of great interest and importance as gaze behavior in natural environments differs from that in artificial environments. A huge number of studies investigating gaze behavior in natural environments have provided many fundamental insights about it, such as that it is task-specific, repeatable, and based on a just-in-time mechanism. In addition, it has also been shown that different task demands (different types of terrain) affect gaze behavior while walking or cycling in general. However, up to now, it remains unclear to what extent different task demands affect gaze behavior in motor tasks other than walking and cycling. Three experiments will be presented which were executed in largely natural environments to investigate this question. The first experiment addressed the question to what extent different task demands (accuracy) affect gaze behavior while transporting water glasses with different filling levels (continuous task). The second experiment addressed the question to what extent different task demands (task relevance) affect gaze behavior while performing a penalty kick in football (ballistic task). The third experiment addressed the question to what extent different task demands (amount of available information) affect gaze behavior while predicting shot direction of penalty kicks in

football (interceptive task). Results from all three experiments revealed that different task demands also affect gaze behavior in motor task other than walking or cycling. However, the results revealed that the differences in gaze behavior only appear in certain phases of the task. At which phase these differences appeared depends on the respective motor task. In the ballistic and the interceptive task, the differences appeared only at the earlier phases. In contrast, in the continuous task, the differences appeared only at the later phases.

Keeping track of an object during self-motion

John J.-J. Kim and Laurence R. Harris

Updating egocentric positions of surrounding objects during self-motion is fundamental to our ability to navigate around the world. However, past studies have shown that people make systematic errors in the direction of the movement when updating positions during lateral self-motion. To determine the source of these errors, we measured errors in remembered target position with and without passive lateral movements. We also varied the self-motion feedback, providing either both physical and visual motion, with physical motion only, or visual motion only. Using Oculus Rift (CV1), we presented targets (lateral eccentricities: +.69m, +.46m, +.23m, 0m, or -.23m; simulated viewing distance 1.75m) briefly (0.5s) on a simulated projector screen in the virtual environment. After an idle period (5s) or a lateral movement (left or right at ~0.092 m/s for 5s; moving distance: +.46m), they positioned a dot at a remembered target position by pointing a hand-held controller. Participants fixated a cross at all time until they had to point at the target location.
In general, participants underestimated target eccentricity with greater underestimations for more eccentric targets when remembering target positions without motion. After passive lateral motion, the remembered target positions shifted in the direction of the movement with full (both visual and physical) and visually-induced movement. However, the shift was to the opposite direction with physical movement only. Errors, difference between remembered and actual target position, were also greater with only physical movement compared to full or visual movement. They were most accurate at remembering position for the target that was in front of them before the movement (0 initial eccentricity).
Our ability to update a target position is affected by its initial eccentricity and perceived magnitude of movement. Future experiments will extend these studies using constant acceleration rather than constant speed to evaluate the effect of vestibular input on our updating.

Individual selection history biases visual attention depending on the task preparation

Hossein Abbasi, Hanna Kadel, Anna Schubö

Visual selective attention is an ability to filter the irrelevant and focus on the relevant information. Bottom-up, top-down and learning experience are the mechanisms which bias visual attention. Our main question in this study is to find out to what extent learning experience and top-down mechanism counteract each other in guiding visual attention.
To answer this question, participants were randomly divided into color- and shape-predictive groups. In a categorization task, participants in the color-predictive group categorized a color singleton (green vs. blue) while participants in the other group categorized a shape singleton (pentagon vs. triangle). To investigate the impact of learning experience, the categorization task was combined with an additional singleton search task. Participants had to complete two experimental sessions with predictable or partial-predictable trial sequences of both tasks. The distractor in the search task was expected to impair visual attention more strongly for the participants in the color- than for the participants in the shape-predictive group. More preparation in predictable sequence was expected to ease distractor inhibition, especially for the participants in the color-predictive group.
Results showed that learned experience in the categorization task biased attention deployment in the search task in the expected manner. RTs and ERPs results showed that this attention bias was impaired (but not overruled) by increasing the task preparation. This was represented as faster RTs and smaller PD/ND in predictable compared with

partial-predictable trial sequence. In sum our results indicate that individual selection history is a strong factor which can shape visual attention, although task preparation can only reduce this bias.

It wasn't me: External source attribution dampens shifts in predicted sensory consequences but not proprioception
Raphael Q. Gastrock, Shanaathanan Modchalingam, Chad Vachon, Bernard Marius 't Hart, Denise Y. P. Henriques

People constantly adapt movements to dynamic conditions, while taking the source of errors into account. When visual feedback of the hand is altered, adaptation involves updating hand-position estimates based on changes in proprioception and efferent-based predicted sensory consequences. Our recent work found persistent shifts in hand-position estimates, despite awareness of the external nature of the perturbation. Such explicit knowledge should, however, make the brain attribute the source of errors externally and not shift hand-position estimates. Here, participants trained with a 30-degree rotated hand-cursor, and we manipulated the error attribution in four ways: the 1) “non-instructed” control group received neither instructions nor different visual stimuli, 2) “instructed” group received a counter-strategy for the rotation, 3) “cursor jump” group saw the cursor misalignment mid-reach on every trial, 4) “hand view” group saw their actual hand and misaligned cursor on every trial. During training the instructed group immediately countered the rotation, while other groups showed typical learning rates. When asked to either include or exclude the strategy developed to counter the rotation, only the non-instructed group could not do so at will. Moreover, reach aftereffects for the hand view group were lower compared to the other groups. Participants also localized their hand before and after training. They either moved their own hand, allowing for hand localization with both proprioception and predictions, or the robot moved their hand, leaving only proprioception. We found that shifts in predicted sensory consequences were dampened for the hand view group, but proprioceptive recalibration persisted in all groups. Although groups differed with error attribution to the cursor, we speculate that proprioception is recalibrated based on the cursor, not the actual hand.

Wednesday, June 19, 2019

The effect of corrective saccades on subsequent oculomotor behavior
Alexander Goettker & Karl R. Gegenfurtner

Moving objects are one of the most salient things in our environment and typically will attract the gaze. There is converging evidence that the oculomotor system uses a reliability-weighted integration of prior stimulus movements and the current sensory input to overcome internal processing delays, so that the eyes are at the right place at the right time. The goal of our study was to investigate the relevant signals for integrating prior information and especially how the oculomotor behavior is integrated across experimental trials. We created sequences with the same physical target movements, the only difference being that in some cases additional corrective saccades were executed in a particular trial, due to trial-by-trial variability of eye movements. We observed a systematic influence of the occurrence and direction of corrective saccades on the oculomotor behavior in the next trial. This allows two important insights: First, it suggests that there is a representation of target velocity that contains epochs of pursuit as well as corrective saccades, indicating shared signals between the saccadic and pursuit system. Second, the direction of the effect of the corrective saccades indicates that the retinal slip is mediating the effect of the previous trial, and not perceived speed. This suggests different uses of extra-retinal and retinal information for oculomotor control and perception.

Laminar organization of reward signal in the superior colliculus priority map
Janis Y Kan, Brian J White, Laurent Itti, Douglas P Munoz

Visual orienting is sometimes modeled as being directed by a saliency map representing the conspicuity of visual space, and a priority map that combines bottom-up saliency and top-down relevance. 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. Using a multi-channel linear micro-electrode, we compared monkey SCs and SCi firing rate and local field potential (LFP) in response to visual saccade targets that were matched for saliency but varies in relevancy. One or two bar-shaped stimuli serving as saccade targets were presented as salient pop-out stimuli in a homogenous wide-field array of bars that differ from targets in color and orientation. Target color was used to indicate large, small, or no reward if the monkey makes a saccade to it, varying the behavioural relevance and therefore priority of the targets. We found a depth-dependent representation of priority in the SC. There were only small differences in SCs firing in response to the various stimuli. In contrast, SCi activity showed strong modulation starting around 80ms after stimuli appearance, with rewarded stimuli evoking the highest response, followed by non-rewarded but salient stimuli, and homogenous background stimuli evoking the lowest response. This pattern of reward modulation was qualitatively similar even when controlling for saccade direction. A stimulus-evoked biphasic LFP response was observed in both layers of the SC, with reward modulation emerging in the later, negative portion of the response. This supports the model that saliency and relevancy information converges in deeper layers of the SC.

Neural correlates of preparing hand movements during object use
Mareike Pazen, Benjamin Straube, Tilo Kircher, and Jody C. Culham

Prior to interacting with objects in the environment, we need to define the intended goal of our action and translate it into appropriate body movements. To this end, we need to flexibly integrate object-related information into action planning processes. In a series of fMRI experiments, we assess how the neural system prepares such object interactions.
Experiment 1: Participants move a handle using either an object or only their hand. We expect that healthy participants use object-related information to predict upcoming sensory action consequences. In patients with schizophrenia, whose symptoms (e.g., hallucinations) are thought to rely on deficient predictive mechanisms, we expect impairments in integrating object-related information into the prediction. Preliminary results corroborate our hypothesis.
Experiment 2: Healthy participants either grasp or turn a dial positioned in one of two oblique orientations. We expect that upcoming movements can be decoded from differential fMRI activity patterns in key regions of the frontoparietal cortex prior to action execution.
Together, our findings will show how objects affect the preparation of object interactions with regards to 1) the prediction of action consequences and to 2) planning-related computations of upcoming motor sequences.

Increased tactile suppression for reaches with goal-relevant tactile consequences
Lindsey E Fraser, Marie C Mosebach and Katja Fiehler

When we move, our sensitivity to touch is reduced. This “tactile suppression” is thought to be a mechanism for gating self-generated sensory feedback (Williams et al., 1998). In a previous study, we tested suppression of a tactile stimulus applied during reach-to-tap movements. When we added an additional, uninformative tactile stimulus to the end of a movement, we found late-reach suppression selectively increased. These results suggested anticipation of movement consequences modulates suppression in a temporally sensitive way (Fraser & Fiehler, 2018).
In the present study, we asked: Do we still suppress in anticipation of movement consequences, when those consequences provide valuable information? Participants were presented with a large circle onscreen, and were instructed to reach out and find an invisible target floating in the air in front of the circle. Participants received either a tactile cue or a visual cue to indicate they had hit the target (the hand was tracked using a motion capture system).

The circle's colour cued what type of feedback would be given. We measured suppression of a tactile stimulus delivered to the dorsal surface of the finger at early and late time points in the reach.
We hypothesized that the stimulus would be suppressed less when tactile feedback was expected, given that it uniquely signaled task completion and suppression would be detrimental to task performance. In fact, participants showed more suppression in the tactile feedback condition than the visual one, for both early and late reach. Our results suggest movement outcome prediction may interact with task demands, such as attentional demands, to produce final suppression characteristics.

The influence of real objects and visual-manual exploration on infants' understanding of the familiar size of objects
Sensoy, Ö.; Culham, J.C. & Schwarzer, G.

Previous research has shown that infants can successfully distinguish different sizes. However, it remains an open question when infants learn the familiar size that is the typical real-world size of objects. In the present study, we investigated when infants start to discriminate the familiar size of an object from novel sizes that is larger or smaller sizes than the familiar size. We also examined how stimulus format (real objects vs. photographs) influences infants' visual responses.
A total of 135 7- and 12-month-old infants were presented with highly familiar objects such as real objects or photographs. All stimuli were shown in their familiar size and in novel sizes (50% larger or smaller than the familiar size). In a preferential looking paradigm, objects were first presented for 10 s in a visual only condition and then for 20 s in a visual-manual condition.
In the visual condition, analysis of a significant age x size and stimulus format x age interaction, showed that 7-month-olds looked equally long at the familiar and novel sizes, both for the real objects and the photographs. However, 12-month-olds looked longer at the novel-sized real objects, but did not show such discrimination for the photographs. In the visual-manual condition, analysis of a significant stimulus format x size showed that both age groups preferred to look at the novel-sized real objects. For the photographs, infants of both age groups did not show this preference. Taken together, our results show that infants can discriminate novel from familiar sizes and this ability is strongest for older infants (12- vs. 7-months-olds), for real objects (vs. photos) and when manual exploration is possible (vs. not). These results suggest that direct interactions with real objects facilitate children's understanding of object size in ways beyond what is enabled by visual exploration alone or by pictures.

Assessment of ataxia by analysis of poses estimated from single-camera video
Matt L. Laporte, Paul Schrater, Juan Fernandez-Ruiz, Konrad Kording, Gunnar Blohm

Human motion is controlled by the nervous system and conveys information about its function, including the nature of motor disorders. Many algorithms try to replicate human skill in inferring body motion from videos, with modest success, but neuroscientists still rely largely on pose data from expensive and non-portable motion capture systems. Since 2012, convolutional neural networks have made feature extraction from images more reliable, but most of the resulting pose estimation methods neglect dynamics and thus have limited usefulness to movement science. By combining an interpretable and expressive generative model of dynamics with state-of-the-art feature extractors, I will assess the severity of ataxia symptoms from single-camera videos. While I expect the inclusion of the dynamical model will improve the plausibility of pose sequence estimates, it is unclear whether it will improve confidence in regressing to an ataxia rating. These results will have implications for the adoption of video-base pose tracking techniques in neuroscience, and may reveal potentials and limitations in existing models.

Processing of multisensory self-motion information: path-integration and heading
Elisabeth Rosenblum & Frank Bremmer

During self-motion, different sources of sensory information have to be integrated for successful navigation through space. Here, we ask (i) if and how the processing of multisensory self-motion information is modulated by self-controlled action in a distance reproduction task (path integration) and (ii) if and how tactile flow affects the perceived direction of visually simulated self-motion (heading). The influence of tactile, visual (and auditory) information on the perception of simulated self-motion will be investigated in a human fMRI and behavioral experiment. In the fMRI study, subjects will be presented a combination of unisensory (visual, auditory, tactile) and multisensory (trimodal) self-motion stimuli. Straight-ahead self-motion will be simulated across a 2-D ground plane (visual condition) associated with an auditory stimulus (auditory condition: either a pure tone with frequency scaled with simulated speed or auditory VR) and a continuous airflow directed on the subjects‚Äô forehead (tactile condition). Participants will be asked to reproduce the travelled distance (active condition) of a previously seen self-motion (encoding condition) or to passively observe a self-displacement produced by themselves in one of their previous active trials (replay condition). In line with previous human fMRI studies, also from our group, we expect enhanced activity in early sensory cortices and attenuated activity in angular gyrus and frontal cortex. In the behavioral study, subjects will be presented a brief (200ms) visual stimulus simulating forward self-motion across a ground plane in one of seven directions. Tactile flow (200ms, presented before, during or after visual stimulation) will be aligned or not with the visually simulated heading direction. Subjects will have to fixate at one of three stationary targets. We hypothesize an influence of the tactile flow on visual heading perception. Different gaze directions will allow us to determine the frame of reference of visually based heading perception.

Investigating the Neural Substrate underlying a Fast Orienting Response
Aaron Cecala, Brian Corneil

Animals produce thousands of orienting movements each day to acquire information about, and/or to interact with, items in their local environment. These orienting movements may: 1) involve the coordination of multiple body segments; 2) be dependent upon an individual's goals and the environmental context within which they are embedded; and/or 3) be affected by senescence or disease. For a human-centric example, consider the instance in which a passing waiter accidentally bumps a patron's table with enough force to tip over a resting glass of wine. In this case, a healthy patron's nervous system rapidly detects the glass's relative motion, re-orients gaze by coordinating eye and head movements, and executes a rapid reaching movement towards the glass in an attempt to catch it before the wine is spilt. While this fast orienting response (FOR) allows the patron to successfully catch the glass, an individual who suffers from optic ataxia as a result of posterior parietal cortex (PPC) damage would likely have difficulty catching the glass. While data collected over the last half-century from primates in controlled laboratory settings has been used to support the prevailing view that the PPC is integral for the feedback (online correction), and the primary and dorsal premotor (PMd) cortices in the feedforward (planning & initiation) phases of reaching movements, there is an emerging view that the superior colliculus (SC) contributes to the earliest phases of the reach. My talk will briefly discuss anatomical, physiological, and behavioural evidence supporting this emerging view as well as planned experiments that will test the hypothesis that the SC is necessary for the feed-forward phase of both gaze and limb movements toward visual objects in non-human primates. These experiments will also help clarify the interactions between, and contributions of, cortical and midbrain structures during visually guided reading.

Which brain areas are responsible for which aspects of grasping?
Lina K Klein, Kevin Stubbs, Guido Maiello, Daria Proklova, Vivian C Paulun, Jody C Culham, Roland W Fleming

Most neuroimaging studies of both grasping and object recognition have focused on simple objects made from homogenous materials. However, in behavioral experiments with complex objects, we have shown that participants can use visual object shape and material distribution to select optimal grasps based on a combination of factors: natural grasp axis, grasp aperture, the object's overall weight, and mass distribution. Given that visual perception of

object shape and material distribution are putatively a ventral-stream function; whereas, grasping is putatively a dorsal-stream function, we used functional magnetic resonance imaging (fMRI) to characterize the role of brain regions in both streams during grasping of multi-material objects. We recorded brain activation while participants grasped and lifted objects made of wooden and brass cubes at preselected grasp points. To tease apart the different components of grasp selection, grasps were optimized for either torque, grasp aperture, grasp axis, or a combination of these. For example, some grasps were optimal with respect to minimizing torque, but suboptimal with respect to the aperture. Within visual and visuomotor regions of interest, we examined activation levels and patterns (with representational similarity analysis) to infer neural coding of grasp attributes. When participants grasped objects in configurations with high torque – that is when their grips had to counteract object rotation due to gravity – versus low torque, activation was observed in the grasp-selective anterior intraparietal sulcus, aIPS (in the lateral dorsal stream), the reach-selective superior parieto-occipital sulcus, SPOC (in the medial dorsal stream), and the object-selective lateral occipital cortex, LOC (in the ventral stream). These results suggest that when materials and their distribution are relevant for grasping, both visual streams are recruited.

The role of semantic abstractness and speech-gesture relatedness – An fMRI study on language and action
Miriam Steines, Arne Nagels, Tilo Kircher & Benjamin Straube

The ability to understand and integrate information conveyed through language and concurrent actions is essential for face-to-face interactions. It has been shown that the neural integration of co-verbal gestures is highly dependent on the abstractness of an utterance. Here, we tested the hypothesis that different neural mechanisms contribute to the detection of semantic relatedness of speech and gesture in a concrete vs. abstract sentence context.
During functional magnetic resonance imaging (fMRI) scanning, 41 healthy subjects viewed videos of an actor speaking a concrete (C) or abstract sentence (A) accompanied by a related (R) or unrelated gesture (U). After each video, subjects had to judge the relatedness of speech and gesture.
The interaction of abstractness and relatedness revealed significant clusters of activation in the bilateral inferior frontal gyri (IFG), SMA and the right superior frontal gyrus. By contrast, no overlapping activation for the processing of unrelated gestures in a concrete and abstract context were found.
Our results support the hypothesis that different neural mechanisms contribute to the detection of semantic relatedness of speech and gesture in a concrete vs. abstract sentence context.

The effect of motion parallax and stereopsis on the sense of presence in the pit room environment
Siavash Eftekharifar, Nikolaus Troje

The sense of presence is highly intertwined with virtual reality (VR) and is defined as subjective feeling of being in an environment even when users are physically situated in another. Several depth cues seem to be involved to create the sense of presence in VR. Motion parallax and stereopsis are considered the essential parts of immersive virtual environments. However, their relative contribution to create the sense of presence is unclear. In two experiments, we attempted to answer this question using two versions of the classic pit room paradigm.
In the first experiment, participants were asked to cross a deep abyss between two platforms on a narrow plank. Participants completed the task under three experimental conditions: 1) Lateral component of motion parallax was disabled, 2) Stereopsis was disabled, 3) Normal VR with both stereopsis and motion parallax. As a subjective measure of presence, participants responded to a presence questionnaire after each condition while their electrodermal activity (EDA) was also recorded as a measure of stress and anxiety in stressful environments. The importance of motion parallax was shown by EDA ($F[2,54]=6.71$; $P<0.005$). Questionnaire scores, however, did not show any difference among the conditions ($F[2,54]=0.04$; n.s).
We applied the same experimental manipulations to a second experiment. In a slightly less stressful situation, participants were asked to stand on a ledge and drop virtual balls to the specified targets into the abyss. Results of

both presence questionnaire ($F[2,36]=4.87$; $p<0.05$) and EDA ($F[2,36]=8.19$; $p<0.005$) demonstrated the importance of motion parallax over stereopsis
Both experiments showed that in VR, motion parallax is a more important depth cue than stereopsis in terms of fear response as measures by EDA. Presence questionnaires also revealed the importance of motion parallax to the sense of presence in the second experiment.

Influence of allocentric cues on visual and predictive responses in monkey FEF
Adrian Schütz, Vishal Bharmauria, Xiaogang Yan, Hongying Wang, Frank Bremmer, John Douglas Crawford

Our environment is full of allocentric cues that may indicate the remembered or expected location of a point of interest. In this study we hypothesized that visual responses in the macaque frontal eye field (FEF) may play a crucial role in the integration of allocentric and egocentric information for saccade generation. We analyzed 102 FEF neurons in a memory delay saccade task. The monkey was presented a cross landmark, then fixated, during which a quasi-predictable target was flashed (100 ms), 11° from the landmark in one of four directions. After a mask, monkeys had to saccade to the remembered target location. Landmark, fixation point and target locations were varied across trials to ensure probing the entire receptive field of each neuron. Based on previous findings (Sajad et al., CerCor, 2015), we assumed a target-relative-to-eye coding of FEF visual responses. In order to quantify allocentric influences, we calculated non parametric fits for the neurons' receptive fields for a continuum of reference frames describing the transition between retinal target coordinates (Te) and target position relative to the cue (TLe). Overall, neuronal responses were better fitted in an allocentric reference (TLe) frame compared to the egocentric (Te). Starting 100 ms after landmark onset and persisting until 80 ms after target onset, responses were best described by an intermediate reference-frame representing both ego- and allocentric coding simultaneously. We hypothesized this being predictive activity relating to possible future target positions. Accordingly, we tested the coding with respect to future gaze position (Ge) and found an influence of Ge on responses throughout the trial. These results suggest that in the presence of a landmark (i) population and single-cell activity encode information in various reference frames simultaneously and that (ii) these allocentric cues enable the brain to create probabilistic models for the future goal of eye movements.

Thursday, June 20, 2019

How mid-level visual object properties affect spatial coding within and outside of peripersonal space
Harun Karimpur, Filipp Schmidt, Katja Fiehler

We show enhanced behavioral responses to objects in our immediate surround compared to objects outside of reach space. Backed up by many neurophysiological studies this finding established the concept of peripersonal space. Within peripersonal space, we spatially encode objects-for-action based on a combination of egocentric (object-to-self) and allocentric (object-to-object) information. However, it is not clear how the interaction between these reference frames is modulated by the affordance of an object and the distance to the observer.
This is in line with the recently proposed action-field theory of peripersonal space. Rather to think of an in-or-out zone, the theory defines peripersonal space as a graded field reflecting the context-dependent relevance of our actions which either aim to avoid or approach objects. Here we tested the role of object-affordance in spatial coding for different distances by using a pointing task in virtual reality. We presented a target object surrounded by task-irrelevant landmarks within and outside the participant's peripersonal space. After a brief mask and delay, the landmarks shortly reappeared without the target, either at the same position (baseline) or horizontally shifted. After their disappearance, participants were asked to point to the remembered target object within the empty scene. To manipulate the level of object-affordance, we varied mid-level visual object properties of shape and texture (spiky metallic versus soft rubber ball).

We found that reaching endpoints deviated in the direction of landmark shifts suggesting the use of allocentric information. This effect was more strongly affected by mid-level visual object properties within compared to outside of peripersonal space. Our findings suggest that spatial coding in our immediate surround is modulated by object-affordance.

Stimulus dependencies in visual working memory
Ben Cuthbert, Dominic Standage, Martin Paré, Gunnar Blohm

Visual working memory experiments typically involve asking a subject to memorize several visual stimuli such as coloured shapes, oriented lines, faces, or objects. Computational accounts of recall performance often assume that each stimulus presented in a trial is encoded independently, ignoring higher-level group statistics that have been shown to bias recall and impact task performance. Here, we analyzed response data from a delayed estimation task that required the report of all stimuli presented (6 coloured squares). We found serial dependencies in consecutive (same-trial) reports, which was supported by analysis of mutual information between report distributions. Participants also appeared to leverage the colour similarity of same-trial stimuli: the number of clusters inferred by a non-parametric clustering algorithm was predictive of recall performance. This finding was replicated with data from the classic single-report version of the delayed estimation task. Taken together, these results provide further evidence that humans encode high-level statistics of visual scenes in working memory. The non-parametric clustering algorithm implemented also provides a novel way to characterize the configuration of randomly-generated stimulus arrays, allowing for re-analyses of many visual working memory recall datasets.

Perceiving affect from human motion – modality (in)dependence and gender differences
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The ability to perceive and interpret emotional behavior constitutes a core competence for social interactions. Humans are extremely adept at recognizing emotional states in others even from highly reduced biological motion. However, computer- based tasks are limited in their level of immersion and therefore neglect the potential importance of realism that could alter perception and behavioral responses. In this regard, virtual reality offers a way to increase the level of immersion by considering sensorimotor contingencies through real-time environments. Using motion capture, we created realistic 3D avatars displaying emotional interactions. These avatars were used within a virtual reality paradigm to investigate whether emotions are perceived differently in a physical space as compared to a pictorial space. Specifically, we asked participants to i) judge the valence of the depicted interaction, i.e. positive or negative and ii) to indicate whether they would rather approach or avoid the observed interaction. Additionally, we measured physiological signals, i.e. electrodermal activity as well as the center of pressure displacement in order to see, whether explicit behavior ratings are reflected within implicit physiological responses. Our results indicate that the level of immersion does not mediate valence judgments or avoid-approach tendencies. However, a strong gender effect was revealed with regard to the rated avoid-approach behavior. While female participants showed a strong correlation between valence judgment and the tendency to avoid or approach the observed emotional interaction, men displayed higher variations in this relationship. Moreover, we found that explicit rating behavior is reflected within implicit center of pressure displacement in the anterior–posterior plane. We conclude that the perception of affect as well as the tendency to respond to emotional interactions is independent from the level of immersion and may depend more strongly on interindividual differences.

Saccadic Eye Movements, Pupillary Responses, and Eye-Blink Rate as a Possible Markers in Prodromal Parkinson's Disease

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Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder affecting approximately 1-2% of people over the age of 60. A major challenge in PD research is the discovery of a disease modifying therapy. In order to successfully prove a disease modifying effect of such a treatment, biomarkers must be identified in the prodromal phase of PD. This can be done via investigating pre-clinical patients that exhibit no movement impairments - such as correlated behavioural disorders, and non-manifesting carriers of genetic mutations that are both affiliated with an increased risk for developing PD. Rapid eye-movement (REM) sleep behaviour disorder (RBD) is a parasomnia characterized by the loss of muscle atonia during the REM sleep cycle, leading to those affected to act out their typically violent dreams. Within 10-15 years of this diagnosis, idiopathic RBD patients have an 85% chance of developing an alpha-synuclien neurodegenerative disease, most commonly PD, making this disease the most specific prodromal feature of PD. Also, variations of the Leucine-rich repeat kinase 2 (LRRK2) gene are associated with the development of PD, and have been shown to be indistinguishable from idiopathic manifestation of PD, indicating a potential that both LRRK2 carriers, and non-LRRK2 carriers of PD have similar pathophysiology.
Non-manifesting carriers of LRRK2, and individuals with RBD are ideal candidates to investigate early behavioral biomarkers. Previous studies have demonstrated deficits in cognitive control of eye movements in PD, in particular, visually triggered pro-saccades (look towards a peripheral target) and volitionally-guided anti-saccades (look away from a peripheral target). Specific deficits include shorter latency saccadic reaction times (SRTs) during pro-saccades, more express saccades (90ms>SRT>140ms from stimulus onset), longer SRTs during anti-saccades, more direction errors (erroneously looking towards the target during anti-saccade trials), a damped autonomic light reflex response, and fewer eye-blinks compared to healthy, age-matched controls. It is believed that cognitive and behavioral deficits emerge years, and in some cases, decades before cardinal motor symptoms manifest.
We hypothesize that individuals with RBD and non-manifesting carriers of LRRK2 will exhibit these similar saccadic, pupillary, and eye-blink deficits as patients with PD. Our results show that non-manifesting carriers of LRRK2 make more express saccades, more anticipatory saccades and more anti-saccade direction errors. Individuals with RBD and LRRK2 carriers have significantly less pupil constriction and dilation. Preliminary eye-blink results show no significant difference between groups, though further analysis is still needed. These results indicate that saccade and pupillary behavior during pro- and anti- saccade task have the potential to be early behavioral biomarkers for Parkinson's disease.

Influence of gestures on the neural processing of semantic complexity

Paulina Cuevas, Miriam Steines, Yifei He, Arne Nagels, Jody Culham and Benjamin Straube

Gestures are elemental components of social communication and aid comprehension of verbal messages; however, little is known about the potential role of gestures in facilitating processing of semantic complexity in an ecologically valid setting.
The goal of the study was to investigate whether cognitive load, as indexed by semantic complexity, is modulated by the presentation of gestures accompanying speech. 20 healthy participants watched 16 video clips of a short narrative while instructed to carefully listen to and watch the narrator while functional magnetic resonance imaging (fMRI) data were acquired. The videos contained passages with and without various co-speech gestures, as well as passages where the semantic complexity was either low or high, as measured by the metric of idea density. Increasing semantic complexity led to reduced activation within the default mode network (DMN); whereas, presents of gestures decreased activation in language-related regions (left middle temporal gyrus and left inferior frontal gyrus) and increased activation in high-level visual and multimodal regions of occipitotemporal cortex. Most interestingly, an interaction between semantic complexity and gestures was observed in a language-related area in

left anterior temporal cortex; specifically, increasing gestures led to a greater drop in activation with high vs. low semantic complexity.
In sum these results provide evidence that the facilitation of gestures on semantic processing, particularly for complex narratives, is reflected in the neural substrates of language processing.

The effects of distractor salience on goal-directed action under different task instructions
Tom Nissens & Katja Fiehler

Before reaching for a target object, this object has to be selected first. During this selection process several non-target objects (distractors) can cause distraction and, as such, influence reaching behavior. Physically salient objects tend to attract movement trajectories during search task but repel movement trajectory when the target is cued. In this study we directly tested these hypotheses. In the first experiment participants had to search for a target diamond among circles and reach to it. In the second experiment, the target diamond was cued and participants had to reach to the cued target diamond among circles. One of the circles could be in a high or low physically salient color i.e. near or far away from the target color in color space while isoluminant; or all circles were in the color of the target (baseline). In experiment one, during search, we expected to see the trajectory to deviate toward the salient circle, and this more so in the high compared to low salience condition. In experiment two, with a cued target, we expected to find the trajectory to deviate away from the salient circle, and this more so in the high compared to low salience condition. Furthermore, we analyzed whether the effect of salience on movement trajectory is modulated by reach latency and/or distance between target and distractor. In experiment one, we indeed found the trajectory to deviate towards the salient distractor and this more so for the high compared to low salience condition. The difference in trajectory deviation between the high and low salience condition was largest on trials with short reach latency when the distractor was 2 positions away from the target. Currently, the data collection for experiment two is still ongoing; results will be presented.

Cortical networks for updating of grasp orientation across saccades: an fMRIa / functional connectivity study
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Coordinated reach-to-grasp movements are often accompanied by rapid eye movements (saccades) that displace the desired object image relative to the retina. Parietal cortex compensates for this by updating reach goals relative to current gaze direction, but its role in the integration of oculomotor and visual orientation signals for updating grasp plans is unknown. Based on a recent perceptual experiment, we hypothesized that inferior parietal cortex (specifically supramarginal gyrus; SMG) integrates saccade and visual signals to update grasp plans in more superior parietal areas. To test this hypothesis, we employed a functional magnetic resonance adaptation paradigm, where an oblong 3D object was first presented at one of two possible orientations (0° or 135°), and then was re-presented at the same orientation (Repeat condition) or at the other orientation (Novel condition). Participants (n=17) fixated on one of two LEDs (on either side of the central grasp object) initially and either fixated the same LED (Fixation condition) upon re-presentation of the object or made a saccade to the other LED (Saccade condition). Participants were then required to grasp the object. In order to determine the functional connections in the brain during the preparation of the grasp (i.e., during object re-presentation), we performed a psychophysiological interaction analysis with right SMG as the hub, whereby we investigated activity in cortical regions related to saccades as compared with fixations. Overall, we found that right SMG and several parietal grasp areas, namely left anterior intraparietal sulcus (aIPS) and bilateral superior parietal lobe (SPL), met our criteria for transsaccadic orientation integration: during movement preparation, they showed task-dependent sac-cade modulations and, during grasp execution, they were specifically sensitive to changes in object orientation that followed saccades. Finally, SMG showed enhanced functional connectivity with both prefrontal saccade areas (consistent with oculomotor input) and aIPS / SPL (consistent with sensorimotor

output). These results support the general role of parietal cortex for the integration of visuospatial perturbations, and provide specific cortical modules for the integration of oculomotor and visual signals for grasp updating.

Saccadic adaptation to temporarily delayed stimuli
Ilja Wagner, Christian Wolf, & Alexander C. Schütz

Saccadic adaptation is an adaptive learning mechanism that ensures saccade accuracy. Earlier studies demonstrated that saccades to perceptually-irrelevant stimuli are only adapted when the post-saccadic error occurs shortly after saccade offset (e.g. Shafer, Noto, & Fuchs, 2000). Here, we test the hypothesis that saccades to perceptually-relevant stimuli can be adapted even when the error occurs long after saccade offset.
Participants were instructed to saccade to a perceptually-irrelevant saccade target that was displayed at a horizontal eccentricity of 10¬∞. Two seconds after saccade offset, a Gabor patch appeared for 150 ms. The Gabor patch was shown randomly 4¬∞ above or below the center of the saccade target. Two seconds after Gabor offset, a reference stimulus was displayed at the saccade target position and participants had to judge if the orientation of the reference and the Gabor matched. Vertical saccade amplitudes showed robust trial-to-trial changes in the direction of the Gabor. The adaptation magnitude was comparable to a control experiment, in which the perceptually-relevant Gabor was shown for 150 ms directly after saccade onset.
Our findings demonstrate that saccades to perceptually-relevant stimuli can be adapted even when an error occurs long after saccade offset. Such a long temporal evaluation window might be necessary under natural conditions, when the saccade target is temporarily occluded after the saccade or when saccades guide and anticipate actions (Land & Hayhoe, 2001), whose consequences arise only later on.

The relationship between infants' motor skills and their visual spatial abilities
Gloria Gehb, Bianca Jovanovic, Claudia Kubicek, Amanda Kelch, & Gudrun Schwarzer

We investigated the relation between infants‚Äô fine and gross motor skills, and their visual spatial abilities. In the first study we examined the relation between 9 month old infants‚Äô manual object exploration skills and their ability to grasp predictively for a moving partly occluded object. Our results showed a positive relation between one specific object exploration procedure and the rate of predictive grasping attempts. Infants who performed higher amounts of haptic scans to explore an object showed a higher prediction rate than infants with a lower amount of haptic scanning.
In the second study we investigated the question if self-produced visual combined with locomotor experience or only visual experiences are the crucial factors for an improvement of infants' visual spatial abilities. For that reason, we trained 6 to 7 month old infants who have not yet been able to locomote by themselves in locomotion for 3 days per week over 3 weeks. The infants are randomly assigned to an active or a passive training condition, or a waiting group. In the active training condition, the infants had the opportunity to move by a walker through a circular pathway by moving their lower legs, whereby they gained visual and locomotor experience. In the passive training condition, the infants were slowly pushed through the pathway by an experimenter and thereby experienced locomotion only visually. The infants participated in a mental rotation and a visual prediction task prior to and after the training or waiting phases. Preliminary results show a positive relationship between locomotion training and visual spatial abilities. Infants of the training groups performed better in the visual spatial task compared to infants of the control group.

Predicting the sensory consequences of one's own actions: Neural suppression effects in healthy subjects and patients with schizophrenia
Lukas Uhlmann, Mareike Pazen, Bianca van Kemenade, Olaf Steinsträter, Laurence R. Harris, Tilo Kircher, Benjamin Straube

In order to establish meaningful interactions with our environment, it is crucial that we are able to distinguish self-generated from externally generated stimuli. It has been established that self-generated sensory consequences can be predicted based on a copy of the motor command (efference copy), which allows one to suppress the neural processing of predicted consequences, thereby enabling self-other distinction. In patients with schizophrenia, however, efference copy-based predictive mechanisms appear to be impaired, which possibly contributes to the development of cardinal symptoms, such as delusions of control or hallucinations. In a previous fMRI study with healthy subjects, we showed that viewing self-generated compared to externally generated hand movements is related to less neural activation (suppression effect) in visual and somatosensory areas. Moreover, we found that in posterior parietal (e.g., angular gyrus), frontal (e.g., middle frontal gyrus), and temporal (middle temporal gyrus) brain areas, suppression effects were only present when participants saw their own hands, but not when they viewed someone else's hand moving in accordance with their action. These results suggest that the brain generates predictions specifically for movements of one's own hand, thus contributing to self-other distinction during the performance of an action. Based on this, we currently investigate whether suppression effects differ in patients with schizophrenia when compared to matched healthy participants. Preliminary data show that neural suppression of self-generated continuous action feedback in visual regions is reduced in patients with schizophrenia. Furthermore, it appears that in regions related to predictive processing (e.g., cerebellum), hand identity influences neural suppression in healthy subjects, but not in patients with schizophrenia. Overall, our preliminary results support the claim that efference copy-based predictive mechanisms are impaired in patients with schizophrenia, thus linking basic mechanisms of action-perception coupling to higher-level self-other processing.

Attribution of error: adapting in virtual reality
Shanaathanan Modchalingam, Denise Henriques

When our intended movements have unintended outcomes, the human motor system can quickly adapt future movements. Motor output is modified in a way such that motor errors, that is, the difference between the expected and the perceived consequences of any motor output, are reduced. The attribution of experienced errors to sources plays an important role in motor adaptation. Errors may be attributed to internal sources, e.g. an arm used for reaching, and various external sources, e.g. a tool used to extend a reach or the environment in which the reach occurs. Here, participants reach to spherical targets located on a flat horizontal plane in a virtual environment using their right hand. During some reaches, the visual movement path of the hand is rotated about the starting position – introducing errors. Participants adapt and reduce these errors over time. Participants then reach to targets without visual feedback of their hand with and without the presence of the flat plane. Furthermore, they reach to targets in a slightly different workspace, again with and without the presence of the flat plane. We determine the proportion of overall adaptation that is only present when the plane is visible, which is related to the proportion of the error that is attributed to the plane. Using conventional setups, we can alter the behaviour of the end effector and targets during reaches, but not the environment in which the experiment occurs. Virtual reality environments enable us to alter the environment as well, giving us control of more parameters to tackle this question of source attribution.

Allocentric information influences real-time reaching movements
Zijian Lu, Katja Fiehler

The 2-streams model of vision suggests that egocentric and allocentric reference frames are utilized by the dorsal and the ventral stream for real-time and memory-guided movements, respectively. Recent studies argue against such a strict functional distinction by providing evidence for the use of an egocentric reference frame not only in real-time, but also in memory-guided movements. In this study we focus on allocentric spatial coding and investigate its use in real-time and memory-guided reaching. We presented participants with a naturalistic scene on a monitor which consisted of six objects on a table that served as reach targets. Participants were informed about the target object

after scene encoding, and were prompted by a go cue to reached to its position. After target identification a brief air-puff was applied to the participant's right eye inducing an eye blink. During the blink the target object disappeared from the scene, and in half of the trials the other five table objects were shifted horizontally in the same direction. We varied the timing of the blink resulting in three types of movement: (1) in the memory-guided delay movement, the blink was triggered by the air puff 500 ms before the go cue, (2) in the memory-guided no-delay movement, the blink was triggered with the go cue, and (3) in the online movement, the blink was triggered ~250 ms after the onset of the reach (= real-time movement). We found that object shifts systematically influenced participants' reaching endpoints and trajectories of memory-guided movements and, importantly, also of real-time movements. Overall, this effect was stronger for memory-guided movements. Our findings suggest that humans make use of an allocentric reference frame irrespective of whether movements are controlled online or based on memory.

EEG Correlates of Homeostatic Expectation following Electrical Brain Stimulation
Brandon Caie, Paul Schrater, Aarlenne Khan, Gunnar Blohm

Expectations are a product of internal drives and external sensations. The stability of expectation is important for regulating brain function in changing environments. Here, we perturb the sequential formation of expectations via electrical brain stimulation, and observe a homeostatic response of expectation in brain and behaviour. Human participants performed a free choice saccade task while undergoing fMRI-guided HD-transcranial direct current stimulation of the right frontal eye fields (rFEF). A reinforcement learning model of choice behaviour suggests that anodal stimulation enhanced the reinforcement of expectation, while cathodal stimulation reduced it. Behaviour following stimulation offset showed the opposite effect. We imaged network effects of stimulation on rFEF by contrasting EEG recordings in the pre and post-stimulation period. Time-frequency subtractions of the post EEG relative to pre-stimulation shows a nonspecific modulation of theta power relative to polarity, while alpha and beta power were modulated in the inter-choice interval during random sequences of trials that supported the sequential reinforcement of expectation. We conclude that expectations can be transiently perturbed by electrical stimulation, and suggest that the neural response facilitating a homeostatic response to brain stimulation is coupled to the reinforcing aspects of a sensory environment.

Saccadic and pupillometric eyemovement-perception under target-driven and free-viewing condition in RBD, PD and neurodegenerative diseases as a prodromal and longitudinal biomarker
Mahboubeh Habibi, Felix Bernhard, Julia Morris, Douglas Munoz, Wolfgang H. Oertel

Idiopathic REM sleep behavior disorder (iRBD) is considered a prodromal stage of Parkinson's disease (PD). Within 10 to 20 years, patients with RBD converge in up to 85% of cases to a neurodegenerative disease of the type of α-synucleinopathies, such as PD or more rarely, Dementia with Lewy Bodies (DLB), and multi-system atrophy (MSA). Several studies have shown that RBD may be an important risk factor and predictor of Parkinson's disease. Other than idiopathic Parkinson's disease, there are atypical forms like the above mentioned MSA and also Progressive supranuclear palsy (PSP). In terms of characteristic, atypical Parkinsonian syndromes suffer from a fast progression of motor and non-motor symptoms. In addition, patients with PD suffer from impaired attention control based on prefrontal cortex, pre-motor cortex, and basal ganglia disorders. Since basal ganglia are thought to have a role in controlling ocular fixation, it is expected that patients with parkinsonian conditions would show impaired performance in fixation tasks. Two pupillometrics methods, "Pro-and-anti-saccades" and "free viewing" are used by an Eye-tracking system. In the first Task, Subjects are instructed to, prior to target appearance to either automatically look at the peripheral targets (pro-saccade) or to suppress automatic response and voluntary look away from the targets (anti-saccade). The free viewing part is designed to investigate saliency by eliciting bottom up eye movements to continually changing video stimuli. Clips of movies are presented in blocks of 1-minute duration and subjects attend to these movies under natural viewing conditions. Parameters such as hypometric and multi-step saccades, as well as parameters like pupil size, eye position, and common ocular motion parameters, take into account in the

evaluations. These experiments aiming to detect impairment of certain brain structures, important for pupillometric and oculomotor function, especially LC, SC and pre-frontal cortex in patients with RBD, PD, MSA, and PSP.

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Notes